

SHADOW - Main Result

Calculation: 3 x E 138 4p2MW HH 131 m, Alle receptorer, høyde 1 m koter, Layout 161018

Assumptions for shadow calculations

Maximum distance for influence	1,500 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
756	273	294	448	665	896	924	602	406	378	490	882	7,014

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: Højdekoter_1m_1km.wpo (23)

Obstacles used in calculation

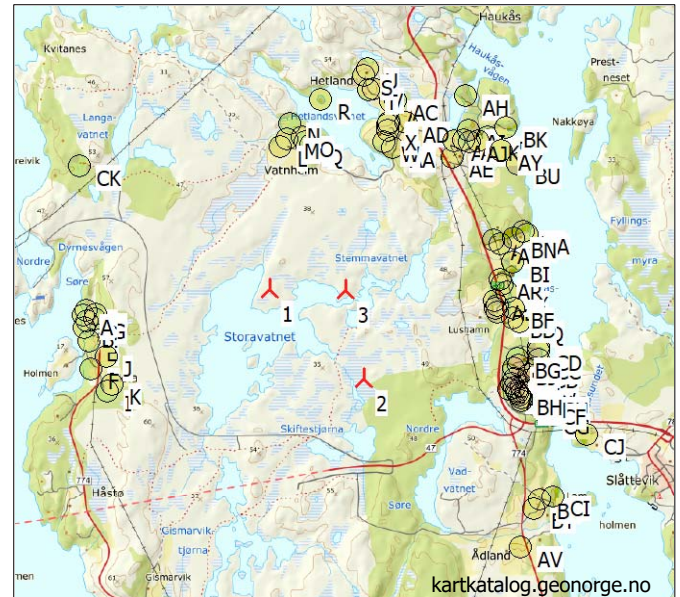
Eye height: 1.5 m

Grid resolution: 10.0 m

Topographic shadow included in calculation

All coordinates are in

UTM WGS84 Zone: 32



▲ New WTG

● Shadow receptor

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type						
			[m]		Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
								[kW]	[m]	[m]	[RPM]
1	296,318	6,581,543	26.0	T1	No	ENERCON	E-138-4,200	4,200	138.6	131.0	0.0
2	296,916	6,580,914	24.0	T2	No	ENERCON	E-138-4,200	4,200	138.6	131.0	0.0
3	296,825	6,581,507	30.0	T3	No	ENERCON	E-138-4,200	4,200	138.6	131.0	0.0

Shadow receptor-Input

No.	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	295,076	6,581,436	4.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
B	295,080	6,581,352	8.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
C	295,097	6,581,398	7.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
D	295,099	6,581,465	9.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
E	295,103	6,581,261	8.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
F	295,106	6,581,077	18.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
G	295,148	6,581,408	8.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
H	295,157	6,581,440	9.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
I	295,207	6,580,928	31.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
J	295,216	6,581,153	24.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
K	295,242	6,580,970	29.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
L	296,442	6,582,475	29.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
M	296,491	6,582,526	25.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
N	296,510	6,582,626	14.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
O	296,592	6,582,533	23.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
P	296,606	6,582,498	25.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Q	296,645	6,582,481	28.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
R	296,724	6,582,777	13.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
S	297,018	6,582,916	19.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
T	297,049	6,582,819	19.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
U	297,051	6,582,959	20.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
V	297,078	6,582,824	19.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
W	297,133	6,582,471	24.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
X	297,163	6,582,550	22.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Y	297,163	6,582,586	19.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Z	297,173	6,582,601	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AA	297,187	6,582,432	21.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"

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SHADOW - Main Result

Calculation: 3 x E 138 4p2MW HH 131 m, Alle receptorer, højde 1 m koter, Layout 161018

