

LIITE 11

LÄNSI-TOHOLAMMIN TUULIPUISTON VÄLKEMALLINNUSKUVAT

WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:32 / 1
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 18:05/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours)

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 4,42 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:
Wind Atlas

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
607 455 350 331 555 724 885 1.324 1.295 894 536 612 8.569
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: DEM 10m
Obstacles not used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m



WTGs	Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data						
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM	
WTG 01	361.257	7.071.221	130,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 02	360.733	7.070.696	128,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 03	361.299	7.070.700	131,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 04	360.805	7.070.152	123,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 05	361.637	7.068.087	119,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 06	362.145	7.067.900	117,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 07	361.304	7.067.454	120,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 08	362.585	7.067.443	118,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 09	363.041	7.067.249	116,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 10	363.695	7.066.970	120,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 11	360.907	7.066.767	124,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 12	361.463	7.066.781	123,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 13	364.266	7.066.465	121,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 14	361.753	7.066.315	124,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 15	362.496	7.065.836	127,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 16	367.011	7.062.859	144,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 17	367.335	7.062.453	145,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 18	366.616	7.062.159	143,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 19	366.969	7.061.777	142,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 20	366.195	7.061.471	138,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 21	366.604	7.061.097	140,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 22	365.875	7.060.780	139,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 23	366.207	7.060.382	143,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 24	365.085	7.060.442	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 25	365.478	7.060.102	142,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 26	365.902	7.059.795	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 27	362.987	7.060.050	140,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 28	362.180	7.059.830	133,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 29	363.323	7.059.689	153,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 30	362.527	7.059.437	144,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 31	363.676	7.059.303	152,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	

To be continued on next page...
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WindPRO version 2.9.285 Sep 2014

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	Calculated: 10.12.2014 18:05/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours)

...continued from previous page

	Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data						
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM	
WTG 32	362.893	7.059.030	154,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 33	364.021	7.058.914	148,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	
WTG 34	363.317	7.058.563	157,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0	

Shadow receptor-Input

No.	Finish TM ETRS-TM35FIN-ETRS89				Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width [m]				
HH 02	363.422	7.063.536	129,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 06	369.043	7.063.490	105,3	1,0	1,0	0,0	90,0	"Green house mode"
HH 07	358.077	7.070.960	123,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 08	364.219	7.061.582	136,7	1,0	1,0	0,0	90,0	"Green house mode"
HH 11	359.470	7.068.086	120,6	1,0	1,0	0,0	90,0	"Green house mode"
HH 13	363.332	7.063.621	128,9	1,0	1,0	0,0	90,0	"Green house mode"
HH 14	359.589	7.068.053	121,1	1,0	1,0	0,0	90,0	"Green house mode"
HH 17	368.880	7.060.960	131,2	1,0	1,0	0,0	90,0	"Green house mode"
HH 18	357.983	7.070.622	122,7	1,0	1,0	0,0	90,0	"Green house mode"
HH 20	361.968	7.064.913	128,5	1,0	1,0	0,0	90,0	"Green house mode"
HH 22	359.592	7.067.992	120,2	1,0	1,0	0,0	90,0	"Green house mode"
HH 26	364.547	7.067.745	111,3	1,0	1,0	0,0	90,0	"Green house mode"
RH 05	368.239	7.064.340	106,4	1,0	1,0	0,0	90,0	"Green house mode"
RH 07	364.743	7.067.833	105,4	1,0	1,0	0,0	90,0	"Green house mode"
RH 12	365.263	7.067.712	104,1	1,0	1,0	0,0	90,0	"Green house mode"
RH 22	365.633	7.057.676	133,3	1,0	1,0	0,0	90,0	"Green house mode"
RH 30	364.916	7.067.772	107,6	1,0	1,0	0,0	90,0	"Green house mode"
RH 31	364.223	7.057.790	140,9	1,0	1,0	0,0	90,0	"Green house mode"
RH 36	365.743	7.057.644	133,4	1,0	1,0	0,0	90,0	"Green house mode"
RH 39	368.457	7.063.923	106,6	1,0	1,0	0,0	90,0	"Green house mode"
RH 44	365.625	7.057.702	133,4	1,0	1,0	0,0	90,0	"Green house mode"
RH 47	369.170	7.063.316	105,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

Shadow hours

per year

[h/year]

HH 02 0:00

HH 06 0:00

HH 07 0:00

HH 08 1:13

HH 11 0:00

HH 13 0:00

HH 14 0:00

HH 17 0:00

HH 18 0:00

HH 20 0:00

HH 22 0:00

HH 26 4:22

RH 05 0:00

RH 07 2:27

RH 12 1:02

RH 22 0:00

RH 30 2:19

RH 31 5:39

RH 36 0:00

To be continued on next page...

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Project:
Toholampi West

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10.12.2014 18:05/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours)

...continued from previous page

No.	Shadow hours per year [h/year]	Shadow, expected values
RH 39	0:00	
RH 44	0:00	
RH 47	0:00	

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

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (695)	0:00	0:00
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (694)	0:00	0:00
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (697)	0:00	0:00
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (696)	0:00	0:00
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (724)	0:00	0:00
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (710)	0:00	0:00
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (725)	0:00	0:00
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (711)	0:00	0:00
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (706)	5:38	1:05
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (791)	22:59	3:50
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (726)	0:00	0:00
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (727)	0:00	0:00
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (759)	40:01	4:36
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (707)	0:00	0:00
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (708)	0:00	0:00
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (722)	0:00	0:00
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (723)	0:00	0:00
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (720)	0:00	0:00
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (721)	0:00	0:00
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (718)	0:00	0:00
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (719)	0:00	0:00
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (714)	0:00	0:00
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (717)	0:00	0:00
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (715)	8:16	1:13
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (716)	0:00	0:00
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (713)	0:00	0:00
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (698)	0:00	0:00
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (702)	0:00	0:00
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (699)	0:00	0:00
WTG 30	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (703)	0:00	0:00
WTG 31	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (700)	0:00	0:00
WTG 32	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (704)	0:00	0:00
WTG 33	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (701)	0:00	0:00
WTG 34	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (705)	20:07	5:39

