

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

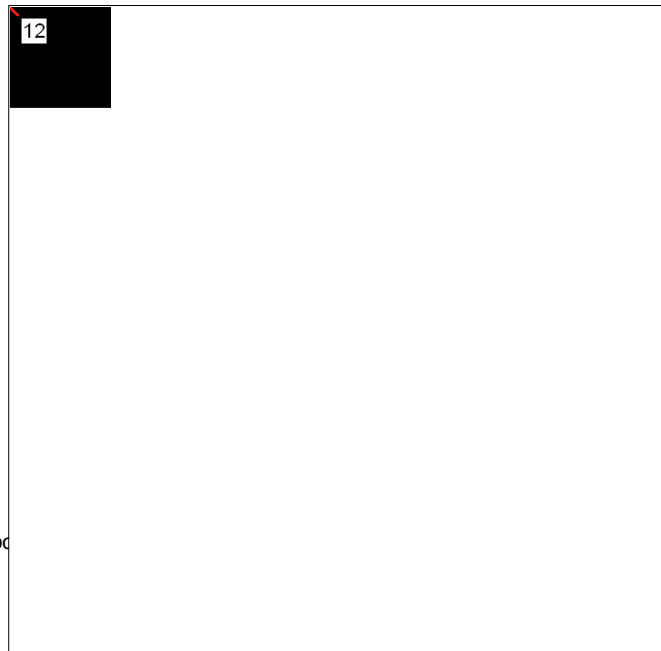
Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [ZAKOPANE]
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 2,18 3,07 3,69 4,28 5,39 5,21 5,74 5,60 4,30 3,94 2,30 1,54

Operational time
 N NE E SE S SW W NW Sum
 525 525 600 750 825 1 125 2 025 1 125 7 500
 Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
 Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_32.wpd
 Obstacles used in calculation
 Eye height: 1,5 m
 Grid resolution: 10,0 m

All coordinates are in
 Polish GK 1992/19-ETRS89



New WTG

Scale 1:100 000
 Shadow receptor

WTGs

Y (east)	X (north)	Z [m]	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	584 363	297 832	275,7 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
2	584 407	297 336	286,8 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
3	584 117	296 929	270,2 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
4	583 645	296 973	263,8 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
5	584 019	297 554	289,2 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
6	583 570	297 631	290,2 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
7	583 835	297 944	286,6 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
8	583 045	297 718	287,6 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
9	583 355	298 028	291,7 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
10	582 959	298 092	290,4 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
11	582 899	298 563	281,3 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
12	582 541	298 703	292,7 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
13	582 204	298 977	294,7 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
14	582 578	297 843	280,3 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
15	581 598	298 239	285,5 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
16	581 716	298 646	301,8 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
17	580 825	299 085	314,1 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
18	579 515	299 288	316,2 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
19	580 361	299 519	315,6 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
20	579 816	299 780	302,4 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
21	579 315	299 602	307,2 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
22	580 747	299 541	311,6 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8
23	581 263	299 358	307,4 VESTAS V112/120/180 3000 80....	Yes	VESTAS	V112/120/180-3 000	3 000	80,0	90,0	1 711 12,8

Shadow receptor-Input

No.	Y (east)	X (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	578 198	300 740	267,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
B	579 369	300 798	281,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
C	579 215	300 409	287,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
D	579 105	300 037	291,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
E	579 967	300 511	274,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"

