

Anlage 3
Berechnungsergebnisse Zusatzbelastung

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

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 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA

Schatten nur relevant, wo Rotorblatt mind. 20% der Sonne verdeckt

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont

3 °

Tage zwischen Berechnungen

1 Tag(e)

Berechnungszeitsprung

1 Minuten

Die dargestellten Zeiten sind die astronomisch maximal mögliche

Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

Eine WEA wird nicht berücksichtigt, wenn sie von keinem Teil der

Rezeptorfläche aus sichtbar ist. Die Sichtbarkeitsberechnung basiert auf

den folgenden Annahmen:

Verwendete Höhenlinien: Höhenlinien: CONTOURLINE_ONLINEDATA_0.wpo (1)

Hindernisse in Berechnung verwendet

Berechnungshöhe ü.Gr. für Karte: 1,5 m

Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:

UTM (north)-ETRS89 Zone: 32

WEA

	Ost	Nord	Z	Beschreibung	WEA-Typ		Typ	Nennleistung	Rotor-durchmesser	Nabenhöhe	Schattendaten	
					Aktuell	Hersteller					Beschatt.-Bereich	U/min
			[m]					[kW]	[m]	[m]	[m]	[U/min]
1	606.556	5.991.795	52,4	WEA 1	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
2	607.097	5.991.895	50,0	WEA 2	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
3	606.825	5.991.392	50,0	WEA 3	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
4	607.330	5.991.494	50,0	WEA 4	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
5	606.955	5.990.935	50,0	WEA 5	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
6	607.614	5.991.141	50,0	WEA 6	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
7	607.418	5.990.784	45,2	WEA 7	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
8	608.025	5.990.923	40,7	WEA 8	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
9	607.098	5.990.474	44,3	WEA 9	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
10	607.729	5.990.474	39,9	WEA 10	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
11	607.625	5.989.978	36,8	WEA 11	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0
12	607.367	5.989.560	40,0	WEA 12	Ja	GE WIND ENERGY	5.5-158 Thrust 700-5.500	5.500	158,0	120,9	1.819	0,0

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
A	IO 1	606.679	5.989.510	48,2	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
B	IO 2	606.671	5.989.527	47,4	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
C	IO 3	606.572	5.989.470	46,8	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
D	IO 4	606.279	5.989.776	48,5	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
E	IO 5	606.282	5.989.825	49,7	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
F	IO 6	606.253	5.989.867	50,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
G	IO 7	606.228	5.990.275	50,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
H	IO 8	606.195	5.990.322	50,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
I	IO 9	606.228	5.990.409	50,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
J	IO 10	606.644	5.992.832	53,8	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
K	IO 11	607.772	5.991.929	45,9	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
L	IO 12	608.687	5.990.429	26,6	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
M	IO 13	608.548	5.990.038	26,7	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
N	IO 14	608.243	5.989.995	30,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
O	IO 15	608.331	5.989.736	30,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
P	IO 16	608.657	5.989.846	23,4	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
Q	IO 17	608.349	5.992.356	20,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
R	IO 18	608.766	5.992.585	28,5	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0
S	IO 19	609.010	5.991.942	20,0	1,0	1,0	2,0	90,0	"Gewächshaus-Modus"	3,0

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

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20.08.2019 10:57/3.2.744**SHADOW - Hauptergebnis****Berechnung: Zusatzbelastung****Berechnungsergebnisse**

Schattenrezeptor

astron. max. mögl. Beschattungsdauer

Nr.	Name	Stunden/Jahr [h/a]	Schattentage/Jahr [d/a]	Max.Schattendauer/Tag [h/d]
A IO 1		89:08	174	0:53
B IO 2		82:19	153	0:52
C IO 3		63:19	144	0:46
D IO 4		38:34	139	0:33
E IO 5		46:23	156	0:33
F IO 6		58:39	170	0:37
G IO 7		95:16	233	0:56
H IO 8		88:58	235	0:48
I IO 9		106:42	249	0:43
J IO 10		15:12	39	0:29
K IO 11		199:16	231	1:30
L IO 12		86:30	213	0:41
M IO 13		109:54	205	1:00
N IO 14		117:15	227	0:59
O IO 15		129:30	160	1:14
P IO 16		63:09	169	0:36
Q IO 17		56:29	143	0:43
R IO 18		13:35	57	0:21
S IO 19		34:41	118	0:28

Gesamtmenge der max. mögl. Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal [h/a]
1 WEA 1		13:42
2 WEA 2		80:02
3 WEA 3		21:35
4 WEA 4		88:34
5 WEA 5		72:20
6 WEA 6		107:03
7 WEA 7		75:11
8 WEA 8		18:58
9 WEA 9		158:52
10 WEA 10		114:41
11 WEA 11		258:50
12 WEA 12		172:32

Summen in Rezeptortabelle und WEA-Tabelle können sich unterscheiden, da eine WEA gleichzeitig an zwei oder mehr Rezeptoren Beschattung verursachen kann und/oder ein Rezeptor gleichzeitig von zwei oder mehr WEA beschattet werden kann.

SHADOW - Kalender

Berechnung: Zusatzbelastung**Schattenrezeptor:** A - IO 1

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender 2019
Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
Die Sonne scheint täglich von Sonnenauf- bis -untergang
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	
1	08:35	08:06	07:08	06:53	07:18 (12)	05:43	22 07:15 (12) 04:52
	16:02	16:53	17:50	19:49	07:51 (12)	20:45	28 06:19 (11)
2	08:35	08:04	07:06	06:50	07:16 (12)	05:41	26 06:18 (11)
	16:04	16:55	17:52	19:51	07:53 (12)	20:47	26 05:52 (11)
3	08:35	08:02	07:04	06:48	07:14 (12)	05:39	26 05:52 (11)
	16:05	16:57	17:54	19:53	07:54 (12)	20:48	26 06:18 (11)
4	08:35	08:01	07:01	06:46	07:11 (12)	05:37	25 05:53 (11)
	16:06	16:59	17:56	19:54	07:55 (12)	20:50	25 06:18 (11)
5	08:35	07:59	06:59	06:43	07:10 (12)	05:35	23 05:54 (11)
	16:07	17:01	17:58	19:56	07:56 (12)	20:52	23 06:17 (11)
6	08:34	07:57	06:57	06:41	07:08 (12)	05:33	22 05:54 (11)
	16:08	17:04	18:00	19:58	07:56 (12)	20:54	22 06:16 (11)
7	08:34	07:55	06:54	06:38	07:08 (12)	05:31	21 05:56 (11)
	16:10	17:06	18:01	20:00	07:56 (12)	20:56	21 06:17 (11)
8	08:33	07:53	06:52	06:36	07:06 (12)	05:29	20 05:56 (11)
	16:11	17:08	18:03	20:02	07:56 (12)	20:58	20 06:16 (11)
9	08:33	07:51	06:49	06:33	07:06 (12)	05:27	19 05:57 (11)
	16:13	17:10	18:05	20:04	07:57 (12)	20:59	19 06:16 (11)
10	08:32	07:49	06:47	06:31	07:05 (12)	05:25	18 05:57 (11)
	16:14	17:12	18:07	20:06	07:57 (12)	21:01	18 06:15 (11)
11	08:31	07:47	06:45	06:28	07:04 (12)	05:23	18 05:59 (11)
	16:15	17:14	18:09	20:08	07:56 (12)	21:03	15 06:14 (11)
12	08:31	07:46	06:42	06:26	07:04 (12)	05:21	14 06:00 (11)
	16:17	17:16	18:11	20:09	07:57 (12)	21:05	14 06:14 (11)
13	08:30	07:43	06:40	06:24	07:04 (12)	05:19	13 06:00 (11)
	16:19	17:18	18:13	20:11	07:57 (12)	21:06	13 06:13 (11)
14	08:29	07:41	06:37	06:21	07:03 (12)	05:18	12 06:01 (11)
	16:20	17:20	18:15	20:13	07:56 (12)	21:08	12 06:13 (11)
15	08:28	07:39	06:35	06:19	07:03 (12)	05:16	11 06:02 (11)
	16:22	17:22	18:17	20:15	07:56 (12)	21:10	11 06:13 (11)
16	08:27	07:37	06:32	06:17	07:03 (12)	05:14	9 06:03 (11)
	16:24	17:24	18:19	20:17	07:56 (12)	21:12	9 06:12 (11)
17	08:26	07:35	06:30	06:14	07:03 (12)	05:12	8 06:04 (11)
	16:25	17:26	18:21	20:19	07:54 (12)	21:13	8 06:12 (11)
18	08:25	07:33	06:27	06:12	07:03 (12)	05:11	6 06:05 (11)
	16:27	17:28	18:23	20:21	07:54 (12)	21:15	6 06:11 (11)
19	08:24	07:31	06:25	06:10	07:03 (12)	05:09	5 06:06 (11)
	16:29	17:30	18:24	20:22	07:54 (12)	21:17	5 06:11 (11)
20	08:23	07:29	06:23	06:07	07:04 (12)	05:08	3 06:07 (11)
	16:31	17:32	18:26	20:24	07:53 (12)	21:18	3 06:10 (11)
21	08:22	07:27	06:20	06:05	07:04 (12)	05:06	3 06:07 (11)
	16:32	17:34	18:28	20:26	07:52 (12)	21:20	3 06:10 (11)
22	08:21	07:24	06:18	06:03	07:04 (12)	05:05	3 06:07 (11)
	16:34	17:36	18:30	20:28	07:51 (12)	21:21	3 06:10 (11)
23	08:19	07:22	06:15	06:00	07:05 (12)	05:03	3 06:08 (11)
	16:36	17:38	18:32	20:30	07:50 (12)	21:23	3 06:11 (11)
24	08:18	07:20	06:13	05:58	07:05 (12)	05:02	3 06:08 (11)
	16:38	17:40	18:34	20:32	07:49 (12)	21:25	3 06:11 (11)
25	08:17	07:18	06:10	05:56	07:06 (12)	05:00	5 06:07 (11)
	16:40	17:42	18:36	20:34	07:48 (12)	21:26	5 06:12 (11)
26	08:15	07:15	06:08	05:54	07:07 (12)	04:59	6 06:07 (11)
	16:42	17:44	18:38	20:36	07:46 (12)	21:27	6 06:13 (11)
27	08:14	07:13	06:05	05:51	07:08 (12)	04:58	8 06:06 (11)
	16:44	17:46	18:39	20:37	07:45 (12)	21:29	8 06:14 (11)
28	08:12	07:11	06:03	05:49	07:10 (12)	04:57	9 06:06 (11)
	16:46	17:48	18:41	20:39	07:43 (12)	21:30	9 06:15 (11)
29	08:11		06:00	05:47	07:11 (12)	04:55	11 06:05 (11)
	16:48		18:43	20:41	07:41 (12)	21:32	11 06:16 (11)
30	08:09		05:58	05:45	07:13 (12)	04:54	12 06:05 (11)
	16:49		18:45	20:43	07:39 (12)	21:33	12 06:17 (11)
31	08:08		06:55	07:21 (12)		04:53	
	16:51		19:47	07:50 (12)		21:34	
Sonnenscheinstunden				419	494	511	
astr.max.mögl.Beschattung				88	1359	885	387