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Project:
Toholampi West

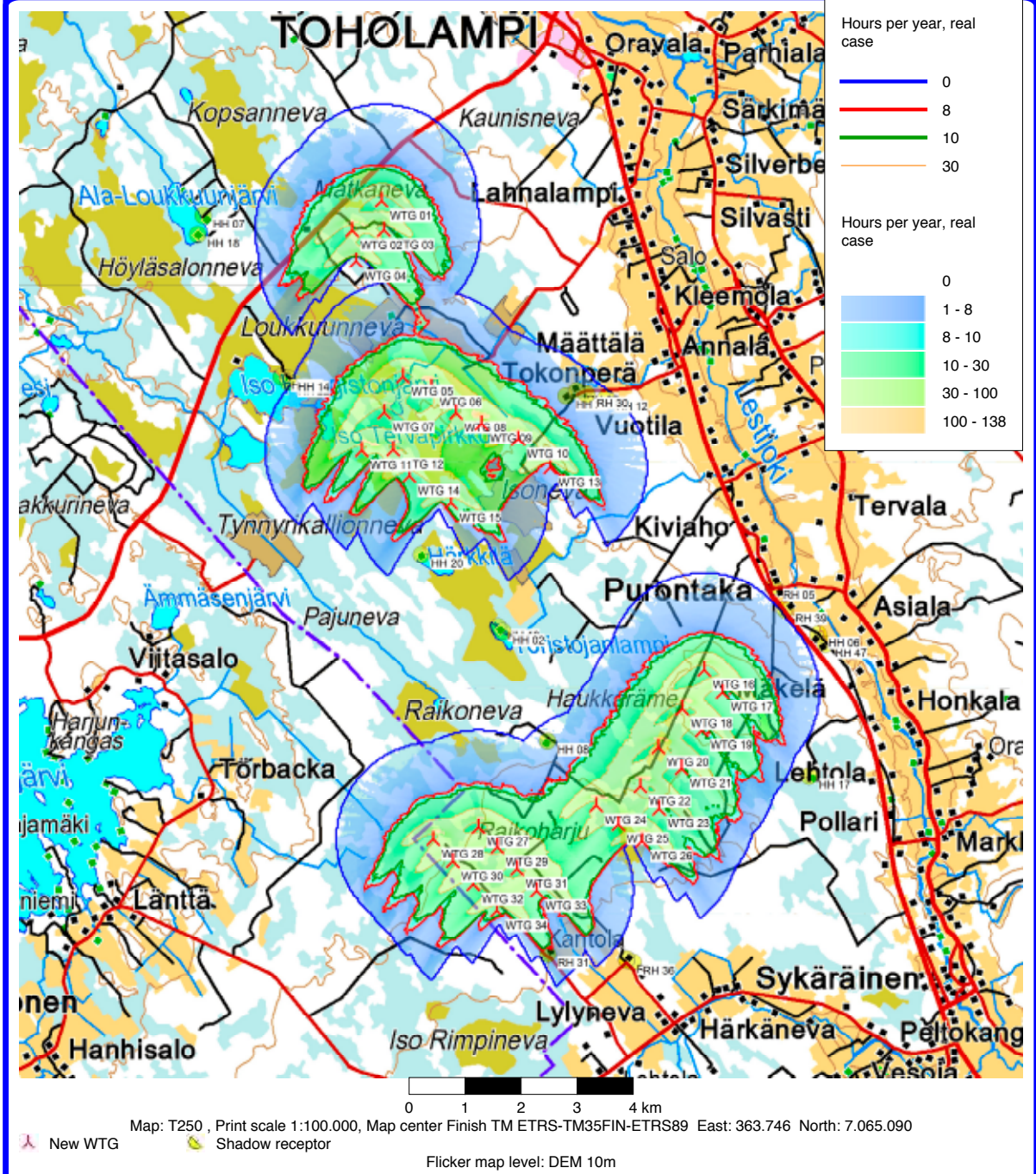
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10.12.2014 18:05/2.9.285

SHADOW - Map

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours)



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Project:	Printed/Page
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	Licensed user:
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	Calculated:
	10.12.2014 19:44/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours) + FM

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 4,42 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:
Wind Atlas

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
607 455 350 331 555 724 885 1.324 1.295 894 536 612 8.569
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: DEM 10m
Area object(s) used in calculation:
Forest Mask - Lower Tree Heights
Obstacles used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m

WTGs

Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data					
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
[m]											
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WTG 02	360.733	7.070.696	128,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
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WTG 04	360.805	7.070.152	123,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 05	361.637	7.068.087	119,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 06	362.145	7.067.900	117,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 07	361.304	7.067.454	120,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 08	362.585	7.067.443	118,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 09	363.041	7.067.249	116,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 10	363.695	7.066.970	120,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 11	360.907	7.066.767	124,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 12	361.463	7.066.781	123,1 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 13	364.266	7.066.465	121,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 14	361.753	7.066.315	124,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 15	362.496	7.065.836	127,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 16	367.011	7.062.859	144,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 17	367.335	7.062.453	145,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 18	366.616	7.062.159	143,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 19	366.969	7.061.777	142,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 20	366.195	7.061.471	138,1 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 21	366.604	7.061.097	140,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 22	365.875	7.060.780	139,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 23	366.207	7.060.382	143,1 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 24	365.085	7.060.442	142,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 25	365.478	7.060.102	142,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 26	365.902	7.059.795	142,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 27	362.987	7.060.050	140,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 28	362.180	7.059.830	133,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 29	363.323	7.059.689	153,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0

To be continued on next page...

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WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:34 / 2
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 19:44/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours) + FM

...continued from previous page

Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data					
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
[m]											
WTG 30	362.527	7.059.437	144,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 31	363.676	7.059.303	152,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 32	362.893	7.059.030	154,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 33	364.021	7.058.914	148,8 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 34	363.317	7.058.563	157,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0

Shadow receptor-Input

Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data					
No.	East	North	Z	Width	Height	a.g.l.	Degrees from south cw	Slope of window	Direction mode		
[m]				[m]	[m]	[m]	[°]	[°]			
HH 02	363.422	7.063.536	129,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 06	369.043	7.063.490	105,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 07	358.077	7.070.960	123,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 08	364.219	7.061.582	136,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 11	359.470	7.068.086	120,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 13	363.332	7.063.621	128,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 14	359.589	7.068.053	121,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 17	368.880	7.060.960	131,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 18	357.983	7.070.622	122,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 20	361.968	7.064.913	128,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 22	359.592	7.067.992	120,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
HH 26	364.547	7.067.745	111,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 05	368.239	7.064.340	106,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 07	364.743	7.067.833	105,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 12	365.263	7.067.712	104,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 22	365.633	7.057.676	133,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 30	364.916	7.067.772	107,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 31	364.223	7.057.790	140,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 36	365.743	7.057.644	133,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 39	368.457	7.063.923	106,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 44	365.625	7.057.702	133,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"		
RH 47	369.170	7.063.316	105,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"		

Calculation Results

Shadow receptor

Shadow, expected values

No. Shadow hours per year [h/year]

HH 02	0:00
HH 06	0:00
HH 07	0:00
HH 08	0:00
HH 11	0:00
HH 13	0:00
HH 14	0:00
HH 17	0:00
HH 18	0:00
HH 20	0:00
HH 22	0:00
HH 26	4:22
RH 05	0:00
RH 07	1:21
RH 12	0:00
RH 22	0:00
RH 30	0:00

To be continued on next page...

