

## SHADOW - Main Result

### 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

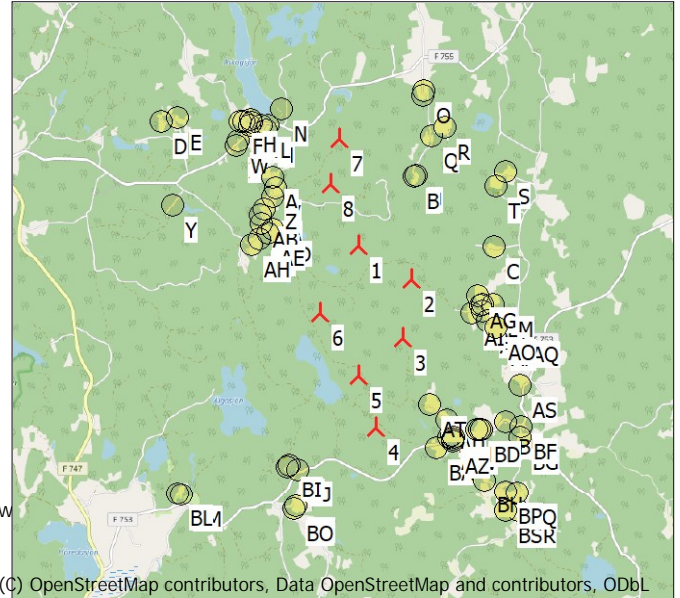
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [VAXJO /KRONOBER G]  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
1,36 1,52 2,62 6,08 8,82 7,64 6,65 5,42 4,02 2,68 1,38 0,88

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
430 451 545 591 595 537 599 930 1 374 1 351 663 496 8 562

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: Elevation Grid Data Object: Gudmundsås\_EMDGrid\_0.w  
Obstacles used in calculation  
Receptor grid resolution: 1,0 m

All coordinates are in  
Swedish UTM 33-SWREF99 (SE)



### WTGs

Easting	Northing	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	500 536	6 346 072	258,6 WTG3	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
2	501 243	6 345 628	256,5 WTG4	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
3	501 120	6 344 838	259,6 WTG6	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
4	500 764	6 343 661	248,4 WTG8	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
5	500 535	6 344 349	245,4 WTG7	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
6	500 024	6 345 173	241,6 WTG5	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
7	500 274	6 347 479	261,5 WTG1	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0
8	500 167	6 346 881	241,5 WTG2	Yes	VESTAS	V150-6.0-6 000	6 000	150,0	155,0	1 898	0,0

### Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
	[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
A	499 403	6 346 973	275,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
B	501 275	6 346 981	280,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
C	502 335	6 346 066	302,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
D	497 930	6 347 704	261,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
E	498 131	6 347 762	260,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
F	498 971	6 347 701	256,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
G	499 008	6 347 711	257,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
H	499 110	6 347 740	254,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
I	499 124	6 347 691	252,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
J	499 091	6 347 665	252,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
K	499 250	6 347 656	259,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
L	499 338	6 347 661	261,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
M	499 318	6 347 605	268,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
N	499 521	6 347 884	258,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
O	501 404	6 348 113	304,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
P	501 389	6 348 053	302,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Q	501 503	6 347 522	294,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
R	501 685	6 347 637	295,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
S	502 483	6 347 044	293,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
T	502 354	6 346 854	296,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
U	501 297	6 346 988	279,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0