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: A - IO 1

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember
1	04:47	06:04 (11)	05:26	07:03 (12)	07:13	08:09
	21:52	06:17 (11)	05:32 (11)	07:56 (12)	18:56	16:45
2	04:47	06:04 (11)	05:28	07:03 (12)	07:17	08:11
	21:52	06:18 (11)	05:31	07:55 (12)	18:54	16:43
3	04:48	06:04 (11)	05:30	07:03 (12)	07:18	08:12
	21:51	06:19 (11)	05:31	07:55 (12)	18:51	16:41
4	04:49	06:03 (11)	05:31	07:03 (12)	07:20	08:14
	21:51	06:21 (11)	05:32	07:55 (12)	18:49	16:39
5	04:50	06:02 (11)	05:33	07:03 (12)	07:22	08:15
	21:50	06:21 (11)	05:33	07:53 (12)	18:47	16:37
6	04:51	06:02 (11)	05:35	07:03 (12)	07:24	08:17
	21:50	06:22 (11)	05:36	07:53 (12)	18:44	16:35
7	04:52	06:01 (11)	05:36	07:04 (12)	07:26	08:18
	21:49	06:23 (11)	05:37	07:52 (12)	18:42	16:33
8	04:53	06:01 (11)	05:38	07:04 (12)	07:28	08:19
	21:48	06:23 (11)	05:39	07:50 (12)	18:39	16:31
9	04:54	06:01 (11)	05:40	07:04 (12)	07:29	08:21
	21:48	06:24 (11)	05:41	07:49 (12)	18:37	16:29
10	04:55	06:00 (11)	05:42	07:06 (12)	07:31	08:22
	21:47	06:25 (11)	05:43	07:48 (12)	18:34	16:28
11	04:56	06:00 (11)	05:43	07:08 (12)	07:33	08:23
	21:46	06:26 (11)	05:44	07:47 (12)	18:32	16:26
12	04:57	05:59 (11)	05:45	07:09 (12)	07:35	08:24
	21:45	06:26 (11)	05:46	07:45 (12)	18:30	16:24
13	04:58	05:59 (11)	05:47	07:11 (12)	07:37	08:25
	21:44	06:27 (11)	05:48	07:43 (12)	18:27	16:23
14	04:59	05:58 (11)	05:49	07:13 (12)	07:39	08:26
	21:43	06:27 (11)	05:50	07:41 (12)	18:25	16:21
15	05:01	05:59 (11)	05:51	07:14 (12)	07:41	08:27
	21:42	06:29 (11)	05:52	07:37 (12)	18:23	16:19
16	05:02	05:58 (11)	05:52	07:16 (12)	07:42	08:28
	21:41	06:29 (11)	05:53	07:34 (12)	18:20	16:18
17	05:03	05:58 (11)	05:54	07:19 (12)	07:44	08:29
	21:40	06:29 (11)	05:55	07:29 (12)	18:18	16:16
18	05:05	05:57 (11)	05:56	07:14 (12)	07:46	08:30
	21:39	06:30 (11)	05:57	07:12 (12)	18:16	16:15
19	05:06	05:57 (11)	05:58	07:12 (12)	07:48	08:31
	21:37	06:30 (11)	05:59	07:11 (12)	18:13	16:13
20	05:07	05:57 (11)	05:59	07:11 (12)	07:50	08:31
	21:36	06:31 (11)	06:00	07:10 (12)	18:11	16:12
21	05:09	05:57 (11)	06:01	07:10 (12)	07:52	08:32
	21:35	06:31 (11)	06:02	07:09 (12)	18:09	16:10
22	05:10	05:56 (11)	06:03	07:10 (12)	07:54	08:33
	21:33	06:31 (11)	06:04	07:08 (12)	18:06	16:09
23	05:12	05:57 (11)	06:05	07:08 (12)	07:56	08:33
	21:32	06:32 (11)	06:06	07:07 (12)	18:04	16:08
24	05:13	05:56 (11)	06:07	07:08 (12)	07:58	08:34
	21:30	06:32 (11)	06:08	07:07 (12)	18:02	16:06
25	05:15	05:57 (11)	06:08	07:07 (12)	08:00	08:34
	21:29	06:33 (11)	06:09	07:06 (12)	18:00	16:05
26	05:16	05:56 (11)	06:10	07:06 (12)	08:02	08:35
	21:27	06:32 (11)	06:11	07:05 (12)	17:58	16:04
27	05:18	05:56 (11)	06:12	07:05 (12)	08:04	08:35
	21:26	06:33 (11)	06:13	07:04 (12)	16:55	16:03
28	05:20	05:56 (11)	06:14	07:05 (12)	08:06	08:35
	21:24	06:32 (11)	06:15	07:04 (12)	16:53	16:02
29	05:21	05:57 (11)	06:16	07:04 (12)	08:07	08:35
	21:22	06:33 (11)	06:17	07:03 (12)	16:51	16:01
30	05:23	05:56 (11)	06:17	07:04 (12)	08:07	08:35
	21:21	06:32 (11)	06:18	07:03 (12)	16:49	16:00
31	05:25	05:58 (11)	06:19	07:04 (12)	08:08	08:35
	21:19	06:33 (11)	06:20	07:03 (12)	16:47	16:01
Sonnenscheinstunden	514	462	384	330	259	232
astr.max.mögl.Beschattung	885	1068	676			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)
	Minuten mit Schatten		

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** B - IO 2

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender: 2019
 Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
 Die Sonne scheint täglich von Sonnenauf- bis -untergang
 Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
 Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35	08:06	07:08	06:53	07:18 (12)	05:43
	16:02	16:53	17:50	19:49	07:59 (12)	20:45
2	08:35	08:04	07:06	06:50	07:16 (12)	05:41
	16:04	16:55	17:52	19:51	08:00 (12)	20:47
3	08:35	08:02	07:04	06:48	07:15 (12)	05:39
	16:05	16:57	17:54	19:53	08:01 (12)	20:48
4	08:35	08:01	07:01	06:46	07:14 (12)	05:37
	16:06	16:59	17:56	19:54	08:01 (12)	20:50
5	08:35	07:59	06:59	06:43	07:13 (12)	05:35
	16:07	17:01	17:58	19:56	08:02 (12)	20:52
6	08:34	07:57	06:57	06:41	07:12 (12)	05:33
	16:08	17:04	18:00	19:58	08:01 (12)	20:54
7	08:34	07:55	06:54	06:38	07:11 (12)	05:31
	16:10	17:06	18:01	20:00	08:02 (12)	20:56
8	08:33	07:53	06:52	06:36	07:10 (12)	05:29
	16:11	17:08	18:03	20:02	08:01 (12)	20:58
9	08:33	07:51	06:49	06:33	07:10 (12)	05:27
	16:13	17:10	18:05	20:04	08:02 (12)	20:59
10	08:32	07:49	06:47	06:31	07:10 (12)	05:25
	16:14	17:12	18:07	20:06	08:02 (12)	21:01
11	08:31	07:47	06:45	06:28	07:09 (12)	05:23
	16:15	17:14	18:09	20:08	08:01 (12)	21:03
12	08:31	07:46	06:42	06:26	07:09 (12)	05:21
	16:17	17:16	18:11	20:09	08:01 (12)	21:05
13	08:30	07:43	06:40	06:24	07:09 (12)	05:19
	16:19	17:18	18:13	20:11	08:01 (12)	21:06
14	08:29	07:41	06:37	06:21	07:08 (12)	05:18
	16:20	17:20	18:15	20:13	08:00 (12)	21:08
15	08:28	07:39	06:35	06:19	07:08 (12)	05:16
	16:22	17:22	18:17	20:15	07:59 (12)	21:10
16	08:27	07:37	06:32	06:17	07:09 (12)	05:14
	16:24	17:24	18:19	20:17	07:59 (12)	21:12
17	08:26	07:35	06:30	06:14	07:08 (12)	05:12
	16:25	17:26	18:21	20:19	07:57 (12)	21:13
18	08:25	07:33	06:27	06:12	07:09 (12)	05:11
	16:27	17:28	18:23	20:21	07:57 (12)	21:15
19	08:24	07:31	06:25	06:10	07:09 (12)	05:09
	16:29	17:30	18:24	20:22	07:56 (12)	21:17
20	08:23	07:29	06:23	06:07	07:10 (12)	05:08
	16:31	17:32	18:26	20:24	07:55 (12)	21:18
21	08:22	07:27	06:20	06:05	07:11 (12)	05:06
	16:32	17:34	18:28	20:26	07:54 (12)	21:20
22	08:21	07:24	06:18	06:03	07:11 (12)	05:05
	16:34	17:36	18:30	20:28	07:52 (12)	21:21
23	08:19	07:22	06:15	06:00	07:12 (12)	05:03
	16:36	17:38	18:32	20:30	07:51 (12)	21:23
24	08:18	07:20	06:13	05:58	07:13 (12)	05:02
	16:38	17:40	18:34	20:32	07:50 (12)	21:25
25	08:17	07:18	06:10	05:56	07:14 (12)	05:00
	16:40	17:42	18:36	20:34	07:48 (12)	21:26
26	08:15	07:15	06:08	06:33 (12)	07:16 (12)	04:59
	16:42	17:44	18:38	06:47 (12)	07:46 (12)	21:27
27	08:14	07:13	06:05	06:31 (12)	07:18 (12)	04:58
	16:44	17:46	18:39	06:51 (12)	07:44 (12)	21:29
28	08:12	07:11	06:03	06:28 (12)	07:20 (12)	04:57
	16:46	17:48	18:41	06:53 (12)	07:42 (12)	21:30
29	08:11		06:00	06:26 (12)	07:23 (12)	04:55
	16:48		18:43	06:56 (12)	07:38 (12)	21:32
30	08:09		05:58	06:23 (12)	06:13 (11)	04:54
	16:49		18:45	06:57 (12)	06:14 (11)	21:33
31	08:08		05:55	07:21 (12)		04:53
	16:51		19:47	07:58 (12)		21:34
Sonnenscheinstunden	248	271	365	419	494	511
astr.max.mögl.Beschattung			160	1268	884	141

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender**Berechnung: Zusatzbelastung Schattenrezeptor: B - IO 2****Voraussetzungen für Berechnung des Schattenwurfs**

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember
1	04:47	05:26	06:00 (11)	06:21	07:08 (12)	07:13
	21:52	21:17	20:11	18:56	16:45	15:59
2	04:47	05:28	06:01 (11)	06:23	07:08 (12)	07:15
	21:52	21:15	20:08	18:54	16:43	15:58
3	04:48	05:30	06:02 (11)	06:25	07:08 (12)	07:18
	21:51	21:14	20:06	18:51	16:41	15:58
4	04:49	05:31	06:04 (11)	06:26	07:08 (12)	07:20
	21:51	21:12	20:03	18:49	16:39	15:57
5	04:50	05:33	06:05 (11)	06:28	07:07 (12)	07:22
	21:50	21:10	20:01	18:47	16:37	15:56
6	04:51	05:35	06:07 (11)	06:30	07:07 (12)	07:24
	21:50	21:08	19:58	18:44	16:35	15:56
7	04:52	05:36	06:09 (11)	06:32	07:07 (12)	07:26
	21:49	21:06	19:56	18:42	16:33	15:55
8	04:53	05:38	06:10 (11)	06:33	07:07 (12)	07:28
	21:48	21:04	19:54	18:39	16:31	15:55
9	04:54	05:40	06:12 (11)	06:35	07:07 (12)	07:29
	21:48	21:02	19:51	18:37	16:29	15:54
10	04:55	05:42	06:14 (11)	06:37	07:08 (12)	07:31
	21:47	21:00	19:49	18:34	16:28	15:54
11	04:56	05:43	06:15 (11)	06:39	07:09 (12)	07:33
	21:46	20:58	19:46	18:32	16:26	15:54
12	04:57	05:45	06:17 (11)	06:41	07:09 (12)	07:35
	21:45	20:56	19:44	18:30	16:24	15:53
13	04:58	05:47	06:18 (11)	06:42	07:11 (12)	07:37
	21:44	20:54	19:41	18:27	16:23	15:53
14	04:59	05:49	06:20 (11)	06:44	07:13 (12)	07:39
	21:43	20:52	19:39	18:25	16:21	15:53
15	05:01	05:51	07:31 (12)	06:46	07:14 (12)	07:41
	21:42	20:50	19:36	18:23	16:19	15:53
16	05:02	05:52	07:27 (12)	06:48	07:16 (12)	07:42
	21:41	20:47	19:34	18:20	16:18	15:53
17	05:03	05:54	07:25 (12)	06:49	07:18 (12)	07:44
	21:40	20:45	19:31	18:18	16:16	15:53
18	05:05	05:56	07:23 (12)	06:51	07:20 (12)	07:46
	21:39	20:43	19:29	18:16	16:15	15:53
19	05:06	05:58	07:20 (12)	06:53	07:22 (12)	07:48
	21:37	20:41	19:26	18:13	16:13	15:54
20	05:07	05:59	07:19 (12)	06:55	07:50	07:50
	21:36	20:39	19:24	18:11	16:12	15:54
21	05:09	06:01	07:18 (12)	06:57	07:52	07:52
	21:35	20:36	19:21	18:09	16:10	15:54
22	05:10	06:03	07:17 (12)	06:58	07:54	07:54
	21:33	20:34	19:19	18:06	16:09	15:55
23	05:12	06:05	07:15 (12)	07:00	07:56	07:55
	21:32	20:32	19:16	18:04	16:08	15:55
24	05:13	06:07	07:14 (12)	07:02	07:58	07:57
	21:30	20:29	19:14	18:02	16:06	15:56
25	05:15	06:08	07:13 (12)	07:04	08:00	07:59
	21:29	20:27	19:11	18:00	16:05	15:56
26	05:16	06:10	07:12 (12)	07:06	08:02	08:01
	21:27	20:25	19:09	17:58	16:04	15:57
27	05:18	06:12	07:11 (12)	07:07	07:04	08:02
	21:26	20:22	19:06	16:55	16:03	15:58
28	05:20	06:14	07:11 (12)	07:09	07:06	08:04
	21:24	20:20	19:04	16:53	16:02	15:58
29	05:21	06:16	07:09 (12)	07:11	07:07	08:06
	21:22	20:18	19:01	16:51	16:01	15:59
30	05:23	06:17	07:09 (12)	07:13	07:09	08:07
	21:21	20:15	18:59	16:49	16:00	16:00
31	05:25	06:19	07:09 (12)		07:11	08:35
	21:19	20:13	08:01 (12)		16:47	16:01
Sonnenscheinstunden	514	462	384	330	259	232
astr.max.mögl.Beschattung	725	980	781			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende
			(WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** C - IO 3

