Licensed user:
Eurowind Project A/S
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DK-9500 Hobro
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Lita Ionut / ili@eurowindenergy.com
Calculated:
13.10.2021 16:33/3.4.388

SHADOW - Main Result

Calculation: Sg170hh115 wtg6 moved

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) [NORRKOPING]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,92	2,22	3,42	6,16	9,78	8,52	7,67	6,33	5,05	3,02	1,57	1,25

Operational hours are calculated from WTGs in calculation and wind distribution:
MCP LT - MCP session (1) - [Regression] till 01.02.2021 adjustments done (10

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
575	649	580	477	487	652	875	1.123	1.110	875	649	550	8.602

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: Elevation Grid Data Object: Lervik updated_EMDGrid_0
Area object(s) used in calculation:
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
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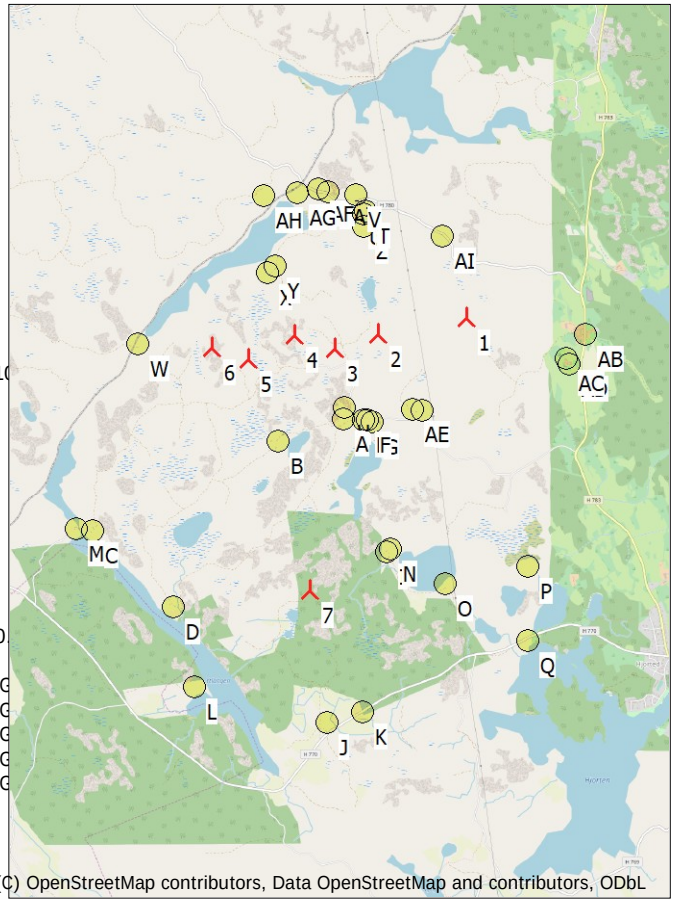
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Obstacles used in calculation
Eye height for map: 1,0 m
Grid resolution: 1,0 m

All coordinates are in
Swedish UTM 33-SWEREF99 (SE)



Scale 1:75.000
New WTG
Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	575.953	6.390.605	89,9	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
2	575.071	6.390.428	80,7	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
3	574.647	6.390.281	97,2	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
4	574.245	6.390.405	101,6	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
5	573.786	6.390.156	82,6	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
6	573.424	6.390.269	101,0	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8
7	574.443	6.387.869	92,8	Siemens Gamesa SG 6.0-...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	115,0	2.041	8,8

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]
A	574.753	6.389.580	82,6	1,0	1,0	0,0	90,0	"Green house mode"	1,0
B	574.102	6.389.346	90,8	1,0	1,0	0,0	90,0	"Green house mode"	1,0
C	572.275	6.388.421	76,4	1,0	1,0	0,0	90,0	"Green house mode"	1,0
D	573.094	6.387.687	74,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
E	574.948	6.389.578	75,2	1,0	1,0	0,0	90,0	"Green house mode"	1,0
F	574.984	6.389.579	74,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
G	575.034	6.389.557	74,2	1,0	1,0	0,0	90,0	"Green house mode"	1,0
H	574.758	6.389.696	86,2	1,0	1,0	0,0	90,0	"Green house mode"	1,0
I	575.209	6.388.267	73,2	1,0	1,0	0,0	90,0	"Green house mode"	1,0
J	574.641	6.386.559	71,8	1,0	1,0	0,0	90,0	"Green house mode"	1,0