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WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:34 / 3
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 19:44/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours) + FM

...continued from previous page

No.	Shadow, expected values Shadow hours per year [h/year]
RH 31	5:39
RH 36	0:00
RH 39	0:00
RH 44	0:00
RH 47	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (695)	0:00	0:00
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (694)	0:00	0:00
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (697)	0:00	0:00
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (696)	0:00	0:00
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (724)	0:00	0:00
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (710)	0:00	0:00
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (725)	0:00	0:00
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (711)	0:00	0:00
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (706)	5:38	1:05
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (791)	16:02	2:38
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (726)	0:00	0:00
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (727)	0:00	0:00
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (759)	13:09	1:21
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (707)	0:00	0:00
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (708)	0:00	0:00
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (722)	0:00	0:00
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (723)	0:00	0:00
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (720)	0:00	0:00
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (721)	0:00	0:00
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (718)	0:00	0:00
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (719)	0:00	0:00
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (714)	0:00	0:00
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (717)	0:00	0:00
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (715)	0:00	0:00
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (716)	0:00	0:00
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (713)	0:00	0:00
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (698)	0:00	0:00
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (702)	0:00	0:00
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (699)	0:00	0:00
WTG 30	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (703)	0:00	0:00
WTG 31	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (700)	0:00	0:00
WTG 32	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (704)	0:00	0:00
WTG 33	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (701)	0:00	0:00
WTG 34	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (705)	20:07	5:39

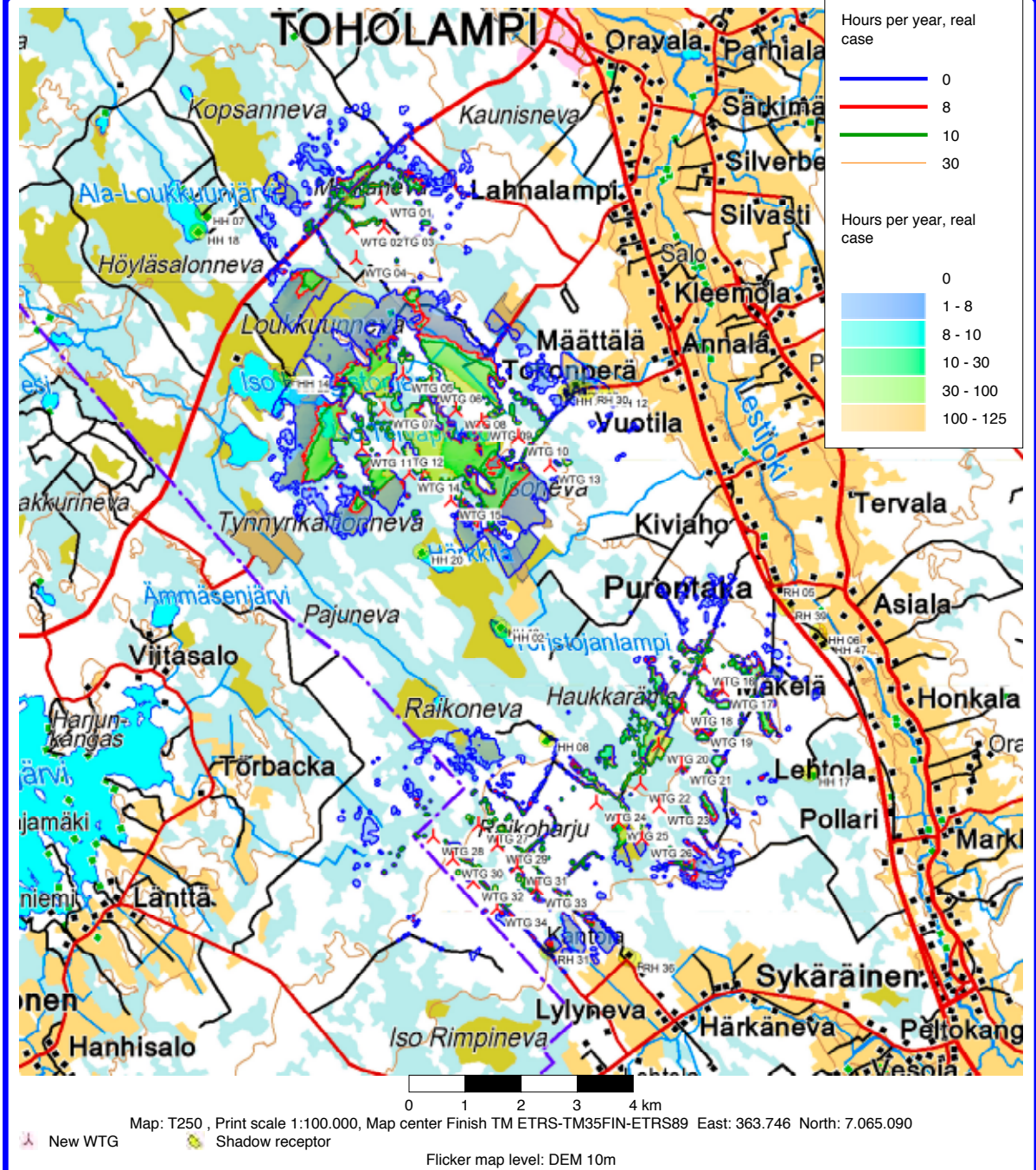
WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:34 / 4
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 19:44/2.9.285

SHADOW - Map

Calculation: Opt1 34x V126 - RC (Oulu daily mean hours) + FM



WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:29 / 1
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 17:53/2.9.285

SHADOW - Main Result

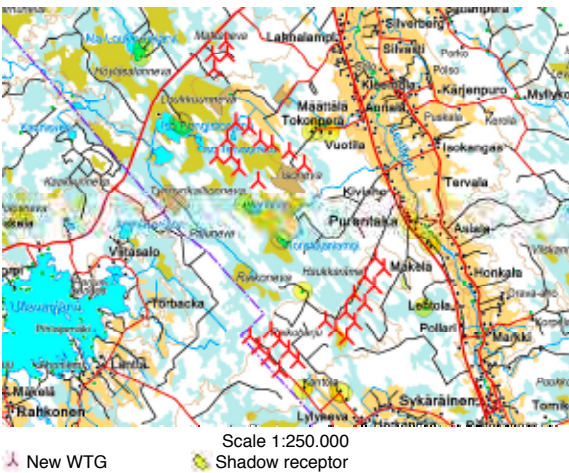
Calculation: Opt1 34x V126 - WC

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: DEM 10m
Obstacles not used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m



WTGs

	Finish TM ETRS-TM35FIN-ETRS89				WTG type		Type-generator	Shadow data				
	East	North	Z	Row data/Description	Valid	Manufact.		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
			[m]									
WTG 01	361.257	7.071.221	130,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 02	360.733	7.070.696	128,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 03	361.299	7.070.700	131,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 04	360.805	7.070.152	123,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 05	361.637	7.068.087	119,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 06	362.145	7.067.900	117,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 07	361.304	7.067.454	120,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 08	362.585	7.067.443	118,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 09	363.041	7.067.249	116,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 10	363.695	7.066.970	120,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 11	360.907	7.066.767	124,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 12	361.463	7.066.781	123,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 13	364.266	7.066.465	121,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 14	361.753	7.066.315	124,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 15	362.496	7.065.836	127,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 16	367.011	7.062.859	144,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 17	367.335	7.062.453	145,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 18	366.616	7.062.159	143,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 19	366.969	7.061.777	142,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 20	366.195	7.061.471	138,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 21	366.604	7.061.097	140,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 22	365.875	7.060.780	139,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 23	366.207	7.060.382	143,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 24	365.085	7.060.442	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 25	365.478	7.060.102	142,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 26	365.902	7.059.795	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 27	362.987	7.060.050	140,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 28	362.180	7.059.830	133,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 29	363.323	7.059.689	153,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 30	362.527	7.059.437	144,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 31	363.676	7.059.303	152,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 32	362.893	7.059.030	154,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 33	364.021	7.058.914	148,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 34	363.317	7.058.563	157,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0