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender 2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni			
1	08:35 16:02	08:06 16:53	07:08 17:50	06:53 19:49	07:18 (12) 07:32 (12)	05:43 20:45	06:11 (11) 07:21 (12)	04:52 21:36	05:59 (11) 06:13 (11)
2	08:35 16:04	08:04 16:55	07:06 17:52	06:50 19:51	07:16 (12) 07:35 (12)	05:41 20:47	06:09 (11) 06:14 (11)	04:51 21:37	06:00 (11) 06:11 (11)
3	08:35 16:05	08:02 16:57	07:04 17:54	06:48 19:53	07:14 (12) 07:37 (12)	05:39 20:48	06:07 (11) 06:16 (11)	04:50 21:38	06:02 (11) 06:09 (11)
4	08:35 16:06	08:01 16:59	07:01 17:56	06:46 19:54	07:11 (12) 07:38 (12)	05:37 20:50	06:05 (11) 06:17 (11)	04:49 21:39	
5	08:35 16:07	07:59 17:01	06:59 17:58	06:43 19:56	07:09 (12) 07:40 (12)	05:35 20:52	06:03 (11) 06:18 (11)	04:48 21:41	
6	08:34 16:08	07:57 17:04	06:57 18:00	06:41 19:58	07:06 (12) 07:40 (12)	05:33 20:54	06:01 (11) 06:18 (11)	04:48 21:42	
7	08:34 16:10	07:55 17:06	06:54 18:01	06:38 20:00	07:04 (12) 07:41 (12)	05:31 20:56	05:59 (11) 06:19 (11)	04:47 21:43	
8	08:33 16:11	07:53 17:08	06:52 18:03	06:36 20:02	07:01 (12) 07:41 (12)	05:29 20:58	05:57 (11) 06:19 (11)	04:46 21:44	
9	08:33 16:13	07:51 17:10	06:49 18:05	06:33 20:04	07:00 (12) 07:42 (12)	05:27 20:59	05:56 (11) 06:20 (11)	04:46 21:45	
10	08:32 16:14	07:49 17:12	06:47 18:07	06:31 20:06	06:59 (12) 07:43 (12)	05:25 21:01	05:54 (11) 06:20 (11)	04:45 21:46	
11	08:31 16:15	07:48 17:14	06:45 18:09	06:29 20:08	06:58 (12) 07:42 (12)	05:23 21:03	05:52 (11) 06:20 (11)	04:45 21:46	
12	08:31 16:17	07:46 17:16	06:42 18:11	06:26 20:09	06:58 (12) 07:43 (12)	05:21 21:05	05:51 (11) 06:21 (11)	04:44 21:47	
13	08:30 16:19	07:43 17:18	06:40 18:13	06:24 20:11	06:57 (12) 07:43 (12)	05:19 21:06	05:49 (11) 06:21 (11)	04:44 21:48	
14	08:29 16:20	07:41 17:20	06:37 18:15	06:21 20:13	06:56 (12) 07:42 (12)	05:18 21:08	05:48 (11) 06:21 (11)	04:43 21:49	
15	08:28 16:22	07:39 17:22	06:35 18:17	06:19 20:15	06:56 (12) 07:42 (12)	05:16 21:10	05:48 (11) 06:21 (11)	04:43 21:49	05:18 (10) 05:19 (10)
16	08:27 16:24	07:37 17:24	06:32 18:19	06:17 20:17	06:56 (12) 07:42 (12)	05:14 21:12	05:48 (11) 06:21 (11)	04:43 21:50	05:18 (10) 05:19 (10)
17	08:26 16:25	07:35 17:26	06:30 18:21	06:14 20:19	06:56 (12) 07:41 (12)	05:12 21:13	05:49 (11) 06:21 (11)	04:43 21:50	05:18 (10) 05:20 (10)
18	08:25 16:27	07:33 17:28	06:27 18:23	06:12 20:21	06:56 (12) 07:41 (12)	05:11 21:15	05:48 (11) 06:20 (11)	04:43 21:51	05:18 (10) 05:20 (10)
19	08:24 16:29	07:31 17:30	06:25 18:24	06:10 20:22	06:56 (12) 07:40 (12)	05:09 21:17	05:49 (11) 06:20 (11)	04:43 21:51	05:18 (10) 05:20 (10)
20	08:23 16:31	07:29 17:32	06:23 18:26	06:07 20:24	06:57 (12) 07:40 (12)	05:08 21:18	05:49 (11) 06:20 (11)	04:43 21:52	05:18 (10) 05:20 (10)
21	08:22 16:32	07:27 17:34	06:20 18:28	06:05 20:26	06:57 (12) 07:39 (12)	05:06 21:20	05:50 (11) 06:20 (11)	04:43 21:52	05:18 (10) 05:21 (10)
22	08:21 16:34	07:24 17:36	06:18 18:30	06:03 20:28	06:57 (12) 07:37 (12)	05:05 21:21	05:50 (11) 06:20 (11)	04:43 21:52	05:18 (10) 05:21 (10)
23	08:19 16:36	07:22 17:38	06:15 18:32	06:00 20:30	06:57 (12) 07:37 (12)	05:03 21:23	05:50 (11) 06:18 (11)	04:43 21:52	05:19 (10) 05:22 (10)
24	08:18 16:38	07:20 17:40	06:13 18:34	05:58 20:32	06:58 (12) 07:36 (12)	05:02 21:25	05:51 (11) 06:18 (11)	04:43 21:53	05:19 (10) 05:21 (10)
25	08:17 16:40	07:18 17:42	06:10 18:36	05:56 20:34	06:59 (12) 07:34 (12)	05:00 21:26	05:52 (11) 06:18 (11)	04:44 21:53	05:19 (10) 05:21 (10)
26	08:15 16:42	07:15 17:44	06:08 18:38	05:54 20:36	07:00 (12) 07:33 (12)	04:59 21:28	05:53 (11) 06:17 (11)	04:44 21:53	05:20 (10) 05:22 (10)
27	08:14 16:44	07:13 17:46	06:05 18:39	05:52 20:37	07:01 (12) 07:32 (12)	04:58 21:29	05:54 (11) 06:17 (11)	04:44 21:53	05:20 (10) 05:22 (10)
28	08:12 16:46	07:11 17:48	06:03 18:41	05:49 20:39	07:03 (12) 07:30 (12)	04:57 21:30	05:54 (11) 06:16 (11)	04:45 21:53	05:21 (10) 05:22 (10)
29	08:11 16:48		06:00 18:43	05:47 20:41	07:04 (12) 07:28 (12)	04:55 21:32	05:55 (11) 06:16 (11)	04:45 21:52	
30	08:09 16:50		05:58 18:45	05:45 20:43	07:07 (12) 07:25 (12)	04:54 21:33	05:56 (11) 06:15 (11)	04:46 21:52	
31	08:08 16:51		06:55 19:47	07:21 (12) 07:27 (12)		04:53 21:34	05:57 (11) 06:14 (11)		
Sonnenscheinstunden	248	271	365	419	494	744	511	60	
astr.max.mögl.Beschattung			6	1089					

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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SHADOW - Kalender

Berechnung: ZusatzbelastungSchattenrezeptor: C - IO 3

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender2019
Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
Die Sonne scheint täglich von Sonnenauf- bis -untergang
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlrichtung
Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember
1	04:47 21:52	05:26 21:17	05:59 (11) 06:31 (11)	06:21 07:42 (12)	07:15 18:56	08:09 15:59
2	04:47 21:52	05:28 21:15	06:01 (11) 06:31 (11)	06:23 20:08	07:17 18:54	08:11 15:58
3	04:48 21:51	05:30 21:14	06:02 (11) 06:31 (11)	06:25 20:06	07:18 18:51	08:12 15:58
4	04:49 21:51	05:31 21:12	06:04 (11) 06:31 (11)	06:26 20:03	07:20 18:49	08:14 15:57
5	04:50 21:50	05:33 21:10	06:05 (11) 06:30 (11)	06:28 20:01	07:22 18:47	08:15 15:56
6	04:51 21:50	05:35 21:08	06:07 (11) 06:30 (11)	06:30 19:58	07:24 18:44	08:17 15:56
7	04:52 21:49	05:36 21:06	06:09 (11) 06:29 (11)	06:32 19:56	07:26 18:42	08:18 15:55
8	04:53 21:48	05:38 21:04	06:10 (11) 06:28 (11)	06:33 19:54	07:28 18:39	08:19 15:55
9	04:54 21:48	05:40 21:02	06:12 (11) 06:27 (11)	06:35 19:51	07:29 18:37	08:21 15:54
10	04:55 21:47	05:42 21:00	06:14 (11) 06:26 (11)	06:37 19:49	07:31 18:34	08:22 15:54
11	04:56 21:46	05:43 20:58	06:15 (11) 06:24 (11)	06:39 19:46	07:33 18:32	08:23 15:54
12	04:57 21:45	05:45 20:56	06:17 (11) 06:23 (11)	06:41 19:44	07:35 18:30	08:24 15:53
13	04:58 21:44	05:47 20:54	06:19 (11) 07:29 (12)	06:42 19:41	07:37 18:27	08:25 15:53
14	04:59 21:43	05:49 20:52	07:15 (12) 07:32 (12)	06:44 19:39	07:39 18:25	08:26 15:53
15	05:01 21:42	05:51 20:50	07:12 (12) 07:35 (12)	06:46 19:36	07:41 18:23	08:27 15:53
16	05:02 21:41	05:52 20:47	07:10 (12) 07:36 (12)	06:48 19:34	07:42 18:20	08:28 15:53
17	05:03 21:40	05:54 20:45	07:08 (12) 07:38 (12)	06:50 19:31	07:44 18:18	08:29 15:53
18	05:05 21:39	05:56 20:43	07:07 (12) 07:39 (12)	06:51 19:29	07:46 18:16	08:30 15:53
19	05:06 21:37	05:58 20:41	07:05 (12) 07:40 (12)	06:53 19:26	07:48 18:13	08:31 15:54
20	05:07 21:36	05:59 20:39	07:04 (12) 07:41 (12)	06:55 19:24	07:50 18:11	08:31 15:54
21	05:09 21:35	06:01 (11) 20:36	07:03 (12) 07:42 (12)	06:57 19:21	07:52 18:09	08:32 15:54
22	05:10 21:33	06:01 (11) 20:34	07:02 (12) 07:43 (12)	06:58 19:19	07:54 18:06	08:33 15:55
23	05:12 21:32	06:00 (11) 20:32	07:01 (12) 07:43 (12)	07:00 19:16	07:56 18:04	08:33 15:55
24	05:13 21:30	06:00 (11) 20:29	07:00 (12) 07:43 (12)	07:02 19:14	07:58 18:02	08:34 15:56
25	05:15 21:29	06:00 (11) 20:27	07:00 (12) 07:44 (12)	07:04 19:11	08:00 18:00	08:34 15:56
26	05:16 21:27	05:59 (11) 20:25	06:59 (12) 07:43 (12)	07:06 19:09	08:02 17:58	08:35 15:57
27	05:18 21:26	05:59 (11) 20:22	06:58 (12) 07:44 (12)	07:07 19:06	08:02 16:55	08:35 15:58
28	05:20 21:24	05:59 (11) 20:20	06:58 (12) 07:44 (12)	07:09 19:04	08:04 16:53	08:35 15:58
29	05:21 21:22	05:59 (11) 20:18	06:57 (12) 07:43 (12)	07:11 19:01	08:06 16:51	08:35 15:59
30	05:23 21:21	05:59 (11) 20:15	06:57 (12) 07:43 (12)	07:13 18:59	08:07 16:49	08:35 16:00
31	05:25 21:19	05:59 (11) 20:13	06:57 (12) 07:43 (12)		08:11 16:47	08:35 16:01
Sonnenscheinstunden	514	462	384	330	259	232
astr.max.mögl.Beschattung	526	941	433			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat
Sonnenlaufgang (SS:MM)
Sonnenuntergang (SS:MM)
Minuten mit Schatten

Zeitpunkt (SS:MM) Schattenanfang
Zeitpunkt (SS:MM) Schattenende

(WEA mit erstem Schatten)
(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender**Berechnung: Zusatzbelastung Schattenrezeptor: D - IO 4****Voraussetzungen für Berechnung des Schattenwurfs**