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SHADOW - Main Result

Calculation: Sg170hh115 wtg6 moved

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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]
K	574.992	6.386.673	70,8	1,0	1,0	0,0	90,0	"Green house mode"	1,0
L	573.313	6.386.900	80,4	1,0	1,0	0,0	90,0	"Green house mode"	1,0
M	572.107	6.388.447	67,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
N	575.233	6.388.294	71,6	1,0	1,0	0,0	90,0	"Green house mode"	1,0
O	575.794	6.387.954	63,0	1,0	1,0	0,0	90,0	"Green house mode"	1,0
P	576.615	6.388.150	62,2	1,0	1,0	0,0	90,0	"Green house mode"	1,0
Q	576.630	6.387.414	60,8	1,0	1,0	0,0	90,0	"Green house mode"	1,0
R	575.530	6.389.679	87,0	1,0	1,0	0,0	90,0	"Green house mode"	1,0
S	574.904	6.391.628	71,6	1,0	1,0	0,0	90,0	"Green house mode"	1,0
T	574.933	6.391.644	71,1	1,0	1,0	0,0	90,0	"Green house mode"	1,0
U	574.851	6.391.636	71,8	1,0	1,0	0,0	90,0	"Green house mode"	1,0
V	574.833	6.391.805	83,6	1,0	1,0	0,0	90,0	"Green house mode"	1,0
W	572.689	6.390.296	73,0	1,0	1,0	0,0	90,0	"Green house mode"	1,0
X	573.962	6.391.022	83,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
Y	574.039	6.391.083	79,7	1,0	1,0	0,0	90,0	"Green house mode"	1,0
Z	574.907	6.391.492	77,7	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AA	574.560	6.391.835	84,3	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AB	577.147	6.390.464	86,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AC	576.950	6.390.226	80,4	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AD	576.986	6.390.171	83,0	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AE	575.438	6.389.691	87,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AF	574.454	6.391.858	83,9	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AG	574.248	6.391.811	74,5	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AH	573.915	6.391.775	81,1	1,0	1,0	0,0	90,0	"Green house mode"	1,0
AI	575.698	6.391.411	84,0	1,0	1,0	0,0	90,0	"Green house mode"	1,0

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	64:17	95	0:58	18:45
B	0:00	0	0:00	0:00
C	0:00	0	0:00	0:00
D	13:36	39	0:29	3:27
E	28:25	75	0:33	8:23
F	24:56	67	0:33	7:23
G	23:38	76	0:31	6:46
H	67:05	110	0:53	20:02
I	34:30	59	0:45	6:26
J	0:00	0	0:00	0:00
K	0:00	0	0:00	0:00
L	13:53	49	0:25	4:15
M	0:00	0	0:00	0:00
N	32:16	57	0:44	5:56
O	13:39	38	0:29	3:04
P	0:00	0	0:00	0:00
Q	0:00	0	0:00	0:00
R	55:25	114	0:45	15:31
S	88:38	102	1:17	12:19
T	79:33	99	1:15	11:02
U	86:45	103	1:17	12:03
V	44:02	86	0:45	6:05
W	70:58	94	1:12	16:36
X	249:05	163	2:41	35:32
Y	238:41	157	2:41	33:34
Z	112:12	113	1:30	15:47
AA	32:57	96	0:46	4:27
AB	17:00	44	0:33	4:11
AC	38:47	96	0:38	10:56
AD	36:15	95	0:36	10:24
AE	57:22	111	0:50	15:55
AF	30:46	88	0:33	4:10

To be continued on next page...

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SHADOW - Main Result

Calculation: Sg170hh115 wtg6 moved

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AG	43:18	54	1:10	5:47
AH	39:21	76	1:03	5:03
AI	121:10	122	1:30	17:13

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (24)	186:41	38:41
2	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (25)	138:02	19:51
3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (26)	167:05	28:51
4	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (27)	281:39	45:57
5	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (28)	199:39	40:41
6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (29)	180:54	35:49
7	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 115,0 m (TOT: 200,0 m) (30)	79:35	17:50

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.