WindPRO version 2.9.285 Sep 2014

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	Calculated: 10.12.2014 17:53/2.9.285

SHADOW - Main Result

Calculation: Opt1 34x V126 - WC

Shadow receptor-Input

No.	Finish TM ETRS-TM35FIN-ETRS89				Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z							
HH 02	363.422	7.063.536	129,0		1,0	1,0	1,0		0,0	"Green house mode"
HH 06	369.043	7.063.490	105,3		1,0	1,0	1,0		0,0	"Green house mode"
HH 07	358.077	7.070.960	123,0		1,0	1,0	1,0		0,0	"Green house mode"
HH 08	364.219	7.061.582	136,7		1,0	1,0	1,0		0,0	"Green house mode"
HH 11	359.470	7.068.086	120,6		1,0	1,0	1,0		0,0	"Green house mode"
HH 13	363.332	7.063.621	128,9		1,0	1,0	1,0		0,0	"Green house mode"
HH 14	359.589	7.068.053	121,1		1,0	1,0	1,0		0,0	"Green house mode"
HH 17	368.880	7.060.960	131,2		1,0	1,0	1,0		0,0	"Green house mode"
HH 18	357.983	7.070.622	122,7		1,0	1,0	1,0		0,0	"Green house mode"
HH 20	361.968	7.064.913	128,5		1,0	1,0	1,0		0,0	"Green house mode"
HH 22	359.592	7.067.992	120,2		1,0	1,0	1,0		0,0	"Green house mode"
HH 26	364.547	7.067.745	111,3		1,0	1,0	1,0		0,0	"Green house mode"
RH 05	368.239	7.064.340	106,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 07	364.743	7.067.833	105,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 12	365.263	7.067.712	104,1		1,0	1,0	1,0		0,0	"Green house mode"
RH 22	365.633	7.057.676	133,3		1,0	1,0	1,0		0,0	"Green house mode"
RH 30	364.916	7.067.772	107,6		1,0	1,0	1,0		0,0	"Green house mode"
RH 31	364.223	7.057.790	140,9		1,0	1,0	1,0		0,0	"Green house mode"
RH 36	365.743	7.057.644	133,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 39	368.457	7.063.923	106,6		1,0	1,0	1,0		0,0	"Green house mode"
RH 44	365.625	7.057.702	133,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 47	369.170	7.063.316	105,0		1,0	1,0	1,0		0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Shadow, worst case		
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
HH 02	0:00	0	0:00
HH 06	0:00	0	0:00
HH 07	0:00	0	0:00
HH 08	8:16	31	0:21
HH 11	0:00	0	0:00
HH 13	0:00	0	0:00
HH 14	0:00	0	0:00
HH 17	0:00	0	0:00
HH 18	0:00	0	0:00
HH 20	0:00	0	0:00
HH 22	0:00	0	0:00
HH 26	30:14	103	0:26
RH 05	0:00	0	0:00
RH 07	18:40	67	0:22
RH 12	6:58	29	0:19
RH 22	0:00	0	0:00
RH 30	16:26	62	0:21
RH 31	20:07	55	0:26
RH 36	0:00	0	0:00
RH 39	0:00	0	0:00
RH 44	0:00	0	0:00
RH 47	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]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (695)	0:00	
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (694)	0:00	

To be continued on next page...

Project:
Toholampi West

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Calculated:
10.12.2014 17:53/2.9.285

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SHADOW - Main Result

Calculation: Opt1 34x V126 - WC

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (697)	0:00	
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (696)	0:00	
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (724)	0:00	
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (710)	0:00	
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (725)	0:00	
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (711)	0:00	
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (706)	5:38	
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (791)	22:59	
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (726)	0:00	
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (727)	0:00	
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (759)	40:01	
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (707)	0:00	
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (708)	0:00	
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (722)	0:00	
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (723)	0:00	
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (720)	0:00	
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (721)	0:00	
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (718)	0:00	
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (719)	0:00	
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (714)	0:00	
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (717)	0:00	
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (715)	8:16	
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (716)	0:00	
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (713)	0:00	
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (698)	0:00	
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (702)	0:00	
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (699)	0:00	
WTG 30	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (703)	0:00	
WTG 31	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (700)	0:00	
WTG 32	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (704)	0:00	
WTG 33	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (701)	0:00	
WTG 34	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (705)	20:07	

Project:
Toholampi West

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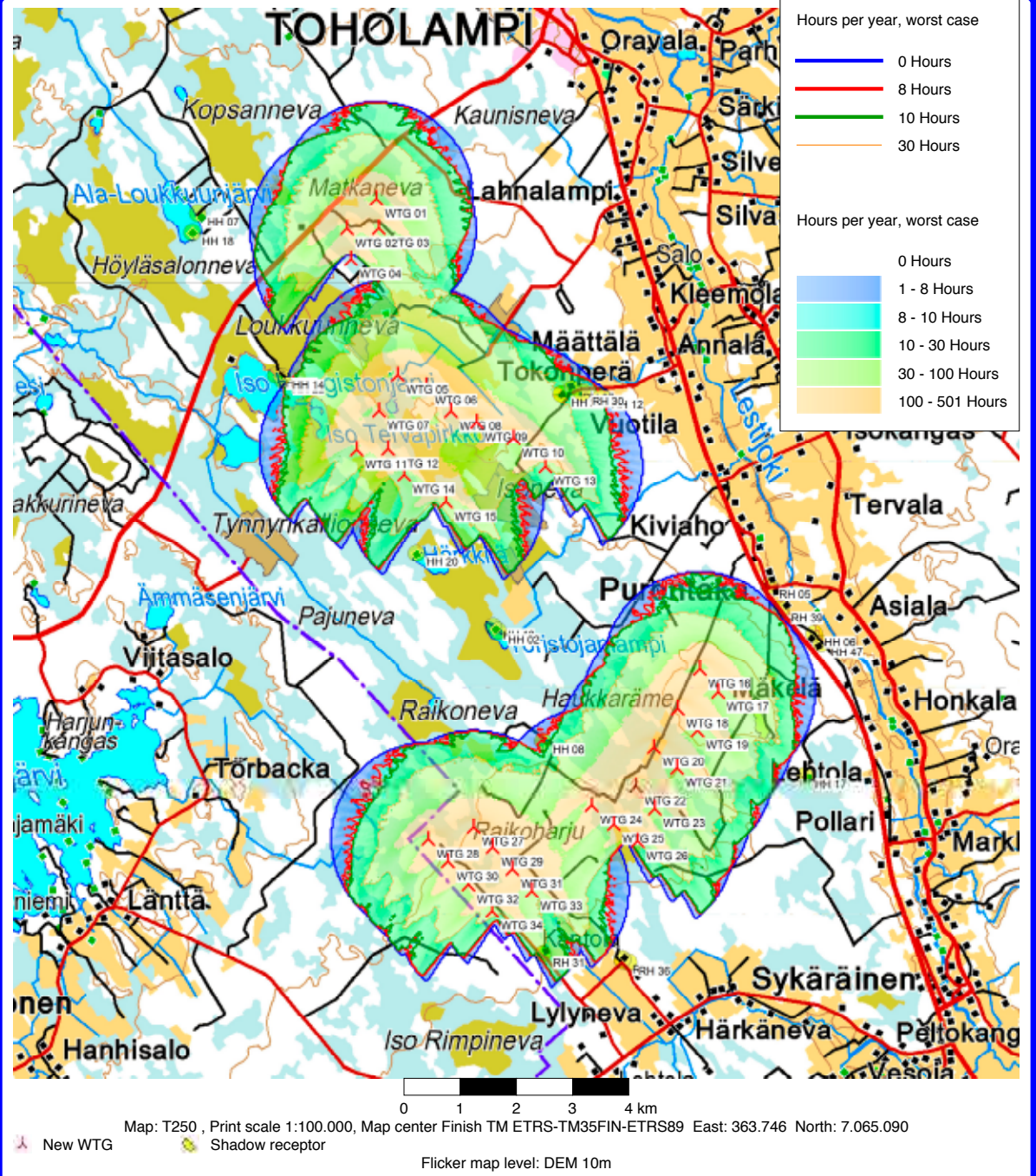
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SHADOW - Map