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SHADOW - Main Result

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No.	Y (east)	X (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
F	580 231	300 539	271,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
G	580 788	300 763	268,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
H	580 798	300 522	271,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
I	581 247	300 509	277,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
J	581 971	300 576	284,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
K	581 947	299 898	290,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
L	582 274	299 831	287,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
M	583 342	300 353	292,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
N	585 022	298 693	252,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
O	584 993	298 162	261,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
P	584 816	298 438	260,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Q	584 460	298 456	261,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
R	583 884	298 450	266,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
S	583 648	298 508	268,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
T	583 108	299 208	270,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
U	582 717	299 261	276,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
V	582 223	299 465	280,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
W	578 363	299 368	289,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
X	578 733	299 170	303,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Y	579 098	298 722	309,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Z	579 321	298 739	306,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AA	579 588	298 716	300,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AB	579 999	298 700	296,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AC	580 299	298 517	284,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AD	580 552	298 188	273,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AE	580 960	297 954	267,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AF	581 166	298 015	273,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AG	581 468	297 761	267,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AH	581 828	297 793	271,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AI	581 965	297 811	270,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AJ	582 214	297 406	256,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AK	582 621	296 886	247,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AL	582 916	296 822	250,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AM	583 342	296 407	244,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AN	582 650	296 087	243,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AO	584 186	296 048	241,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AP	584 502	296 154	246,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AQ	585 292	296 401	259,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AR	584 422	295 575	242,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AS	581 855	295 704	244,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AT	581 413	296 006	249,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
AU	580 453	296 829	260,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case				Shadow, expected values	
No.	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	7:29	40	0:13	0:47	
B	0:00	0	0:00	0:00	
C	26:59	78	0:31	3:15	
D	53:05	114	0:41	6:14	
E	5:31	20	0:21	0:34	
F	11:29	60	0:16	1:31	
G	10:38	56	0:14	1:23	
H	5:36	28	0:16	0:53	
I	13:04	65	0:16	1:47	
J	4:07	28	0:13	0:37	
K	20:08	61	0:32	3:28	
L	9:07	49	0:17	1:48	
M	0:00	0	0:00	0:00	
N	16:21	54	0:29	2:06	

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SHADOW - Main Result

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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]
O	31:03	113	0:37	5:39
P	47:14	118	0:44	6:38
Q	31:03	135	0:24	5:22
R	66:00	183	0:47	10:05
S	99:18	187	1:07	14:34
T	24:09	86	0:26	4:13
U	30:39	124	0:32	5:40
V	17:00	81	0:19	2:48
W	13:38	49	0:29	2:48
X	19:48	77	0:34	4:09
Y	8:42	54	0:13	1:44
Z	5:05	42	0:11	1:04
AA	6:22	47	0:15	1:17
AB	21:02	67	0:33	4:20
AC	5:30	35	0:14	1:04
AD	11:08	52	0:18	2:18
AE	34:02	96	0:28	6:47
AF	31:54	96	0:36	6:18
AG	13:10	81	0:17	2:40
AH	23:50	98	0:37	4:48
AI	32:08	99	0:44	6:34
AJ	30:12	138	0:25	6:16
AK	12:34	64	0:18	2:32
AL	24:15	89	0:33	5:01
AM	0:00	0	0:00	0:00
AN	4:31	33	0:12	0:56
AO	0:00	0	0:00	0:00
AP	0:00	0	0:00	0:00
AQ	5:59	32	0:15	1:08
AR	0:00	0	0:00	0:00
AS	0:00	0	0:00	0:00
AT	0:00	0	0:00	0:00
AU	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 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (1)	70:15	9:23
2 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (2)	7:58	1:12
3 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (3)	17:08	3:24
4 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (4)	20:22	4:11
5 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (5)	27:21	4:23
6 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (6)	19:14	3:20
7 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (7)	34:35	5:41
8 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (8)	40:18	6:57
9 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (9)	76:58	12:11
10 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (10)	28:58	5:54
11 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (11)	21:16	4:17
12 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (12)	25:47	4:32
13 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (13)	32:24	5:56
14 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (14)	31:09	6:08
15 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (15)	52:38	10:10
16 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (16)	16:32	3:17
17 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (17)	31:27	6:16
18 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (18)	14:25	2:58
19 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (19)	31:29	5:06
20 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (20)	61:24	9:25
21 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (21)	69:04	8:07
22 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (22)	20:47	3:43
23 VESTAS V112/120/180 3000 80.0 !O! hub: 90,0 m (TOT: 130,0 m) (23)	30:02	5:34