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No.	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
AB	297,192	6,582,737	19.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AC	297,225	6,582,745	18.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AD	297,284	6,582,592	18.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AE	297,575	6,582,348	23.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AF	297,598	6,582,456	15.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AG	297,660	6,582,458	15.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AH	297,689	6,582,750	13.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AI	297,696	6,582,518	15.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AJ	297,698	6,582,441	14.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AK	297,754	6,582,446	10.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AL	297,807	6,581,382	18.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AM	297,813	6,581,333	11.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AN	297,820	6,581,305	10.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AO	297,820	6,581,785	17.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AP	297,821	6,582,465	11.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AQ	297,826	6,581,350	10.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AR	297,851	6,581,525	12.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AS	297,864	6,581,487	11.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AT	297,866	6,581,757	17.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AU	297,873	6,580,792	28.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AV	297,890	6,579,743	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AW	297,893	6,580,834	24.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AX	297,896	6,581,440	2.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AY	297,908	6,582,373	6.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AZ	297,911	6,580,802	25.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BA	297,914	6,580,860	22.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BB	297,914	6,580,932	19.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BC	297,921	6,580,782	27.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BD	297,921	6,581,264	8.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BE	297,925	6,580,768	27.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BF	297,932	6,581,325	6.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BG	297,938	6,580,996	18.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BH	297,941	6,580,752	27.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BI	297,944	6,581,632	12.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BJ	297,946	6,580,950	19.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BK	297,948	6,582,526	12.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BL	297,950	6,580,711	26.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BM	297,951	6,580,733	26.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BN	297,955	6,581,794	13.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BO	297,957	6,580,810	24.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BP	297,960	6,580,772	28.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BQ	297,967	6,581,234	9.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BR	297,984	6,580,783	27.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BS	297,987	6,580,760	25.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BT	297,997	6,579,993	14.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BU	298,010	6,582,279	7.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BV	298,011	6,580,883	21.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BW	298,013	6,580,853	18.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BX	298,021	6,580,772	23.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BY	298,023	6,581,831	7.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BZ	298,036	6,580,054	14.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CA	298,049	6,581,814	2.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CB	298,057	6,580,924	10.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CC	298,081	6,580,978	4.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CD	298,081	6,581,038	1.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CE	298,087	6,581,063	1.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CF	298,107	6,580,679	7.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CG	298,110	6,580,618	10.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CH	298,114	6,580,726	4.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CI	298,128	6,580,065	12.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CJ	298,374	6,580,465	13.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CK	295,105	6,582,424	26.0	2.0	2.0	1.0	0.0	90.0	"Green house mode"

SHADOW - Main Result

Calculation: 3 x E 138 4p2MW HH 131 m, Alle receptorer, højde 1 m koter, Layout 161018

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	0:00	0	0:00	0:00
B	1:28	17	0:07	0:19
C	0:00	0	0:00	0:00
D	0:00	0	0:00	0:00
E	0:00	0	0:00	0:00
F	16:02	48	0:26	3:29
G	0:00	0	0:00	0:00
H	0:00	0	0:00	0:00
I	28:30	85	0:27	6:08
J	19:10	52	0:29	4:10
K	30:52	88	0:29	6:39
L	77:24	84	1:08	21:41
M	71:50	78	1:06	19:54
N	61:27	72	1:01	16:57
O	71:29	74	1:07	19:12
P	76:17	76	1:09	20:21
Q	77:43	76	1:10	20:23
R	43:13	58	0:55	11:18
S	10:22	36	0:21	2:45
T	38:19	66	0:46	9:29
U	8:21	32	0:19	2:12
V	38:15	68	0:45	9:25
W	55:55	99	0:51	13:24
X	49:16	94	0:47	11:48
Y	47:24	91	0:47	11:24
Z	46:03	90	0:45	11:03
AA	57:16	106	0:49	13:26
AB	37:48	80	0:42	9:08
AC	22:01	56	0:27	5:26
AD	44:08	96	0:40	10:22
AE	28:00	72	0:32	6:08
AF	15:22	46	0:28	3:28
AG	16:28	47	0:27	3:39
AH	0:00	0	0:00	0:00
AI	15:20	47	0:26	3:25
AJ	15:23	44	0:27	3:22
AK	0:08	3	0:03	0:01
AL	38:49	95	0:33	9:06
AM	13:30	55	0:28	3:02
AN	30:17	83	0:33	7:03
AO	30:41	84	0:31	6:36
AP	12:24	40	0:25	2:38
AQ	14:54	56	0:28	3:26
AR	32:07	81	0:32	7:12
AS	28:04	75	0:31	6:25
AT	29:00	81	0:30	6:10
AU	48:51	132	0:34	13:14
AV	0:00	0	0:00	0:00
AW	28:38	98	0:27	7:53
AX	14:28	54	0:28	3:14
AY	11:16	36	0:24	2:19
AZ	36:09	106	0:32	9:36
BA	14:30	38	0:33	3:31
BB	36:43	95	0:32	9:26
BC	40:08	113	0:32	10:48
BD	31:09	80	0:31	7:24
BE	34:07	102	0:32	9:19
BF	28:32	78	0:30	6:42
BG	33:28	88	0:32	8:22
BH	21:17	70	0:26	6:04
BI	25:56	74	0:29	5:37
BJ	33:40	91	0:31	8:34

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SHADOW - Main Result

Calculation: 3 x E 138 4p2MW HH 131 m, Alle receptorer, højde 1 m koter, Layout 161018