Calculation: Opt1 34x V126 - WC



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	Calculated: 10.12.2014 18:11/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours)

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 4,42 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:
Wind Atlas

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
607 455 350 331 555 724 885 1.324 1.295 894 536 612 8.569
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: DEM 10m
Obstacles not used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m



	Finish TM ETRS-TM35FIN-ETRS89				WTG type		Shadow data					
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
			[m]									
WTG 01	361.534	7.070.973	130,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 02	361.060	7.070.875	130,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 03	360.619	7.070.567	124,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 04	361.644	7.068.090	119,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 05	362.158	7.067.891	117,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 06	361.373	7.067.377	120,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 07	362.503	7.067.297	118,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 08	363.026	7.067.259	116,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 09	363.788	7.067.073	118,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 10	360.907	7.066.770	124,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 11	361.401	7.066.617	124,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 12	364.266	7.066.465	121,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 13	361.813	7.066.189	125,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 14	366.817	7.062.708	143,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 15	367.217	7.062.257	145,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 16	366.415	7.061.920	137,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 17	366.711	7.061.297	139,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 18	366.146	7.061.247	138,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 19	365.808	7.060.626	141,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 20	366.307	7.060.536	140,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 21	365.397	7.060.153	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 22	365.966	7.059.900	143,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 23	362.687	7.060.038	137,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 24	362.180	7.059.830	133,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 25	363.197	7.059.807	153,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 26	362.673	7.059.271	151,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 27	363.615	7.059.371	152,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 28	364.021	7.058.914	148,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 29	363.317	7.058.563	157,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0

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Project: Toholampi West	Printed/Page 22.01.2015 16:33 / 2
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 18:11/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours)

Shadow receptor-Input

No.	Finish TM ETRS-TM35FIN-ETRS89				Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Row data/Description						
HH 02	363.422	7.063.536	129,0		1,0	1,0	1,0		0,0	"Green house mode"
HH 06	369.043	7.063.490	105,3		1,0	1,0	1,0		0,0	"Green house mode"
HH 07	358.077	7.070.960	123,0		1,0	1,0	1,0		0,0	"Green house mode"
HH 08	364.219	7.061.582	136,7		1,0	1,0	1,0		0,0	"Green house mode"
HH 11	359.470	7.068.086	120,6		1,0	1,0	1,0		0,0	"Green house mode"
HH 13	363.332	7.063.621	128,9		1,0	1,0	1,0		0,0	"Green house mode"
HH 14	359.589	7.068.053	121,1		1,0	1,0	1,0		0,0	"Green house mode"
HH 17	368.880	7.060.960	131,2		1,0	1,0	1,0		0,0	"Green house mode"
HH 18	357.983	7.070.622	122,7		1,0	1,0	1,0		0,0	"Green house mode"
HH 20	361.968	7.064.913	128,5		1,0	1,0	1,0		0,0	"Green house mode"
HH 22	359.592	7.067.992	120,2		1,0	1,0	1,0		0,0	"Green house mode"
HH 26	364.547	7.067.745	111,3		1,0	1,0	1,0		0,0	"Green house mode"
RH 05	368.239	7.064.340	106,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 07	364.743	7.067.833	105,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 12	365.263	7.067.712	104,1		1,0	1,0	1,0		0,0	"Green house mode"
RH 22	365.633	7.057.676	133,3		1,0	1,0	1,0		0,0	"Green house mode"
RH 30	364.916	7.067.772	107,6		1,0	1,0	1,0		0,0	"Green house mode"
RH 31	364.223	7.057.790	140,9		1,0	1,0	1,0		0,0	"Green house mode"
RH 36	365.743	7.057.644	133,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 39	368.457	7.063.923	106,6		1,0	1,0	1,0		0,0	"Green house mode"
RH 44	365.625	7.057.702	133,4		1,0	1,0	1,0		0,0	"Green house mode"
RH 47	369.170	7.063.316	105,0		1,0	1,0	1,0		0,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No. Shadow hours per year [h/year]

HH 02	0:00
HH 06	0:00
HH 07	0:00
HH 08	0:00
HH 11	0:00
HH 13	0:00
HH 14	0:00
HH 17	0:00
HH 18	0:00
HH 20	0:00
HH 22	0:00
HH 26	4:53
RH 05	0:00
RH 07	2:47
RH 12	2:03
RH 22	0:00
RH 30	2:37
RH 31	5:39
RH 36	0:00
RH 39	0:00
RH 44	0:00
RH 47	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (958)	0:00	0:00
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !O! hub: 167,0 m (TOT: 230,0 m) (957)	0:00	0:00

To be continued on next page...

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:33 / 3
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 18:11/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours)