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrichtungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 16:02	08:06 16:53	07:08 17:50	06:53 19:49	05:43 20:45	04:52 21:36
2	08:35 16:04	08:04 16:55	07:06 17:52	06:50 19:51	05:41 20:47	04:51 21:37
3	08:35 16:05	08:02 16:57	07:04 17:54	06:48 19:53	07:14 (11) 20:48	06:09 (10) 21:37
4	08:35 16:06	08:01 16:59	07:01 17:56	06:46 19:54	07:11 (11) 20:50	06:07 (10) 21:38
5	08:35 16:07	07:59 17:02	06:59 17:58	07:25 (12) 19:56	07:09 (11) 20:52	06:05 (10) 21:41
6	08:34 16:08	07:57 17:04	06:57 18:00	07:23 (12) 19:58	07:06 (11) 20:54	06:01 (10) 21:42
7	08:34 16:10	07:55 17:06	06:54 18:01	07:21 (12) 20:00	07:04 (11) 20:56	05:59 (10) 21:43
8	08:33 16:11	07:53 17:08	06:52 18:03	07:18 (12) 20:02	07:01 (11) 20:58	05:57 (10) 21:44
9	08:33 16:13	07:51 17:10	06:49 18:05	07:16 (12) 20:04	06:59 (11) 20:59	05:56 (10) 21:45
10	08:32 16:14	07:49 17:12	06:47 18:07	07:13 (12) 20:06	06:57 (11) 21:01	05:54 (10) 21:46
11	08:32 16:15	07:48 17:14	06:45 18:09	07:11 (12) 20:08	06:54 (11) 21:03	05:52 (10) 21:46
12	08:31 16:17	07:46 17:16	06:42 18:11	07:08 (12) 20:09	06:52 (11) 21:05	05:51 (10) 21:47
13	08:30 16:19	07:44 17:18	06:40 18:13	07:06 (12) 20:11	06:52 (11) 21:06	05:50 (10) 21:48
14	08:29 16:20	07:41 17:20	06:37 18:15	07:04 (12) 20:13	06:52 (11) 21:08	05:50 (10) 21:49
15	08:28 16:22	07:39 17:22	06:35 18:17	07:05 (12) 20:15	06:53 (11) 21:10	05:51 (10) 21:49
16	08:27 16:24	07:37 17:24	06:32 18:19	07:04 (12) 20:17	06:54 (11) 21:12	05:52 (10) 21:50
17	08:26 16:25	07:35 17:26	06:30 18:21	07:05 (12) 20:19	06:54 (11) 21:13	05:53 (10) 21:50
18	08:25 16:27	07:33 17:28	06:27 18:23	07:04 (12) 20:21	06:55 (11) 21:15	05:53 (10) 21:51
19	08:24 16:29	07:31 17:30	06:25 18:24	07:05 (12) 20:23	06:58 (11) 21:17	06:09 (10) 21:51
20	08:23 16:31	07:29 17:32	06:23 18:26	07:05 (12) 20:24	07:09 (11) 21:18	06:08 (10) 21:51
21	08:22 16:32	07:27 17:34	06:20 18:28	07:07 (12) 20:26	05:08 21:20	05:56 (10) 21:52
22	08:21 16:34	07:24 17:36	06:18 18:30	07:07 (12) 20:28	05:05 21:21	06:06 (10) 21:52
23	08:19 16:36	07:22 17:38	06:15 18:32	07:10 (12) 20:30	05:03 21:23	05:59 (10) 21:52
24	08:18 16:38	07:20 17:40	06:13 18:34	07:12 (12) 20:32	05:02 21:25	04:43 21:53
25	08:17 16:40	07:18 17:42	06:10 18:36	05:56 20:34	05:00 21:26	04:44 21:53
26	08:15 16:42	07:15 17:44	06:08 18:38	05:54 20:36	04:59 21:28	04:44 21:53
27	08:14 16:44	07:13 17:46	06:05 18:40	05:52 20:37	04:58 21:29	04:44 21:53
28	08:12 16:46	07:11 17:48	06:03 18:41	05:49 20:39	04:57 21:30	04:45 21:53
29	08:11 16:48		06:00 18:43	05:47 20:41	04:55 21:32	04:45 21:52
30	08:09 16:50		05:58 18:45	05:45 20:43	04:54 21:33	04:46 21:52
31	08:08 16:51		06:55 19:47		04:53 21:34	
Sonnenscheinstunden	248	271	365	419	494	511
astr. max. mögl. Beschattung			468	297	293	168

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D - IO 4

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember				
1	04:47		05:22 (9)	05:26		06:01 (10)	06:21		06:51 (11)	07:15		07:44 (12)	07:13	08:09	
	21:52	6	05:28 (9)	21:17	22	06:23 (10)	20:11	26	07:17 (11)	18:56	33	08:17 (12)	16:45	15:59	
2	04:47		05:23 (9)	05:28		06:01 (10)	06:23		06:52 (11)	07:17		07:45 (12)	07:15	08:11	
	21:52	5	05:28 (9)	21:15	23	06:24 (10)	20:08	26	07:18 (11)	18:54	32	08:17 (12)	16:43	15:58	
3	04:48		05:24 (9)	05:30		06:02 (10)	06:25		06:54 (11)	07:18		07:47 (12)	07:17	08:12	
	21:51	3	05:27 (9)	21:14	21	06:23 (10)	20:06	24	07:18 (11)	18:51	29	08:16 (12)	16:41	15:58	
4	04:49		05:25 (9)	05:31		06:04 (10)	06:26		06:56 (11)	07:20		07:49 (12)	07:19	08:14	
	21:51	2	05:27 (9)	21:12	20	06:24 (10)	20:03	21	07:17 (11)	18:49	26	08:15 (12)	16:39	15:57	
5	04:50			05:33		06:06 (10)	06:28		06:57 (11)	07:22		07:51 (12)	07:21	08:15	
	21:50			21:10	18	06:24 (10)	20:01	19	07:16 (11)	18:47	24	08:15 (12)	16:37	15:56	
6	04:51			05:35		06:07 (10)	06:30		06:59 (11)	07:24		07:52 (12)	07:23	08:17	
	21:50			21:08	16	06:23 (10)	19:58	17	07:16 (11)	18:44	21	08:13 (12)	16:35	15:56	
7	04:52			05:36		06:09 (10)	06:32		07:01 (11)	07:26		07:54 (12)	07:25	08:18	
	21:49			21:06	14	06:23 (10)	19:56	14	07:15 (11)	18:42	17	08:11 (12)	16:33	15:55	
8	04:53			05:38		06:10 (10)	06:33		07:02 (11)	07:28		07:56 (12)	07:27	08:19	
	21:48			21:04	12	06:22 (10)	19:54	11	07:13 (11)	18:39	14	08:10 (12)	16:31	15:55	
9	04:54			05:40		06:12 (10)	06:35		07:04 (11)	07:29		07:58 (12)	07:29	08:21	
	21:48			21:02	10	06:22 (10)	19:51	8	07:12 (11)	18:37	10	08:08 (12)	16:30	15:54	
10	04:55			05:42		06:14 (10)	06:37		07:06 (11)	07:31		08:00 (12)	07:31	08:22	
	21:47			21:00	8	06:22 (10)	19:49	4	07:10 (11)	18:34	5	08:05 (12)	16:28	15:54	
11	04:56			05:43		06:15 (10)	06:39			07:33			07:33	08:23	
	21:46			20:58	5	06:20 (10)	19:46			18:32			16:26	15:54	
12	04:57			05:45		06:17 (10)	06:41			07:35			07:35	08:24	
	21:45			20:56	2	06:19 (10)	19:44			18:30			16:24	15:53	
13	04:58			05:47			06:42			07:37			07:37	08:25	
	21:44			20:54			19:41			18:27			16:23	15:53	
14	04:59			05:49			06:44			07:39			07:39	08:26	
	21:43			20:52			19:39			18:25			16:21	15:53	
15	05:01			05:51			06:46			07:41			07:41	08:27	
	21:42			20:50			19:36			18:23			16:19	15:53	
16	05:02			05:52			06:48			07:42			07:43	08:28	
	21:41			20:47			19:34			18:20			16:18	15:53	
17	05:03			05:54			06:50			07:44			07:44	08:29	
	21:40			20:45			19:31			18:18			16:16	15:53	
18	05:05			05:56			06:51			07:46			07:46	08:30	
	21:39			20:43			19:29			18:16			16:15	15:53	
19	05:06			05:58			06:53			07:48			07:48	08:31	
	21:37			20:41			19:26			18:13			16:13	15:54	
20	05:07			05:59			06:55			07:50			07:50	08:32	
	21:36			20:39			19:24			18:11			16:12	15:54	
21	05:09			06:01			06:57		07:57 (12)	07:52			07:52	08:32	
	21:35			20:36			19:21	13	08:10 (12)	18:09			16:10	15:54	
22	05:10			06:03			06:58		07:54 (12)	07:54			07:54	08:33	
	21:33			20:34			19:19	19	08:13 (12)	18:06			16:09	15:55	
23	05:12			06:05			07:00		07:52 (12)	07:56			07:56	08:33	
	21:32			20:32			19:16	23	08:15 (12)	18:04			16:08	15:55	
24	05:13		06:09 (10)	06:07			07:02		07:50 (12)	07:58			07:57	08:34	
	21:30	5	06:14 (10)	20:29			19:14	25	08:15 (12)	18:02			16:06	15:56	
25	05:15		06:07 (10)	06:08		07:03 (11)	07:04		07:49 (12)	08:00			07:59	08:34	
	21:29	10	06:17 (10)	20:27	8	07:11 (11)	19:11	27	08:16 (12)	18:00			16:05	15:56	
26	05:16		06:05 (10)	06:10		06:59 (11)	07:06		07:48 (12)	08:02			08:01	08:35	
	21:27	13	06:18 (10)	20:25	14	07:13 (11)	19:09	29	08:17 (12)	17:58			16:04	15:57	
27	05:18		06:04 (10)	06:12		06:57 (11)	07:07		07:47 (12)	07:04			08:03	08:35	
	21:26	16	06:20 (10)	20:23	18	07:15 (11)	19:06	30	08:17 (12)	16:55			16:03	15:58	
28	05:20		06:03 (10)	06:14		06:56 (11)	07:09		07:46 (12)	07:06			08:04	08:35	
	21:24	18	06:21 (10)	20:20	21	07:17 (11)	19:04	32	08:18 (12)	16:53			16:02	15:58	
29	05:21		06:03 (10)	06:16		06:54 (11)	07:11		07:45 (12)	07:08			08:06	08:35	
	21:22	19	06:22 (10)	20:18	23	07:17 (11)	19:01	32	08:17 (12)	16:51			16:01	15:59	
30	05:23		06:02 (10)	06:17		06:53 (11)	07:13		07:44 (12)	07:09			08:08	08:35	
	21:21	20	06:22 (10)	20:15	24	07:17 (11)	18:59	33	08:17 (12)	16:49			16:00	16:00	
31	05:25		06:01 (10)	06:19		06:52 (11)				07:11				08:35	
	21:19	22	06:23 (10)	20:13	26	07:18 (11)				16:47				16:01	
Sonnenscheinstunden	514			462				384			330			259	232
astr.max.mögl.Beschattung		139			305			433			211				