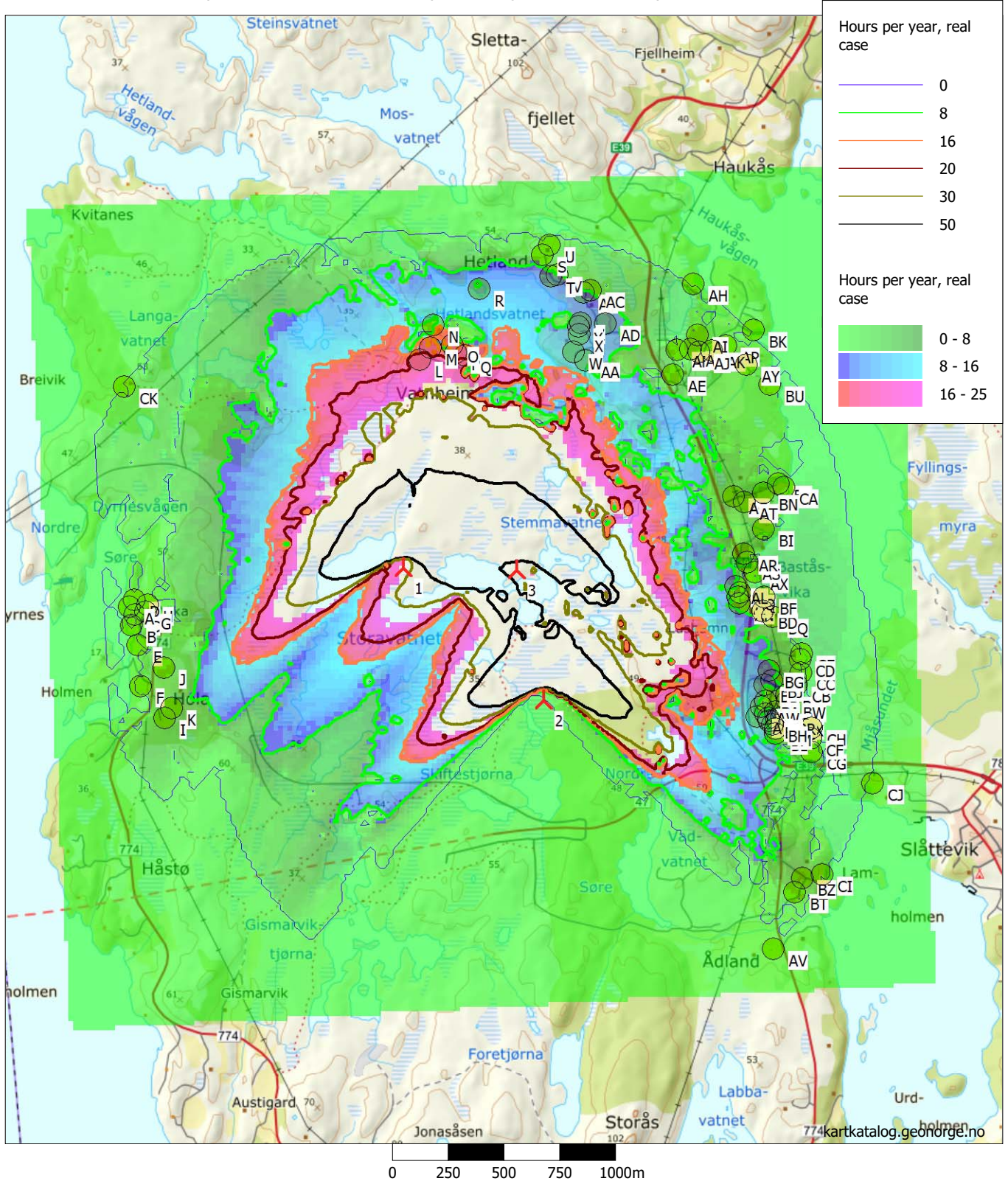
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No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
BK	0:00	0	0:00	0:00
BL	0:00	0	0:00	0:00
BM	0:00	0	0:00	0:00
BN	24:38	73	0:28	5:12
BO	35:10	99	0:31	9:21
BP	35:22	102	0:31	9:29
BQ	28:55	77	0:30	6:52
BR	33:04	94	0:31	8:49
BS	32:52	95	0:30	8:50
BT	17:55	55	0:25	5:11
BU	9:58	33	0:23	2:06
BV	29:59	84	0:30	7:46
BW	30:05	86	0:30	7:52
BX	30:43	90	0:29	8:11
BY	21:57	69	0:26	4:38
BZ	25:58	74	0:25	7:28
CA	19:29	66	0:26	4:07
CB	25:51	78	0:29	6:37
CC	0:00	0	0:00	0:00
CD	10:37	37	0:25	2:47
CE	6:26	21	0:25	1:25
CF	0:00	0	0:00	0:00
CG	6:49	32	0:19	1:45
CH	0:00	0	0:00	0:00
CI	18:47	66	0:24	5:22
CJ	0:00	0	0:00	0:00
CK	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	T1	242:06	57:34
2	T2	187:55	45:08
3	T3	420:20	108:48

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.

SHADOW - Map**Calculation:** 3 x E 138 4p2MW HH 131 m, Alle receptorer, højde 1 m koter, Layout 161018

Map: Topografisk norgeskart, Print scale 1:25,000, Map center UTM WGS84 Zone: 32 East: 296,660 North: 6,581,400

New WTG

Shadow receptor

Flicker map level: Height Contours: Højdekoter_1m_1km.wpo (23)