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No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
V	499 442	6 346 830	264,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
W	498 942	6 347 453	248,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
X	498 919	6 347 393	247,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Y	498 079	6 346 601	222,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Z	499 398	6 346 712	259,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AA	499 292	6 346 554	260,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AB	499 244	6 346 473	263,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AC	499 255	6 346 361	258,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AD	499 407	6 346 279	240,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AE	499 335	6 346 234	243,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AF	499 215	6 346 150	259,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AG	502 118	6 345 403	302,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AH	499 128	6 346 079	265,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AI	502 044	6 345 171	280,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AJ	502 186	6 345 206	297,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AK	502 153	6 345 276	299,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AL	502 187	6 345 285	299,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AM	502 329	6 345 299	297,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AN	502 243	6 345 068	296,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AO	502 361	6 344 987	300,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AP	502 398	6 344 914	292,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AQ	502 671	6 344 971	307,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AR	502 697	6 344 946	305,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AS	502 681	6 344 223	290,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AT	501 482	6 343 959	254,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AU	501 717	6 343 767	253,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AV	501 770	6 343 556	248,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AW	501 799	6 343 543	248,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AX	501 732	6 343 525	249,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AY	501 790	6 343 506	248,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AZ	501 788	6 343 485	248,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BA	501 567	6 343 397	253,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BB	502 107	6 343 627	254,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BC	502 140	6 343 641	255,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BD	502 175	6 343 638	256,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BE	502 484	6 343 737	260,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BF	502 692	6 343 672	257,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BG	502 680	6 343 540	267,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BH	502 216	6 342 961	270,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BI	499 612	6 343 171	219,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BJ	499 727	6 343 101	228,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BK	499 597	6 343 146	219,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BL	498 134	6 342 782	199,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BM	498 179	6 342 772	196,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BN	499 702	6 342 623	240,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BO	499 688	6 342 582	240,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BP	502 492	6 342 808	259,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BQ	502 642	6 342 793	260,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BR	502 657	6 342 558	248,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BS	502 481	6 342 556	244,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0

### Calculation Results

Shadow receptor

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
A	90:38	175	0:46	21:13	
B	80:55	202	0:34	16:50	
C	24:27	92	0:30	3:45	
D	0:00	0	0:00	0:00	
E	0:00	0	0:00	0:00	
F	22:36	69	0:27	3:12	

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No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
G	23:56	70	0:28	3:21
H	27:59	76	0:30	3:42
I	29:09	78	0:30	4:01
J	27:55	77	0:30	3:59
K	36:37	88	0:34	5:06
L	43:22	96	0:37	5:55
M	42:39	97	0:37	6:17
N	64:05	135	0:41	7:05
O	16:44	63	0:28	2:18
P	18:05	65	0:29	2:31
Q	36:16	118	0:29	5:19
R	13:13	53	0:25	2:14
S	7:22	36	0:19	0:52
T	9:40	40	0:22	1:09
U	72:37	186	0:33	14:56
V	66:47	140	0:49	15:38
W	23:53	71	0:27	4:27
X	23:30	68	0:27	4:34
Y	0:00	0	0:00	0:00
Z	61:39	134	0:46	14:20
AA	69:20	165	0:40	14:55
AB	74:26	185	0:37	15:31
AC	83:36	187	0:36	17:02
AD	50:47	131	0:31	6:08
AE	55:37	153	0:30	7:57
AF	53:54	144	0:30	9:53
AG	52:16	103	0:55	11:48
AH	48:06	137	0:29	9:16
AI	79:21	155	0:42	18:20
AJ	53:12	134	0:46	12:37
AK	55:20	127	0:52	12:57
AL	50:36	120	0:52	11:41
AM	29:29	81	0:32	6:30
AN	54:59	149	0:33	12:58
AO	35:39	110	0:30	8:33
AP	39:47	118	0:28	9:35
AQ	14:02	60	0:22	3:16
AR	13:46	60	0:22	3:13
AS	7:49	32	0:22	2:01
AT	77:33	162	0:45	17:56
AU	45:42	111	0:37	11:09
AV	49:59	121	0:35	12:34
AW	48:01	120	0:34	12:05
AX	49:37	117	0:37	12:24
AY	47:10	116	0:35	11:47
AZ	46:19	115	0:35	11:33
BA	52:48	101	0:44	14:07
BB	21:28	72	0:27	5:22
BC	20:12	70	0:26	4:58
BD	18:38	66	0:25	4:34
BE	16:58	69	0:21	3:45
BF	0:00	0	0:00	0:00
BG	0:00	0	0:00	0:00
BH	11:03	41	0:23	2:59
BI	25:52	70	0:30	8:04
BJ	36:58	78	0:32	11:13
BK	26:05	72	0:29	8:07
BL	0:00	0	0:00	0:00
BM	0:00	0	0:00	0:00
BN	0:00	0	0:00	0:00
BO	0:00	0	0:00	0:00
BP	0:00	0	0:00	0:00
BQ	0:00	0	0:00	0:00

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No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
BR	0:00	0	0:00	0:00
BS	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	WTG3	163:12	26:18
2	WTG4	140:37	33:17
3	WTG6	98:04	17:39
4	WTG8	224:03	56:37
5	WTG7	96:36	24:00
6	WTG5	104:44	10:21
7	WTG1	212:30	48:32
8	WTG2	350:47	77:53

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.