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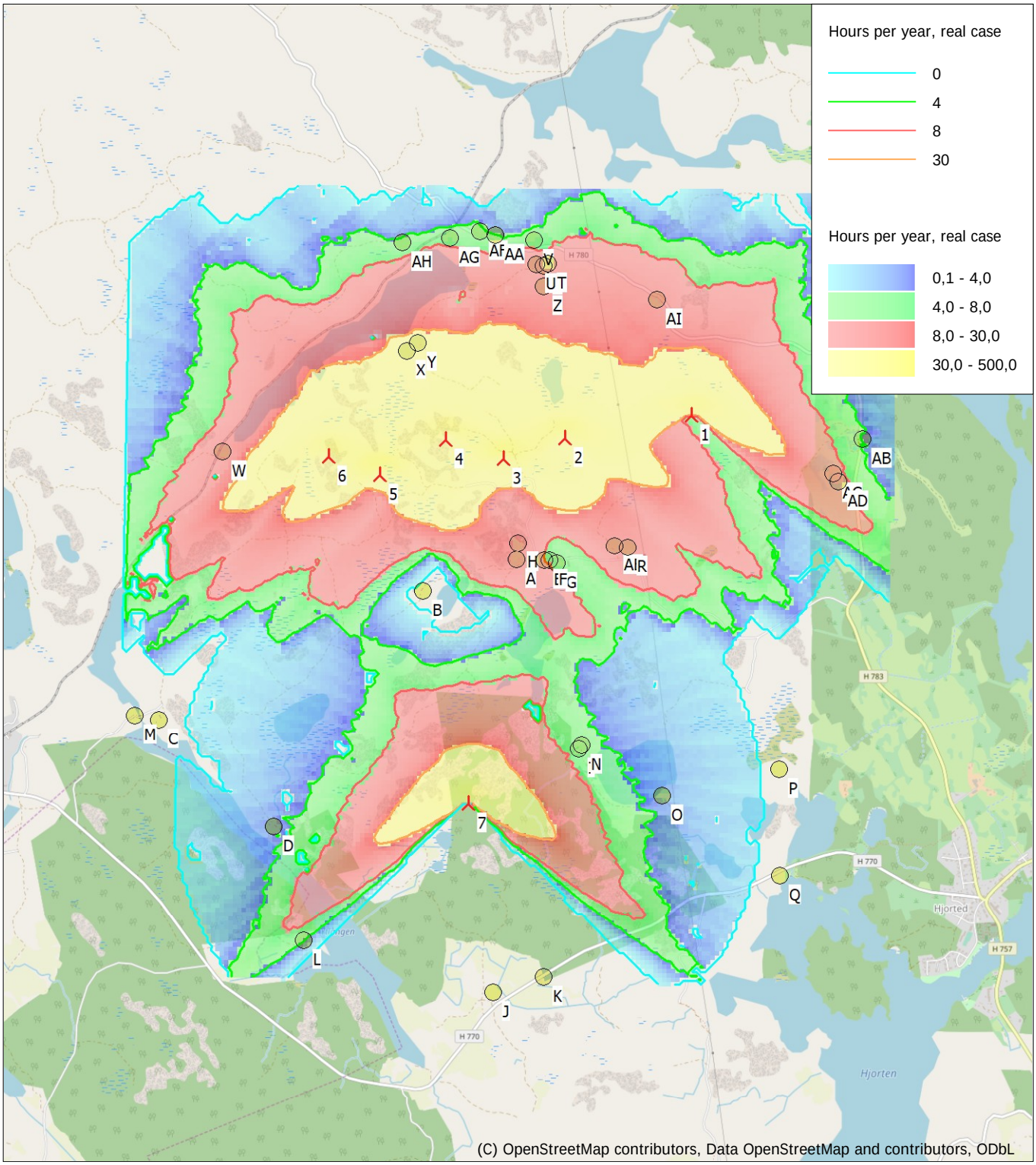
SHADOW - Map

Calculation: Sg170hh115 wtg6 moved



Map: EMD OpenStreetMap , Print scale 1:40.000, Map center Swedish UTM 33-SWEREF99 (SE) East: 574.680 North: 6.389.359

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Lervik updated_EMDGrid_0.wpg (1)