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: E - IO 5

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März		April		Mai		Juni	
1	08:35	08:06	07:08		07:35 (12)	06:53		07:18 (11)	05:43	
	16:02	16:53	17:50	3	07:38 (12)	19:49	6	07:24 (11)	20:45	7
2	08:35	08:04	07:06		07:33 (12)	06:50		07:16 (11)	05:41	
	16:04	16:55	17:52	8	07:41 (12)	19:51	9	07:25 (11)	20:47	10
3	08:35	08:02	07:04		07:30 (12)	06:48		07:14 (11)	05:39	
	16:05	16:57	17:54	12	07:42 (12)	19:53	13	07:27 (11)	20:48	12
4	08:35	08:01	07:01		07:28 (12)	06:46		07:11 (11)	05:37	
	16:06	16:59	17:56	16	07:44 (12)	19:54	16	07:27 (11)	20:50	14
5	08:35	07:59	06:59		07:25 (12)	06:43		07:09 (11)	05:35	
	16:07	17:01	17:58	19	07:44 (12)	19:56	18	07:27 (11)	20:52	16
6	08:34	07:57	06:57		07:23 (12)	06:41		07:06 (11)	05:33	
	16:08	17:04	18:00	22	07:45 (12)	19:58	21	07:27 (11)	20:54	18
7	08:34	07:55	06:54		07:21 (12)	06:38		07:04 (11)	05:31	
	16:10	17:06	18:01	25	07:46 (12)	20:00	23	07:27 (11)	20:56	20
8	08:33	07:53	06:52		07:18 (12)	06:36		07:01 (11)	05:29	
	16:11	17:08	18:03	28	07:46 (12)	20:02	25	07:26 (11)	20:58	21
9	08:33	07:51	06:49		07:16 (12)	06:33		06:59 (11)	05:27	
	16:13	17:10	18:05	31	07:47 (12)	20:04	27	07:26 (11)	20:59	23
10	08:32	07:49	06:47		07:13 (12)	06:31		07:00 (11)	05:25	
	16:14	17:12	18:07	33	07:46 (12)	20:06	25	07:25 (11)	21:01	22
11	08:32	07:48	06:45		07:14 (12)	06:29		06:59 (11)	05:23	
	16:15	17:14	18:09	32	07:46 (12)	20:08	25	07:24 (11)	21:03	21
12	08:31	07:46	06:42		07:13 (12)	06:26		07:00 (11)	05:21	
	16:17	17:16	18:11	32	07:45 (12)	20:09	23	07:23 (11)	21:05	20
13	08:30	07:44	06:40		07:13 (12)	06:24		07:01 (11)	05:19	
	16:19	17:18	18:13	32	07:45 (12)	20:11	21	07:22 (11)	21:06	19
14	08:29	07:41	06:37		07:13 (12)	06:21		07:02 (11)	05:18	
	16:20	17:20	18:15	31	07:44 (12)	20:13	18	07:20 (11)	21:08	17
15	08:28	07:39	06:35		07:14 (12)	06:19		07:03 (11)	05:16	
	16:22	17:22	18:17	29	07:43 (12)	20:15	15	07:18 (11)	21:10	14
16	08:27	07:37	06:32		07:14 (12)	06:17		07:06 (11)	05:14	
	16:24	17:24	18:19	28	07:42 (12)	20:17	9	07:15 (11)	21:12	11
17	08:26	07:35	06:30		07:15 (12)	06:14			05:12	
	16:25	17:26	18:21	26	07:41 (12)	20:19			21:13	8
18	08:25	07:33	06:27		07:16 (12)	06:12			05:11	
	16:27	17:28	18:23	22	07:38 (12)	20:21			21:15	
19	08:24	07:31	06:25		07:18 (12)	06:10			05:09	
	16:29	17:30	18:24	19	07:37 (12)	20:23			21:17	
20	08:23	07:29	06:23		07:20 (12)	06:07			05:08	
	16:31	17:32	18:26	13	07:33 (12)	20:24			21:18	
21	08:22	07:27	06:20			06:05			05:06	
	16:32	17:34	18:28			20:26			21:20	
22	08:21	07:24	06:18			06:03			05:05	
	16:34	17:36	18:30			20:28			21:21	
23	08:19	07:22	06:15			06:00			05:03	
	16:36	17:38	18:32			20:30			21:23	
24	08:18	07:20	06:13			05:58			05:02	
	16:38	17:40	18:34			20:32			21:25	
25	08:17	07:18	06:10			05:56			05:00	
	16:40	17:42	18:36			20:34			21:26	
26	08:15	07:15	06:08			05:54			04:59	
	16:42	17:44	18:38			20:36			21:28	
27	08:14	07:13	06:05			05:52			04:58	
	16:44	17:46	18:40			20:37			21:29	
28	08:12	07:11	06:03			05:49			04:57	
	16:46	17:48	18:41			20:39			21:30	
29	08:11		06:00			05:47		06:15 (10)	04:55	
	16:48		18:43			20:41	1	06:16 (10)	21:32	
30	08:09		05:58			05:45		06:13 (10)	04:54	
	16:50		18:45			20:43	4	06:17 (10)	21:33	
31	08:08		06:55		07:21 (11)				04:53	
	16:51		19:47	2	07:23 (11)				21:34	
Sonnenscheinstunden	248	271	365			419			494	
astr.max.mögl.Beschattung				463		299		273		535

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** E - IO 5

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember			
1	04:47		05:22 (7)	05:26	06:08 (10)	06:21	06:59 (11)	07:15	07:53 (12)	07:13	08:09			
	21:52	20	05:42 (9)	21:17	18	06:26 (10)	20:11	23	07:22 (11)	18:56	31	08:24 (12)	16:45	15:59
2	04:47		05:23 (7)	05:28		06:07 (10)	06:23		06:58 (11)	07:17		07:52 (12)	07:15	08:11
	21:52	19	05:42 (9)	21:15	21	06:28 (10)	20:08	25	07:23 (11)	18:54	32	08:24 (12)	16:43	15:58
3	04:48		05:24 (7)	05:30		06:06 (10)	06:25		06:58 (11)	07:18		07:52 (12)	07:17	08:12
	21:51	18	05:42 (9)	21:14	21	06:27 (10)	20:06	25	07:23 (11)	18:51	32	08:24 (12)	16:41	15:58
4	04:49		05:25 (7)	05:31		06:06 (10)	06:26		06:57 (11)	07:20		07:51 (12)	07:19	08:14
	21:51	17	05:42 (9)	21:12	22	06:28 (10)	20:03	27	07:24 (11)	18:49	33	08:24 (12)	16:39	15:57
5	04:50		05:25 (9)	05:33		06:06 (10)	06:28		06:57 (11)	07:22		07:51 (12)	07:21	08:15
	21:50	16	05:41 (9)	21:10	23	06:29 (10)	20:01	26	07:23 (11)	18:47	33	08:24 (12)	16:37	15:56
6	04:51		05:26 (9)	05:35		06:07 (10)	06:30		06:59 (11)	07:24		07:52 (12)	07:23	08:17
	21:50	15	05:41 (9)	21:08	22	06:29 (10)	19:58	24	07:23 (11)	18:44	30	08:22 (12)	16:35	15:56
7	04:52		05:27 (9)	05:36		06:09 (10)	06:32		07:01 (11)	07:26		07:54 (12)	07:25	08:18
	21:49	14	05:41 (9)	21:06	20	06:29 (10)	19:56	22	07:23 (11)	18:42	28	08:22 (12)	16:33	15:55
8	04:53		05:28 (9)	05:38		06:10 (10)	06:33		07:02 (11)	07:28		07:56 (12)	07:27	08:19
	21:48	12	05:40 (9)	21:04	18	06:28 (10)	19:54	19	07:21 (11)	18:39	25	08:21 (12)	16:31	15:55
9	04:54		05:29 (9)	05:40		06:12 (10)	06:35		07:04 (11)	07:29		07:58 (12)	07:29	08:21
	21:48	11	05:40 (9)	21:02	16	06:28 (10)	19:51	17	07:21 (11)	18:37	22	08:20 (12)	16:30	15:54
10	04:55		05:30 (9)	05:42		06:14 (10)	06:37		07:06 (11)	07:31		08:00 (12)	07:31	08:22
	21:47	9	05:39 (9)	21:00	14	06:28 (10)	19:49	14	07:20 (11)	18:34	19	08:19 (12)	16:28	15:54
11	04:56		05:31 (9)	05:43		06:15 (10)	06:39		07:08 (11)	07:33		08:02 (12)	07:33	08:23
	21:46	7	05:38 (9)	20:58	12	06:27 (10)	19:46	11	07:19 (11)	18:32	16	08:18 (12)	16:26	15:54
12	04:57		05:32 (9)	05:45		06:17 (10)	06:41		07:09 (11)	07:35		08:04 (12)	07:35	08:24
	21:45	5	05:37 (9)	20:56	10	06:27 (10)	19:44	8	07:17 (11)	18:30	13	08:17 (12)	16:24	15:53
13	04:58		05:33 (9)	05:47		06:19 (10)	06:42		07:11 (11)	07:37		08:06 (12)	07:37	08:25
	21:44	2	05:35 (9)	20:54	8	06:27 (10)	19:41	4	07:15 (11)	18:27	9	08:15 (12)	16:23	15:53
14	04:59			05:49		06:20 (10)	06:44			07:39		08:08 (12)	07:39	08:26
	21:43			20:52	5	06:25 (10)	19:39			18:25	4	08:12 (12)	16:21	15:53
15	05:01			05:51		06:22 (10)	06:46			07:41			07:41	08:27
	21:42			20:50	2	06:24 (10)	19:36			18:23			16:19	15:53
16	05:02			05:52			06:48			07:42			07:43	08:28
	21:41			20:47			19:34			18:20			16:18	15:53
17	05:03			05:54			06:50			07:44			07:44	08:29
	21:40			20:45			19:31			18:18			16:16	15:53
18	05:05			05:56			06:51			07:46			07:46	08:30
	21:39			20:43			19:29			18:16			16:15	15:53
19	05:06			05:58			06:53			07:48			07:48	08:31
	21:37			20:41			19:26			18:13			16:13	15:54
20	05:07			05:59			06:55			07:50			07:50	08:32
	21:36			20:39			19:24			18:11			16:12	15:54
21	05:09			06:01			06:57			07:52			07:52	08:32
	21:35			20:36			19:21			18:09			16:10	15:54
22	05:10			06:03			06:58			07:54			07:54	08:33
	21:33			20:34			19:19			18:06			16:09	15:55
23	05:12			06:05			07:00			07:56			07:56	08:33
	21:32			20:32			19:16			18:04			16:08	15:55
24	05:13			06:07			07:02		08:09 (12)	07:58			07:57	08:34
	21:30			20:29			19:14	2	08:11 (12)	18:02			16:06	15:56
25	05:15			06:08			07:04		08:03 (12)	08:00			07:59	08:34
	21:29			20:27			19:11	14	08:17 (12)	18:00			16:05	15:56
26	05:16			06:10			07:06		08:00 (12)	08:02			08:01	08:35
	21:27			20:25			19:09	20	08:20 (12)	17:58			16:04	15:57
27	05:18			06:12			07:07		07:58 (12)	07:04			08:03	08:35
	21:26			20:23			19:06	23	08:21 (12)	16:55			16:03	15:58
28	05:20		06:13 (10)	06:14		07:11 (11)	07:09		07:57 (12)	07:06			08:04	08:35
	21:24	8	06:21 (10)	20:20	3	07:14 (11)	19:04	26	08:23 (12)	16:53			16:02	15:58
29	05:21		06:12 (10)	06:16		07:05 (11)	07:11		07:55 (12)	07:08			08:06	08:35
	21:22	11	06:23 (10)	20:18	13	07:18 (11)	19:01	27	08:22 (12)	16:51			16:01	15:59
30	05:23		06:10 (10)	06:17		07:03 (11)	07:13		07:54 (12)	07:09			08:08	08:35
	21:21	14	06:24 (10)	20:15	17	07:20 (11)	18:59	29	08:23 (12)	16:49			16:00	16:00
31	05:25		06:09 (10)	06:19		07:02 (11)				07:11				08:35
	21:19	17	06:26 (10)	20:13	20	07:22 (11)				16:47				16:01
Sonnenscheinstunden	514			462			384			330			259	232
astr.max.mögl.Beschattung		215			285		386			327				