...continued from previous page

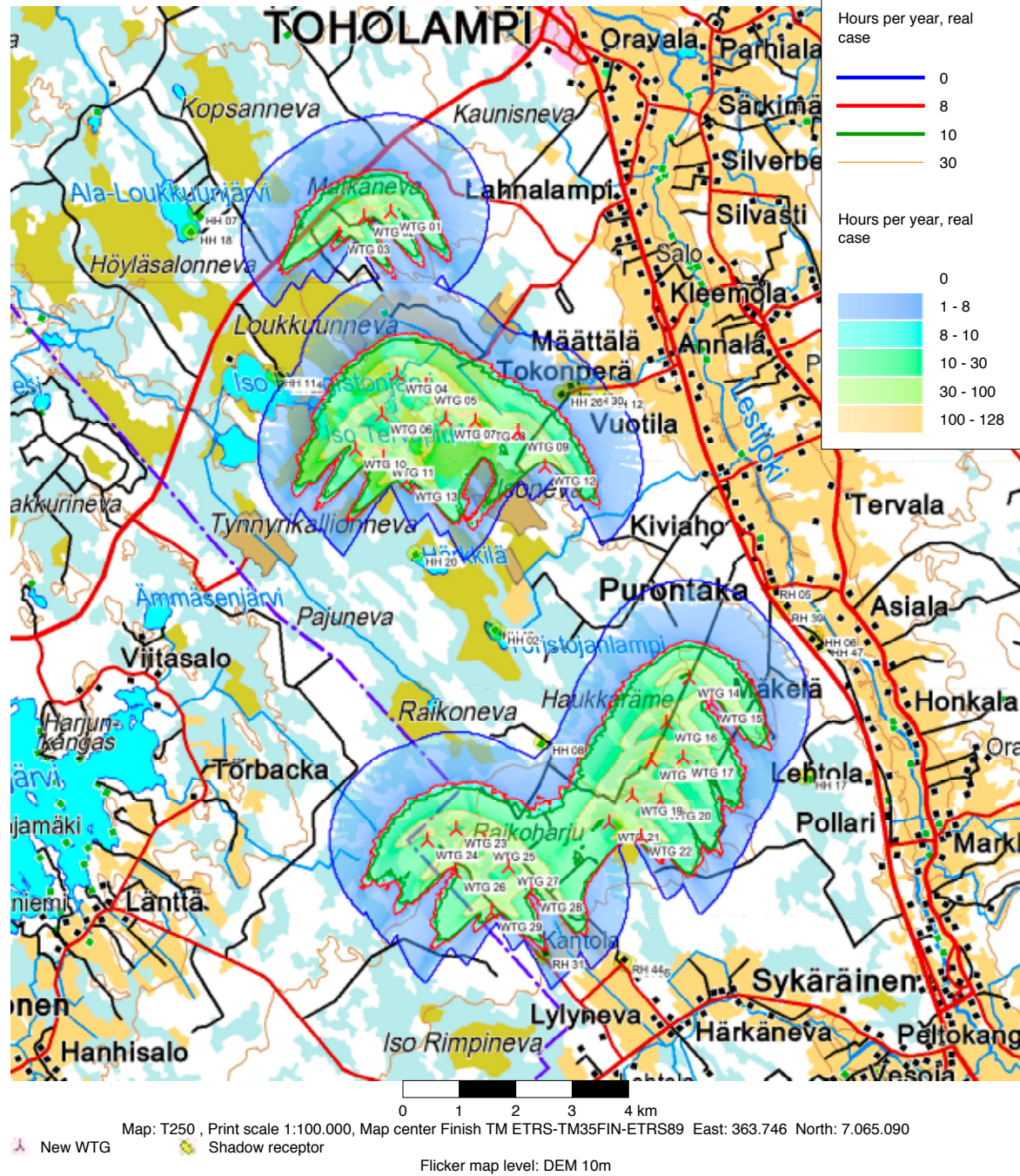
No.	Name	Worst case [h/year]	Expected [h/year]
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (956)	0:00	0:00
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (983)	0:00	0:00
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (972)	0:00	0:00
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (984)	0:00	0:00
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (967)	0:00	0:00
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (973)	5:29	1:03
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (968)	33:16	5:50
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (985)	0:00	0:00
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (966)	0:00	0:00
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (987)	40:01	4:36
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (969)	0:00	0:00
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (975)	0:00	0:00
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (980)	0:00	0:00
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (978)	0:00	0:00
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (979)	0:00	0:00
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (974)	0:00	0:00
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (977)	0:00	0:00
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (982)	0:00	0:00
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (976)	0:00	0:00
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (986)	0:00	0:00
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (962)	0:00	0:00
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (963)	0:00	0:00
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (959)	0:00	0:00
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (964)	0:00	0:00
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (960)	0:00	0:00
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (961)	0:00	0:00
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (965)	20:07	5:39

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
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	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 18:11/2.9.285

SHADOW - Map

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours)



WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:36 / 1
	Licensed user:
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	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 21:15/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours) + FM

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

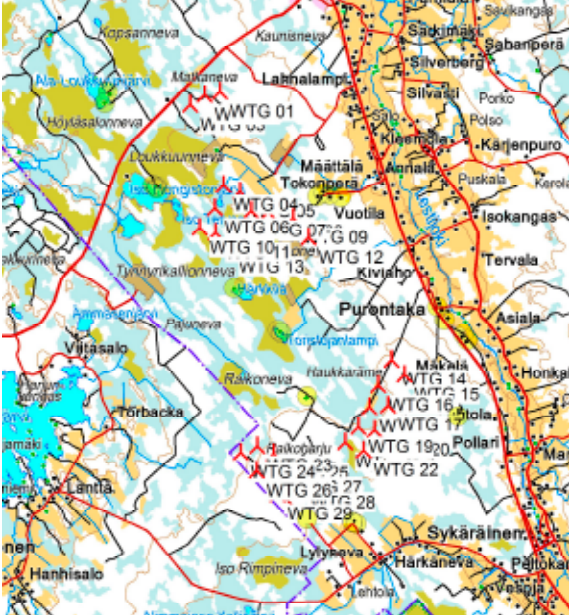
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0,77 2,46 4,42 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:
Wind Atlas

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
607 455 350 331 555 724 885 1.324 1.295 894 536 612 8.569
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: DEM 10m
Area object(s) used in calculation:
Forest Mask - Lower Tree Heights
Obstacles used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m



WTGs

	Finish TM ETRS-TM35FIN-ETRS89			WTG type		Shadow data				
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]
			[m]							
WTG 01	361.534	7.070.973	130,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 02	361.060	7.070.875	130,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 03	360.619	7.070.567	124,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 04	361.644	7.068.090	119,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 05	362.158	7.067.891	117,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 06	361.373	7.067.377	120,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 07	362.503	7.067.297	118,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 08	363.026	7.067.259	116,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 09	363.788	7.067.073	118,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 10	360.907	7.066.770	124,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 11	361.401	7.066.617	124,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 12	364.266	7.066.465	121,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 13	361.813	7.066.189	125,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 14	366.817	7.062.708	143,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 15	367.217	7.062.257	145,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 16	366.415	7.061.920	137,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 17	366.711	7.061.297	139,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 18	366.146	7.061.247	138,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 19	365.808	7.060.626	141,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 20	366.307	7.060.536	140,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 21	365.397	7.060.153	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 22	365.966	7.059.900	143,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 23	362.687	7.060.038	137,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 24	362.180	7.059.830	133,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 25	363.197	7.059.807	153,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 26	362.673	7.059.271	151,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 27	363.615	7.059.371	152,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 28	364.021	7.058.914	148,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0
WTG 29	363.317	7.058.563	157,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:36 / 2
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 21:15/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours) + FM

Shadow receptor-Input

No.	Finish TM ETRS-TM35FIN-ETRS89			Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z						
HH 02	363.422	7.063.536	129,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 06	369.043	7.063.490	105,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 07	358.077	7.070.960	123,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 08	364.219	7.061.582	136,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 11	359.470	7.068.086	120,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 13	363.332	7.063.621	128,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 14	359.589	7.068.053	121,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 17	368.880	7.060.960	131,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 18	357.983	7.070.622	122,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 20	361.968	7.064.913	128,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 22	359.592	7.067.992	120,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"
HH 26	364.547	7.067.745	111,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 05	368.239	7.064.340	106,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 07	364.743	7.067.833	105,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 12	365.263	7.067.712	104,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 22	365.633	7.057.676	133,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 30	364.916	7.067.772	107,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 31	364.223	7.057.790	140,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 36	365.743	7.057.644	133,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 39	368.457	7.063.923	106,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 44	365.625	7.057.702	133,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
RH 47	369.170	7.063.316	105,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No. Shadow hours per year [h/year]

HH 02	0:00
HH 06	0:00
HH 07	0:00
HH 08	0:00
HH 11	0:00
HH 13	0:00
HH 14	0:00
HH 17	0:00
HH 18	0:00
HH 20	0:00
HH 22	0:00
HH 26	4:53
RH 05	0:00
RH 07	1:41
RH 12	0:00
RH 22	0:00
RH 30	0:00
RH 31	5:39
RH 36	0:00
RH 39	0:00
RH 44	0:00
RH 47	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !OI hub: 167,0 m (TOT: 230,0 m) (958)	0:00	0:00
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 !OI hub: 167,0 m (TOT: 230,0 m) (957)	0:00	0:00

To be continued on next page...

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:36 / 3
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 21:15/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours) + FM

...continued from previous page

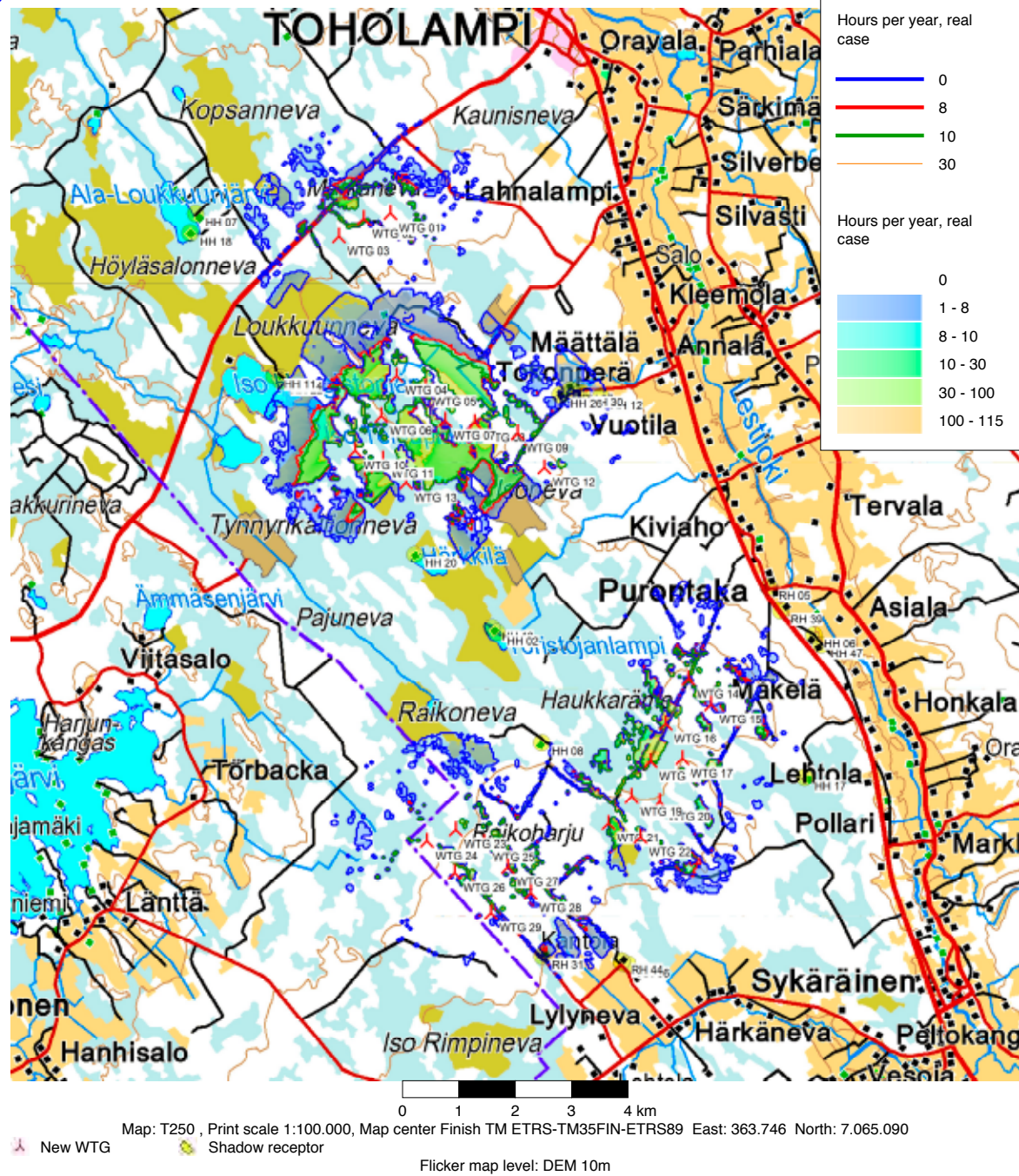
No.	Name	Worst case [h/year]	Expected [h/year]
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (956)	0:00	0:00
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (983)	0:00	0:00
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (972)	0:00	0:00
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (984)	0:00	0:00
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (967)	0:00	0:00
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (973)	5:29	1:03
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (968)	19:32	3:20
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (985)	0:00	0:00
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (966)	0:00	0:00
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (987)	13:09	1:21
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (969)	0:00	0:00
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (975)	0:00	0:00
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (980)	0:00	0:00
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (978)	0:00	0:00
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (979)	0:00	0:00
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (974)	0:00	0:00
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (977)	0:00	0:00
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (982)	0:00	0:00
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (976)	0:00	0:00
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (986)	0:00	0:00
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (962)	0:00	0:00
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (963)	0:00	0:00
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (959)	0:00	0:00
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (964)	0:00	0:00
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (960)	0:00	0:00
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (961)	0:00	0:00
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (965)	20:07	5:39

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:36 / 4
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 21:15/2.9.285

SHADOW - Map

Calculation: Opt2 29x V126 - RC (Oulu daily mean hours) + FM



WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:30 / 1
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 17:59/2.9.285

SHADOW - Main Result

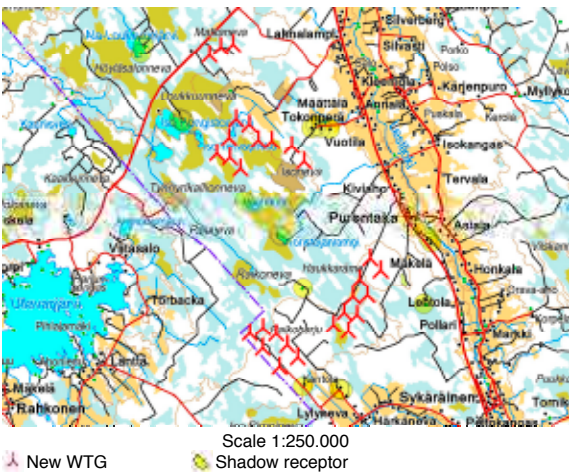
Calculation: Opt2 29x V126 - WC

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: DEM 10m
Obstacles not used in calculation
Eye height: 1,5 m
Grid resolution: 25,0 m