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
	Minuten mit Schatten	

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: F - IO 6

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar		März		April		Mai		Juni		
1	08:35 16:02	08:06 16:53		07:08 17:50	14	07:35 (12) 07:49 (12)	06:53 19:49	15	07:18 (11) 07:33 (11)	05:43 20:45	16:11 (10) 21:36	05:25 (7) 05:47 (9)
2	08:35 16:04	08:04 16:55		07:06 17:52	17	07:33 (12) 07:50 (12)	06:50 19:51	18	07:16 (11) 07:34 (11)	05:41 20:47	06:09 (10) 21:37	05:24 (7) 05:48 (9)
3	08:35 16:05	08:02 16:57		07:04 17:54	20	07:30 (12) 07:50 (12)	06:48 19:53	20	07:14 (11) 07:34 (11)	05:39 20:49	06:07 (10) 21:38	05:23 (7) 05:48 (9)
4	08:35 16:06	08:01 16:59		07:01 17:56	23	07:28 (12) 07:51 (12)	06:46 19:54	22	07:11 (11) 07:33 (11)	05:37 20:50	06:05 (10) 21:39	05:23 (7) 05:49 (9)
5	08:35 16:07	07:59 17:01		06:59 17:58	26	07:25 (12) 07:51 (12)	06:43 19:56	24	07:09 (11) 07:33 (11)	05:35 20:52	06:03 (10) 21:41	05:22 (7) 05:50 (9)
6	08:34 16:08	07:57 17:04		06:57 18:00	29	07:23 (12) 07:52 (12)	06:41 19:58	26	07:06 (11) 07:32 (11)	05:33 20:54	06:02 (10) 21:42	05:21 (7) 05:50 (9)
7	08:34 16:10	07:55 17:06		06:54 18:01	31	07:21 (12) 07:52 (12)	06:38 20:00	25	07:07 (11) 07:32 (11)	05:31 20:56	06:02 (10) 21:43	05:21 (7) 05:51 (9)
8	08:33 16:11	07:53 17:08		06:52 18:03	31	07:20 (12) 07:51 (12)	06:36 20:02	24	07:06 (11) 07:30 (11)	05:29 20:58	06:03 (10) 21:44	05:20 (7) 05:51 (9)
9	08:33 16:13	07:51 17:10		06:49 18:05	31	07:20 (12) 07:51 (12)	06:33 20:04	22	07:07 (11) 07:29 (11)	05:27 20:59	06:04 (10) 21:45	05:20 (7) 05:51 (9)
10	08:32 16:14	07:50 17:12		06:47 18:07	30	07:20 (12) 07:50 (12)	06:31 20:06	19	07:09 (11) 07:28 (11)	05:25 21:01	06:05 (10) 21:46	05:19 (7) 05:51 (9)
11	08:32 16:15	07:48 17:14		06:45 18:09	30	07:20 (12) 07:50 (12)	06:29 20:08	17	07:09 (11) 07:26 (11)	05:23 21:03	06:06 (10) 21:46	05:19 (7) 05:52 (9)
12	08:31 16:17	07:46 17:16		06:42 18:11	28	07:20 (12) 07:48 (12)	06:26 20:09	13	07:11 (11) 07:24 (11)	05:21 21:05	06:08 (10) 21:47	05:19 (7) 05:53 (9)
13	08:30 16:19	07:44 17:18		06:40 18:13	27	07:21 (12) 07:48 (12)	06:24 20:11	1	07:17 (11) 07:18 (11)	05:19 21:06	06:11 (10) 21:48	05:18 (7) 05:52 (9)
14	08:29 16:20	07:41 17:20		06:37 18:15	24	07:22 (12) 07:46 (12)	06:21 20:13			05:18 21:08	04:43 21:49	05:18 (7) 05:53 (9)
15	08:28 16:22	07:39 17:22		06:35 18:17	21	07:23 (12) 07:44 (12)	06:19 20:15			05:16 21:10	04:43 21:49	05:18 (7) 05:53 (9)
16	08:27 16:24	07:37 17:24		06:32 18:19	18	07:24 (12) 07:42 (12)	06:17 20:17			05:14 21:12	04:43 21:50	05:18 (7) 05:53 (9)
17	08:26 16:25	07:35 17:26		06:30 18:21	11	07:28 (12) 07:39 (12)	06:14 20:19			05:12 21:13	04:43 21:51	05:18 (7) 05:54 (9)
18	08:25 16:27	07:33 17:28		06:27 18:23			06:12 20:21			05:11 21:15	04:43 21:51	05:18 (7) 05:54 (9)
19	08:24 16:29	07:31 17:30		06:25 18:24			06:10 20:23			05:09 21:17	04:43 21:51	05:18 (7) 05:54 (9)
20	08:23 16:31	07:29 17:32		06:23 18:26			06:07 20:24			05:08 21:18	04:43 21:52	05:18 (7) 05:54 (9)
21	08:22 16:32	07:27 17:34		06:20 18:28			06:05 20:26			05:06 21:20	04:43 21:52	05:18 (7) 05:55 (9)
22	08:21 16:34	07:24 17:36		06:18 18:30			06:03 20:28			05:05 21:21	04:43 21:52	05:18 (7) 05:55 (9)
23	08:19 16:36	07:22 17:38		06:15 18:32			06:00 20:30			05:03 21:23	05:34 (9) 21:52	05:19 (7) 05:56 (9)
24	08:18 16:38	07:20 17:40		06:13 18:34			05:58 20:32			05:02 21:25	05:33 (9) 21:53	05:19 (7) 05:55 (9)
25	08:17 16:40	07:18 17:42		06:10 18:36			05:56 20:34			05:00 21:26	05:32 (9) 21:53	05:19 (7) 05:55 (9)
26	08:15 16:42	07:15 17:44	1	07:42 (12) 18:38			05:54 20:36	2	06:21 (10) 06:23 (10)	04:59 21:28	05:31 (9) 21:53	05:20 (7) 05:56 (9)
27	08:14 16:44	07:13 17:46	6	07:40 (12) 18:40			05:52 20:37	5	06:19 (10) 06:24 (10)	04:58 21:29	05:30 (9) 21:53	05:20 (7) 05:56 (9)
28	08:12 16:46	07:11 17:48	10	07:38 (12) 18:41	1	06:28 (11) 06:29 (11)	05:49 20:39	8	06:17 (10) 06:25 (10)	04:57 21:30	05:29 (9) 21:53	05:21 (7) 05:56 (9)
29	08:11 16:48			06:00 18:43	5	06:26 (11) 06:31 (11)	05:47 20:41	10	06:15 (10) 06:25 (10)	04:55 21:32	05:28 (9) 21:52	05:21 (7) 05:56 (9)
30	08:09 16:50			05:58 18:45	9	06:23 (11) 06:32 (11)	05:45 20:43	13	06:13 (10) 06:26 (10)	04:54 21:33	05:27 (9) 21:52	05:22 (7) 05:57 (9)
31	08:08 16:51			06:55 19:47	12	07:21 (11) 07:33 (11)				04:53 21:35	05:26 (9) 21:52	
Sonnenscheinstunden	248	271		365			419			494		511
astr.max.mögl.Beschattung		17		438			284			334		988

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: F - IO 6

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

Juli		August		September		Oktober		November		Dezember	
1	04:47	05:22 (7)	05:26	06:22 (10)	06:21	07:12 (11)	07:15	08:01 (12)	07:13	08:09	
	21:52	05:56 (9)	21:17	06:24 (10)	20:11	07:21 (11)	18:56	08:26 (12)	16:45	15:59	
2	04:47	05:23 (7)	05:28	06:19 (10)	06:23	07:09 (11)	07:17	08:00 (12)	07:15	08:11	
	21:52	05:56 (9)	21:15	06:28 (10)	20:08	07:24 (11)	18:54	08:27 (12)	16:43	15:58	
3	04:48	05:24 (7)	05:30	06:16 (10)	06:25	07:07 (11)	07:18	07:59 (12)	07:17	08:12	
	21:51	05:57 (9)	21:14	06:30 (10)	20:06	07:26 (11)	18:51	08:27 (12)	16:41	15:58	
4	04:49	05:25 (7)	05:31	06:15 (10)	06:26	07:06 (11)	07:20	07:58 (12)	07:19	08:14	
	21:51	05:57 (9)	21:12	06:31 (10)	20:03	07:27 (11)	18:49	08:28 (12)	16:39	15:57	
5	04:50	05:25 (7)	05:33	06:14 (10)	06:28	07:04 (11)	07:22	07:57 (12)	07:21	08:15	
	21:50	05:56 (9)	21:10	06:33 (10)	20:01	07:27 (11)	18:47	08:28 (12)	16:37	15:56	
6	04:51	05:26 (7)	05:35	06:13 (10)	06:30	07:03 (11)	07:24	07:56 (12)	07:23	08:17	
	21:50	05:56 (9)	21:08	06:33 (10)	19:58	07:28 (11)	18:44	08:27 (12)	16:35	15:56	
7	04:52	05:27 (7)	05:36	06:13 (10)	06:32	07:02 (11)	07:26	07:56 (12)	07:25	08:18	
	21:49	05:57 (9)	21:06	06:34 (10)	19:56	07:28 (11)	18:42	08:27 (12)	16:33	15:55	
8	04:53	05:28 (7)	05:38	06:11 (10)	06:33	07:02 (11)	07:28	07:56 (12)	07:27	08:19	
	21:48	05:57 (9)	21:04	06:34 (10)	19:54	07:27 (11)	18:39	08:27 (12)	16:31	15:55	
9	04:54	05:29 (7)	05:40	06:12 (10)	06:35	07:04 (11)	07:29	07:58 (12)	07:29	08:21	
	21:48	05:56 (9)	21:02	06:34 (10)	19:51	07:27 (11)	18:37	08:27 (12)	16:30	15:54	
10	04:55	05:30 (7)	05:42	06:14 (10)	06:37	07:06 (11)	07:31	08:00 (12)	07:31	08:22	
	21:47	05:56 (9)	21:00	06:35 (10)	19:49	07:27 (11)	18:34	08:26 (12)	16:28	15:54	
11	04:56	05:31 (7)	05:43	06:15 (10)	06:39	07:08 (11)	07:33	08:02 (12)	07:33	08:23	
	21:46	05:56 (9)	20:58	06:34 (10)	19:46	07:27 (11)	18:32	08:25 (12)	16:26	15:54	
12	04:57	05:32 (7)	05:45	06:17 (10)	06:41	07:09 (11)	07:35	08:04 (12)	07:35	08:24	
	21:45	05:56 (9)	20:56	06:34 (10)	19:44	07:25 (11)	18:30	08:24 (12)	16:24	15:53	
13	04:58	05:33 (7)	05:47	06:19 (10)	06:42	07:11 (11)	07:37	08:06 (12)	07:37	08:25	
	21:44	05:55 (9)	20:54	06:34 (10)	19:41	07:25 (11)	18:27	08:23 (12)	16:23	15:53	
14	04:59	05:34 (9)	05:49	06:20 (10)	06:44	07:13 (11)	07:39	08:08 (12)	07:39	08:26	
	21:43	05:55 (9)	20:52	06:33 (10)	19:39	07:24 (11)	18:25	08:22 (12)	16:21	15:53	
15	05:01	05:36 (9)	05:51	06:22 (10)	06:46	07:15 (11)	07:41	08:10 (12)	07:41	08:27	
	21:42	05:55 (9)	20:50	06:33 (10)	19:36	07:23 (11)	18:23	08:20 (12)	16:19	15:53	
16	05:02	05:37 (9)	05:52	06:23 (10)	06:48	07:16 (11)	07:42	08:12 (12)	07:43	08:28	
	21:41	05:54 (9)	20:47	06:31 (10)	19:34	07:20 (11)	18:20	08:18 (12)	16:18	15:53	
17	05:03	05:38 (9)	05:54	06:25 (10)	06:50		07:44	08:14 (12)	07:44	08:29	
	21:40	05:53 (9)	20:45	06:31 (10)	19:31		18:18	08:15 (12)	16:16	15:53	
18	05:05	05:39 (9)	05:56	06:27 (10)	06:51		07:46		07:46	08:30	
	21:39	05:52 (9)	20:43	06:30 (10)	19:29		18:16		16:15	15:53	
19	05:06	05:40 (9)	05:58		06:53		07:48		07:48	08:31	
	21:37	05:51 (9)	20:41		19:26		18:13		16:13	15:54	
20	05:07	05:42 (9)	05:59		06:55		07:50		07:50	08:32	
	21:36	05:51 (9)	20:39		19:24		18:11		16:12	15:54	
21	05:09	05:43 (9)	06:01		06:57		07:52		07:52	08:32	
	21:35	05:49 (9)	20:36		19:21		18:09		16:10	15:54	
22	05:10	05:45 (9)	06:03		06:58		07:54		07:54	08:33	
	21:33	05:47 (9)	20:34		19:19		18:06		16:09	15:55	
23	05:12		06:05		07:00		07:56		07:56	08:33	
	21:32		20:32		19:16		18:04		16:08	15:55	
24	05:13		06:07		07:02		07:58		07:57	08:34	
	21:30		20:29		19:14		18:02		16:06	15:56	
25	05:15		06:08		07:04		08:00		07:59	08:34	
	21:29		20:27		19:11		18:00		16:05	15:56	
26	05:16		06:10		07:06		08:02		08:01	08:35	
	21:27		20:25		19:09		17:58		16:04	15:57	
27	05:18		06:12		07:07		07:04		08:03	08:35	
	21:26		20:23		19:06		16:55		16:03	15:58	
28	05:20		06:14		07:09	08:09 (12)	07:06		08:04	08:35	
	21:24		20:20		19:04	08:21 (12)	16:53		16:02	15:58	
29	05:21		06:16		07:11	08:05 (12)	07:08		08:06	08:35	
	21:22		20:18		19:01	08:23 (12)	16:51		16:01	15:59	
30	05:23		06:17		07:13	08:03 (12)	07:09		08:08	08:35	
	21:21		20:15		18:59	08:24 (12)	16:49		16:00	16:00	
31	05:25		06:19				07:11			08:35	
	21:19		20:13				16:47			16:01	
Sonnenscheinstunden		514			384		330		259	232	
astr.max.mögl.Beschattung		489		259	330		380				

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten
		Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: G - IO 7