WTGs	Finish TM ETRS-TM35FIN-ETRS89				WTG type			Shadow data				
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
	[m]											
												[RPM]
WTG 01	361.534	7.070.973	130,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 02	361.060	7.070.875	130,0	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 03	360.619	7.070.567	124,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 04	361.644	7.068.090	119,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 05	362.158	7.067.891	117,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 06	361.373	7.067.377	120,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 07	362.503	7.067.297	118,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 08	363.026	7.067.259	116,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 09	363.788	7.067.073	118,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 10	360.907	7.066.770	124,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 11	361.401	7.066.617	124,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 12	364.266	7.066.465	121,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 13	361.813	7.066.189	125,1	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 14	366.817	7.062.708	143,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 15	367.217	7.062.257	145,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 16	366.415	7.061.920	137,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 17	366.711	7.061.297	139,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 18	366.146	7.061.247	138,6	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 19	365.808	7.060.626	141,3	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 20	366.307	7.060.536	140,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 21	365.397	7.060.153	142,5	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 22	365.966	7.059.900	143,9	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 23	362.687	7.060.038	137,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 24	362.180	7.059.830	133,7	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 25	363.197	7.059.807	153,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 26	362.673	7.059.271	151,4	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 27	363.615	7.059.371	152,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 28	364.021	7.058.914	148,8	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0
WTG 29	363.317	7.058.563	157,2	VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GrStr 3rdOc-3.300	3.300	126,0	167,0	1.712	0,0

Shadow receptor-Input

No.	Finish TM ETRS-TM35FIN-ETRS89				Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width				
HH 02	363.422	7.063.536	129,0	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 06	369.043	7.063.490	105,3	1,0	1,0	1,0	0,0	90,0 "Green house mode"

To be continued on next page...

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WindPRO version 2.9.285 Sep 2014

Project: Toholampi West	Printed/Page 22.01.2015 16:30 / 2
	Licensed user: wpd AG Stephanitorsbollwerk 3 (Haus LUV) DE-28217 Bremen +49 7142 77810
	Calculated: 10.12.2014 17:59/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - WC

...continued from previous page

No.	Finish TM ETRS-TM35FIN-ETRS89				Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width				
HH 07	358.077	7.070.960	123,0	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 08	364.219	7.061.582	136,7	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 11	359.470	7.068.086	120,6	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 13	363.332	7.063.621	128,9	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 14	359.589	7.068.053	121,1	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 17	368.880	7.060.960	131,2	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 18	357.983	7.070.622	122,7	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 20	361.968	7.064.913	128,5	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 22	359.592	7.067.992	120,2	1,0	1,0	1,0	0,0	90,0 "Green house mode"
HH 26	364.547	7.067.745	111,3	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 05	368.239	7.064.340	106,4	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 07	364.743	7.067.833	105,4	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 12	365.263	7.067.712	104,1	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 22	365.633	7.057.676	133,3	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 30	364.916	7.067.772	107,6	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 31	364.223	7.057.790	140,9	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 36	365.743	7.057.644	133,4	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 39	368.457	7.063.923	106,6	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 44	365.625	7.057.702	133,4	1,0	1,0	1,0	0,0	90,0 "Green house mode"
RH 47	369.170	7.063.316	105,0	1,0	1,0	1,0	0,0	90,0 "Green house mode"

Calculation Results

No.	Shadow, worst case		
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
HH 02	0:00	0	0:00
HH 06	0:00	0	0:00
HH 07	0:00	0	0:00
HH 08	0:00	0	0:00
HH 11	0:00	0	0:00
HH 13	0:00	0	0:00
HH 14	0:00	0	0:00
HH 17	0:00	0	0:00
HH 18	0:00	0	0:00
HH 20	0:00	0	0:00
HH 22	0:00	0	0:00
HH 26	32:50	103	0:29
RH 05	0:00	0	0:00
RH 07	20:20	70	0:24
RH 12	12:27	52	0:19
RH 22	0:00	0	0:00
RH 30	17:44	65	0:22
RH 31	20:07	55	0:26
RH 36	0:00	0	0:00
RH 39	0:00	0	0:00
RH 44	0:00	0	0:00
RH 47	0:00	0	0:00

Total amount of flickering on the shadow receptors caused by each WTG								
No.	Name							
								Worst case Expected
								[h/year] [h/year]
WTG 01	VESTAS V126-3.3 GrStr 3rdOc 3300	126.0	!O!	hub: 167,0 m (TOT: 230,0 m)	(958)			0:00
WTG 02	VESTAS V126-3.3 GrStr 3rdOc 3300	126.0	!O!	hub: 167,0 m (TOT: 230,0 m)	(957)			0:00
WTG 03	VESTAS V126-3.3 GrStr 3rdOc 3300	126.0	!O!	hub: 167,0 m (TOT: 230,0 m)	(956)			0:00
WTG 04	VESTAS V126-3.3 GrStr 3rdOc 3300	126.0	!O!	hub: 167,0 m (TOT: 230,0 m)	(983)			0:00

To be continued on next page...

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:30 / 3
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 17:59/2.9.285

SHADOW - Main Result

Calculation: Opt2 29x V126 - WC

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
WTG 05	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (972)	0:00	
WTG 06	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (984)	0:00	
WTG 07	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (967)	0:00	
WTG 08	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (973)	5:29	
WTG 09	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (968)	33:16	
WTG 10	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (985)	0:00	
WTG 11	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (966)	0:00	
WTG 12	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (987)	40:01	
WTG 13	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (969)	0:00	
WTG 14	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (975)	0:00	
WTG 15	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (980)	0:00	
WTG 16	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (978)	0:00	
WTG 17	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (979)	0:00	
WTG 18	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (974)	0:00	
WTG 19	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (977)	0:00	
WTG 20	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (982)	0:00	
WTG 21	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (976)	0:00	
WTG 22	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (986)	0:00	
WTG 23	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (962)	0:00	
WTG 24	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (963)	0:00	
WTG 25	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (959)	0:00	
WTG 26	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (964)	0:00	
WTG 27	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (960)	0:00	
WTG 28	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (961)	0:00	
WTG 29	VESTAS V126-3.3 GrStr 3rdOc 3300 126.0 IO! hub: 167,0 m (TOT: 230,0 m) (965)	20:07	

WindPRO version 2.9.285 Sep 2014

Project:	Printed/Page
Toholampi West	22.01.2015 16:30 / 4
	Licensed user:
	wpd AG
	Stephanitorsbollwerk 3 (Haus LUV)
	DE-28217 Bremen
	+49 7142 77810
	Calculated:
	10.12.2014 17:59/2.9.285

SHADOW - Map

Calculation: Opt2 29x V126 - WC