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 16:02	08:06 16:53	08:36 (12) 17:08	06:53 19:49	05:43 20:45	06:11 (7) 21:36
2	08:35 16:04	08:04 16:55	08:35 (12) 17:06	06:50 19:51	05:41 20:47	06:09 (7) 21:37
3	08:35 16:05	08:02 16:57	08:33 (12) 17:04	06:48 19:53	05:39 20:49	06:07 (7) 21:38
4	08:35 16:06	08:01 16:59	08:31 (12) 17:01	06:46 19:54	05:37 20:50	06:05 (7) 21:39
5	08:35 16:07	07:59 17:01	08:29 (12) 17:02	06:43 19:56	05:35 20:52	06:03 (7) 21:41
6	08:34 16:08	07:57 17:04	08:27 (12) 17:03	06:41 19:58	05:33 20:54	06:01 (7) 21:42
7	08:34 16:10	07:55 17:06	08:25 (12) 17:04	06:38 20:00	05:31 20:56	05:59 (7) 21:43
8	08:33 16:11	07:53 17:08	08:23 (12) 17:05	06:36 20:02	05:29 20:58	05:57 (7) 21:44
9	08:33 16:12	07:51 17:10	08:21 (12) 17:06	06:33 20:04	05:27 20:59	05:55 (7) 21:45
10	08:32 16:14	07:50 17:12	08:19 (12) 17:07	06:31 20:06	05:25 21:01	05:53 (7) 21:46
11	08:32 16:15	07:48 17:14	08:17 (12) 17:08	06:29 20:08	05:23 21:03	05:51 (7) 21:47
12	08:31 16:16	07:46 17:16	08:15 (12) 17:09	06:26 20:10	05:21 21:05	05:49 (7) 21:48
13	08:30 16:17	07:44 17:18	08:13 (12) 17:10	06:24 20:11	05:19 21:06	05:47 (7) 21:49
14	08:29 16:20	07:41 17:20	08:11 (12) 17:11	06:21 20:13	05:18 21:08	05:46 (7) 21:50
15	08:28 16:22	07:39 17:22	08:09 (12) 17:12	06:19 20:15	05:16 21:10	05:44 (7) 21:51
16	08:27 16:24	07:37 17:24	08:07 (12) 17:13	06:17 20:17	05:14 21:12	05:43 (7) 21:52
17	08:26 16:25	07:35 17:26	08:05 (12) 17:14	06:14 20:19	05:12 21:13	05:41 (7) 21:53
18	08:25 16:27	07:33 17:28	08:03 (12) 17:15	06:12 20:21	05:11 21:15	05:40 (7) 21:54
19	08:24 16:29	07:31 17:30	08:01 (12) 17:16	06:10 20:23	05:09 21:17	05:38 (7) 21:55
20	08:23 16:31	07:29 17:32	07:59 (12) 17:17	06:07 20:24	05:08 21:18	05:36 (7) 21:56
21	08:22 16:32	07:27 17:34	07:57 (12) 17:18	06:05 20:26	05:06 21:20	05:34 (7) 21:57
22	08:21 16:34	07:24 17:36	07:55 (12) 17:19	06:03 20:28	05:05 21:21	05:32 (7) 21:58
23	08:19 16:36	07:22 17:38	07:53 (12) 17:20	06:00 20:30	05:03 21:23	05:30 (7) 21:59
24	08:18 16:38	07:20 17:40	07:51 (12) 17:21	05:58 20:32	05:02 21:25	05:28 (7) 22:00
25	08:17 16:40	07:18 17:42	07:49 (12) 17:22	05:56 20:34	05:00 21:26	05:26 (7) 22:01
26	08:15 16:42	07:15 17:44	07:47 (12) 17:23	05:54 20:36	04:59 21:28	05:24 (7) 22:02
27	08:14 16:44	07:13 17:46	07:45 (12) 17:24	05:52 20:37	04:58 21:29	05:22 (7) 22:03
28	08:12 16:46	07:11 17:48	07:43 (12) 17:25	05:49 20:39	04:56 21:30	05:20 (7) 22:04
29	08:11 16:48		07:41 (12) 17:26	05:47 20:41	04:55 21:32	05:18 (7) 22:05
30	08:09 16:49		07:39 (12) 17:27	05:45 20:43	04:54 21:33	05:16 (7) 22:06
31	08:08 16:51	08:38 (12) 08:41 (12)	07:37 (12) 17:28	05:43 19:47	04:53 21:35	05:14 (7) 22:07
Sonnenscheinstunden	248	271	359	419	494	511
astr.max.mögl.Beschattung	3	359	242	872	1028	441

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: G - IO 7

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:47 21:52 15	05:39 (6) 05:54 (6) 21:17	06:10 (7) 06:36 (7) 21:11	06:50 (9) 07:17 (10) 18:56	07:48 (11) 08:11 (11) 16:45	07:49 (12) 08:16 (12) 15:59
2	04:47 21:52 15	05:40 (6) 05:55 (6) 21:16	06:10 (7) 06:37 (7) 20:08	06:52 (9) 07:17 (10) 18:54	07:47 (11) 08:11 (11) 16:43	07:49 (12) 08:17 (12) 15:58
3	04:48 21:51 16	05:40 (6) 05:56 (6) 21:14	06:09 (7) 06:37 (7) 20:06	06:54 (9) 07:18 (10) 18:51	07:47 (11) 08:12 (11) 16:41	07:49 (12) 08:17 (12) 15:58
4	04:49 21:51 16	05:40 (6) 05:56 (6) 21:12	06:09 (7) 07:08 (9) 20:03	06:56 (10) 07:18 (10) 18:49	07:49 (11) 08:12 (11) 16:39	07:52 (12) 08:17 (12) 15:57
5	04:50 21:50 17	05:39 (6) 05:56 (6) 21:10	06:08 (7) 07:10 (9) 20:01	06:57 (10) 07:17 (10) 18:47	07:51 (11) 08:12 (11) 16:37	07:54 (12) 08:17 (12) 15:56
6	04:51 21:50 18	05:39 (6) 05:57 (6) 21:08	06:08 (7) 07:13 (9) 19:59	06:59 (10) 07:17 (10) 18:44	07:52 (11) 08:10 (11) 16:35	07:56 (12) 08:17 (12) 15:56
7	04:52 21:49 19	05:39 (6) 05:58 (6) 21:06	06:09 (7) 07:15 (9) 19:56	07:01 (10) 07:17 (10) 18:42	07:54 (11) 08:10 (11) 16:33	07:58 (12) 08:16 (12) 15:55
8	04:53 21:48 19	05:39 (6) 05:58 (6) 21:04	06:10 (7) 07:15 (9) 19:54	07:02 (10) 07:15 (10) 18:39	07:56 (11) 08:09 (11) 16:31	07:58 (12) 08:16 (12) 15:55
9	04:54 21:48 20	05:39 (6) 05:59 (6) 21:02	06:12 (7) 07:17 (9) 19:51	07:04 (10) 07:15 (10) 18:37	07:58 (11) 08:08 (11) 16:29	08:02 (12) 08:15 (12) 15:54
10	04:55 21:47 21	05:38 (6) 05:59 (6) 21:00	06:14 (7) 07:18 (9) 19:49	07:06 (10) 07:14 (10) 18:34	08:00 (11) 08:07 (11) 16:28	08:04 (12) 08:14 (12) 15:54
11	04:56 21:46 22	05:38 (6) 06:00 (6) 20:58	06:15 (7) 07:18 (9) 19:46	07:08 (10) 07:12 (10) 18:32	08:02 (11) 08:05 (11) 16:26	08:07 (12) 08:14 (12) 15:54
12	04:57 21:45 22	05:38 (6) 06:00 (6) 20:56	06:17 (7) 07:19 (9) 19:44	07:35 18:30	07:35 16:24	08:09 (12) 08:13 (12) 15:53
13	04:58 21:44 22	05:38 (6) 06:00 (6) 20:54	06:19 (7) 07:20 (9) 19:41	07:37 18:27	07:37 16:23	08:11 (12) 08:12 (12) 15:53
14	04:59 21:43 22	05:38 (6) 06:00 (6) 20:52	06:20 (7) 07:20 (9) 19:39	07:39 18:25	07:39 16:21	08:12 (12) 08:15 (12) 15:53
15	05:01 21:42 24	05:37 (6) 06:01 (6) 20:50	06:22 (7) 07:21 (9) 19:36	07:41 18:23	07:41 16:19	08:16 (12) 08:19 (12) 15:53
16	05:02 21:41 24	05:38 (6) 06:02 (6) 20:47	06:23 (7) 07:20 (9) 19:34	07:43 18:20	07:43 16:18	08:20 (12) 08:22 (12) 15:53
17	05:03 21:40 24	05:38 (6) 06:02 (6) 20:45	06:25 (7) 07:21 (9) 19:31	07:44 18:18	07:44 16:16	08:23 (12) 08:26 (12) 15:53
18	05:05 21:39 22	05:39 (6) 06:01 (6) 20:43	06:40 (9) 07:21 (9) 19:29	06:51 18:16	07:46 16:15	08:30 (12) 08:31 (12) 15:53
19	05:06 21:37 21	05:40 (6) 06:01 (6) 20:41	06:39 (9) 07:21 (9) 19:26	06:53 18:13	07:48 16:13	08:32 (12) 08:33 (12) 15:54
20	05:07 21:36 20	05:42 (6) 06:02 (6) 20:39	06:39 (9) 07:21 (9) 19:24	06:55 18:11	07:50 16:12	08:34 (12) 08:35 (12) 15:54
21	05:09 21:35 19	05:43 (6) 06:02 (6) 20:36	06:39 (9) 07:21 (9) 19:21	06:57 18:09	07:52 16:10	08:36 (12) 08:37 (12) 15:54
22	05:10 21:33 17	05:44 (6) 06:01 (6) 20:34	06:39 (9) 07:21 (9) 19:19	06:58 18:06	07:54 16:09	08:38 (12) 08:39 (12) 15:55
23	05:12 21:32 20	05:46 (6) 06:25 (7) 20:32	06:39 (9) 07:20 (9) 19:16	06:59 18:04	07:56 16:08	08:40 (12) 08:41 (12) 15:55
24	05:13 21:30 25	05:47 (6) 06:28 (7) 20:29	06:39 (9) 07:19 (9) 19:14	07:02 18:02	07:58 16:06	08:42 (12) 08:43 (12) 15:56
25	05:15 21:29 27	05:49 (6) 06:31 (7) 20:27	06:40 (9) 07:19 (9) 19:11	07:04 18:00	07:59 16:05	08:44 (12) 08:45 (12) 15:56
26	05:16 21:27 28	05:50 (6) 06:32 (7) 20:25	06:40 (9) 07:17 (9) 19:09	07:06 17:58	08:01 16:04	08:46 (12) 08:47 (12) 15:57
27	05:18 21:26 27	05:52 (6) 06:33 (7) 20:23	06:42 (9) 07:17 (9) 19:06	07:07 08:05 (11)	08:03 16:03	08:48 (12) 08:49 (12) 15:58
28	05:20 21:24 28	05:53 (6) 06:34 (7) 20:20	06:44 (9) 07:16 (9) 19:04	07:09 08:08 (11)	08:04 16:02	08:50 (12) 08:51 (12) 15:58
29	05:21 21:22 27	05:55 (6) 06:35 (7) 20:18	06:45 (9) 07:14 (9) 19:01	07:11 08:09 (11)	08:06 16:01	08:52 (12) 08:53 (12) 15:59
30	05:23 21:21 25	05:56 (6) 06:35 (7) 20:15	06:47 (9) 07:15 (10) 18:59	07:13 08:10 (11)	07:09 16:49	08:54 (12) 08:55 (12) 16:00
31	05:25 21:19 25	06:11 (7) 06:36 (7) 20:13	06:49 (9) 07:17 (10)	07:11 16:47	07:50 (12) 08:16 (12)	16:01 232
Sonnenscheinstunden	514	462	384	330	259	232
astr.max.mögl.Beschattung	667	1307	249	327	221	

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdauf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: H - IO 8

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 16:02	08:06 16:53	08:36 (12) 17:08	06:53 19:49	07:18 (10) 20:43	06:11 (7) 20:52
2	08:35 16:04	08:04 16:55	08:35 (12) 17:06	06:50 19:51	07:16 (10) 20:45	06:09 (7) 21:36
3	08:35 16:05	08:02 16:57	08:33 (12) 17:04	06:48 19:53	07:14 (10) 20:47	06:08 (7) 21:37
4	08:35 16:06	08:01 16:59	08:31 (12) 17:05	06:46 19:54	07:11 (10) 20:49	06:07 (7) 21:38
5	08:35 16:07	07:59 17:01	08:29 (12) 17:58	06:43 19:56	07:09 (10) 20:52	06:06 (7) 21:41
6	08:34 16:08	07:57 17:04	08:27 (12) 18:00	06:41 19:58	07:06 (10) 20:54	06:05 (7) 21:42
7	08:34 16:10	07:55 17:06	08:25 (12) 18:01	06:38 20:00	07:04 (10) 20:56	06:04 (7) 21:43
8	08:33 16:11	07:53 17:08	08:23 (12) 18:03	06:36 20:02	07:01 (9) 20:58	06:03 (7) 21:44
9	08:33 16:12	07:51 17:10	08:21 (12) 18:05	06:33 20:04	06:59 (9) 20:59	06:02 (7) 21:45
10	08:32 16:14	07:50 17:12	08:20 (12) 18:07	06:31 20:06	06:57 (9) 21:01	06:01 (7) 21:46
11	08:32 16:15	07:48 17:14	08:18 (12) 18:09	06:29 20:08	06:54 (9) 21:03	05:59 (6) 21:47
12	08:31 16:17	07:46 17:16	08:16 (12) 18:11	06:26 20:09	06:52 (9) 21:05	05:58 (6) 21:48
13	08:30 16:19	07:44 17:18	08:14 (12) 18:13	06:24 20:11	06:50 (9) 21:07	05:57 (6) 21:49
14	08:29 16:20	07:41 17:20	08:12 (12) 18:15	06:21 20:13	06:48 (9) 21:09	05:56 (6) 21:50
15	08:28 16:22	07:39 17:22	08:10 (12) 18:17	06:19 20:15	06:46 (9) 21:11	05:55 (6) 21:51
16	08:27 16:24	07:37 17:24	08:08 (12) 18:19	06:17 20:17	06:44 (9) 21:13	05:54 (6) 21:52
17	08:26 16:25	07:35 17:26	08:06 (12) 18:21	06:14 20:19	06:42 (9) 21:15	05:53 (6) 21:53
18	08:25 16:27	07:33 17:28	08:04 (12) 18:23	06:12 20:21	06:40 (9) 21:17	05:52 (6) 21:54
19	08:24 16:29	07:31 17:30	08:02 (12) 18:24	06:10 20:23	06:38 (9) 21:19	05:51 (6) 21:55
20	08:23 16:31	07:29 17:32	08:00 (12) 18:26	06:07 20:24	06:36 (9) 21:21	05:50 (6) 21:56
21	08:22 16:32	07:27 17:34	07:58 (12) 18:28	06:05 20:26	06:34 (9) 21:23	05:49 (6) 21:57
22	08:21 16:34	07:24 17:36	07:56 (12) 18:30	06:03 20:28	06:32 (9) 21:25	05:48 (6) 21:58
23	08:19 16:36	07:22 17:38	07:54 (12) 18:32	06:00 20:30	06:30 (9) 21:27	05:47 (6) 21:59
24	08:18 16:38	07:20 17:40	07:52 (12) 18:34	05:58 20:32	06:28 (9) 21:29	05:46 (6) 22:00
25	08:17 16:40	07:18 17:42	07:50 (12) 18:36	05:56 20:34	06:26 (9) 21:31	05:45 (6) 22:01
26	08:15 16:42	07:15 17:44	07:48 (12) 18:38	05:54 20:36	06:24 (9) 21:33	05:44 (6) 22:02
27	08:14 16:44	07:13 17:46	07:46 (12) 18:40	05:52 20:37	06:22 (9) 21:35	05:43 (6) 22:03
28	08:12 16:46	07:11 17:48	07:44 (12) 18:42	05:50 20:39	06:20 (9) 21:37	05:42 (6) 22:04
29	08:11 16:48	07:09 17:50	07:42 (12) 18:44	05:48 20:41	06:18 (9) 21:39	05:41 (6) 22:05
30	08:09 16:49	07:07 17:52	07:40 (12) 18:46	05:46 20:43	06:16 (9) 21:41	05:40 (6) 22:06
31	08:08 16:51	07:05 17:54	07:38 (12) 18:48	05:44 20:45	06:14 (9) 21:43	05:39 (6) 22:07
Sonnenscheinstunden	248	271	365	419	494	511
astr. max. mögl. Beschattung	14	321	228	1012	725	529

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

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+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: H - IO 8

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

Juli		August		September		Oktober		November		Dezember	
1	04:47	05:22 (5)	05:26	05:59 (6)	06:21	06:50 (9)	07:15	07:57 (11)	07:13	07:54 (12)	08:09
	21:52	05:40 (5)	21:17	06:39 (7)	20:11	07:25 (9)	18:56	08:12 (11)	16:45	08:18 (12)	15:59
2	04:47	05:23 (5)	05:28	06:01 (6)	06:23	06:52 (9)	07:17	07:55 (11)	07:15	07:53 (12)	08:11
	21:52	05:40 (5)	21:16	06:41 (7)	20:08	07:25 (9)	18:54	08:13 (11)	16:43	08:18 (12)	15:58
3	04:48	05:24 (5)	05:30	06:02 (6)	06:25	06:54 (9)	07:18	07:53 (11)	07:17	07:52 (12)	08:12
	21:51	05:40 (5)	21:14	06:41 (7)	20:06	07:24 (9)	18:51	08:14 (11)	16:41	08:19 (12)	15:58
4	04:49	05:25 (5)	05:31	06:20 (7)	06:26	06:56 (9)	07:20	07:52 (11)	07:19	07:53 (12)	08:14
	21:51	05:40 (5)	21:12	06:43 (7)	20:03	07:23 (9)	18:49	08:15 (11)	16:39	08:20 (12)	15:57
5	04:50	05:25 (5)	05:33	06:19 (7)	06:28	06:57 (9)	07:22	07:52 (11)	07:21	07:54 (12)	08:15
	21:50	05:38 (5)	21:10	06:43 (7)	20:01	07:22 (10)	18:47	08:15 (11)	16:37	08:20 (12)	15:56
6	04:51	05:26 (5)	05:35	06:18 (7)	06:30	06:59 (9)	07:24	07:52 (11)	07:23	07:56 (12)	08:17
	21:50	05:38 (5)	21:08	06:44 (7)	19:59	07:22 (10)	18:44	08:15 (11)	16:35	08:20 (12)	15:56
7	04:52	05:27 (5)	05:36	06:18 (7)	06:32	07:01 (10)	07:26	07:54 (11)	07:25	07:58 (12)	08:18
	21:49	05:37 (5)	21:06	06:45 (7)	19:56	07:23 (10)	18:42	08:15 (11)	16:33	08:19 (12)	15:55
8	04:53	05:28 (5)	05:38	06:17 (7)	06:33	07:02 (10)	07:28	07:56 (11)	07:27	08:00 (12)	08:19
	21:48	05:58 (6)	21:04	06:44 (7)	19:54	07:22 (10)	18:39	08:14 (11)	16:31	08:19 (12)	15:55
9	04:54	05:29 (5)	05:40	06:17 (7)	06:35	07:04 (10)	07:29	07:58 (11)	07:29	08:02 (12)	08:21
	21:48	06:00 (6)	21:02	06:45 (7)	19:51	07:22 (10)	18:37	08:14 (11)	16:29	08:19 (12)	15:54
10	04:55	05:30 (5)	05:42	06:17 (7)	06:37	07:06 (10)	07:31	08:00 (11)	07:31	08:04 (12)	08:22
	21:47	06:01 (6)	21:00	06:45 (7)	19:49	07:21 (10)	18:34	08:13 (11)	16:28	08:18 (12)	15:54
11	04:56	05:50 (6)	05:43	06:16 (7)	06:39	07:08 (10)	07:33	08:02 (11)	07:33	08:07 (12)	08:23
	21:46	06:02 (6)	20:58	06:45 (7)	19:46	07:21 (10)	18:32	08:12 (11)	16:26	08:19 (12)	15:54
12	04:57	05:49 (6)	05:45	06:17 (7)	06:41	07:09 (10)	07:35	08:04 (11)	07:35	08:09 (12)	08:24
	21:45	06:03 (6)	20:56	07:18 (9)	19:44	07:19 (10)	18:30	08:11 (11)	16:24	08:18 (12)	15:53
13	04:58	05:48 (6)	05:47	06:19 (7)	06:42	07:11 (10)	07:37	08:06 (11)	07:37	08:11 (12)	08:25
	21:44	06:04 (6)	20:54	07:21 (9)	19:41	07:18 (10)	18:27	08:10 (11)	16:23	08:17 (12)	15:53
14	04:59	05:48 (6)	05:49	06:20 (7)	06:44	07:13 (10)	07:39	08:09 (11)	07:39	08:13 (12)	08:26
	21:43	06:05 (6)	20:52	07:22 (9)	19:39	07:17 (10)	18:25	08:10 (11)	16:21	08:16 (12)	15:53
15	05:01	05:47 (6)	05:51	06:22 (7)	06:46		07:41		07:41		08:27
	21:42	06:05 (6)	20:50	07:24 (9)	19:36		18:23		16:19		15:53
16	05:02	05:48 (6)	05:52	06:23 (7)	06:48		07:43		07:43		08:28
	21:41	06:07 (6)	20:47	07:25 (9)	19:34		18:20		16:18		15:53
17	05:03	05:47 (6)	05:54	06:25 (7)	06:50		07:44		07:44		08:29
	21:40	06:07 (6)	20:45	07:26 (9)	19:31		18:18		16:16		15:53
18	05:05	05:46 (6)	05:56	06:27 (7)	06:51		07:46		07:46		08:30
	21:39	06:07 (6)	20:43	07:28 (9)	19:29		18:16		16:15		15:53
19	05:06	05:46 (6)	05:58	06:28 (7)	06:53		07:48		07:48		08:31
	21:37	06:07 (6)	20:41	07:28 (9)	19:26		18:13		16:13		15:54
20	05:07	05:46 (6)	05:59	06:30 (7)	06:55		07:50		07:50		08:32
	21:36	06:08 (6)	20:39	07:28 (9)	19:24		18:11		16:12		15:54
21	05:09	05:46 (6)	06:01	06:32 (7)	06:57		07:52		07:52		08:32
	21:35	06:08 (6)	20:36	07:29 (9)	19:21		18:09		16:10		15:54
22	05:10	05:45 (6)	06:03	06:52 (9)	06:58		07:54		07:54		08:33
	21:33	06:08 (6)	20:34	07:30 (9)	19:19		18:06		16:09		15:55
23	05:12	05:46 (6)	06:05	06:50 (9)	07:00		07:56		07:56		08:33
	21:32	06:09 (6)	20:32	07:29 (9)	19:16		18:04		16:08		15:55
24	05:13	05:47 (6)	06:07	06:50 (9)	07:02		07:58		07:57		08:34
	21:30	06:09 (6)	20:30	07:30 (9)	19:14		18:02		16:06		15:56
25	05:15	05:49 (6)	06:08	06:50 (9)	07:04		08:00		07:59		08:34
	21:29	06:10 (6)	20:27	07:30 (9)	19:11		18:00		16:05		15:56
26	05:16	05:50 (6)	06:10	06:49 (9)	07:06		08:02		08:01		08:35
	21:27	06:09 (6)	20:25	07:29 (9)	19:09		17:58		16:04		15:57
27	05:18	05:52 (6)	06:12	06:49 (9)	07:07		07:04	08:01 (12)	08:03		08:35
	21:26	06:09 (6)	20:23	07:29 (9)	19:06		16:55	9	08:10 (12)	16:03	15:58
28	05:20	05:53 (6)	06:14	06:49 (9)	07:09		07:06		07:59 (12)	08:04	08:35
	21:24	06:09 (6)	20:20	07:29 (9)	19:04		16:53	15	08:14 (12)	16:02	15:58
29	05:21	05:55 (6)	06:16	06:48 (9)	07:11		07:08		07:57 (12)	08:06	08:35
	21:22	06:09 (6)	20:18	07:28 (9)	19:01		16:51	18	08:15 (12)	16:01	15:59
30	05:23	05:56 (6)	06:17	06:48 (9)	07:13	07:59 (11)	07:09		07:56 (12)	08:08	08:35
	21:21	06:34 (7)	20:15	07:27 (9)	18:59	11	08:10 (11)	21	08:17 (12)	16:00	16:00
31	05:25	05:58 (6)	06:19	06:49 (9)			07:11		07:54 (12)		08:35
	21:19	06:38 (7)	20:13	07:27 (9)			16:47	23	08:17 (12)		16:01
Sonnenscheinstunden		514		462		384		330		259	
astr.max.mögl.Beschattung		538		1126		293		298		254	

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I - IO 9

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 16:02	08:06 16:53	08:36 (12) 17:08	07:35 (11) 19:49	07:18 (10) 20:43	06:19 (7) 21:36
2	08:35 16:04	08:04 16:55	08:36 (12) 17:06	07:33 (11) 19:51	07:16 (10) 20:47	06:20 (7) 21:37
3	08:35 16:05	08:02 16:57	08:36 (12) 17:04	07:30 (11) 19:53	07:14 (9) 20:49	06:20 (7) 21:38
4	08:35 16:06	08:01 16:59	08:36 (12) 17:01	07:27 (11) 19:54	07:11 (9) 20:50	06:21 (7) 21:39
5	08:35 16:07	07:59 17:01	08:37 (12) 17:58	07:27 (11) 19:56	07:09 (9) 20:52	06:21 (7) 21:41
6	08:34 16:08	07:57 17:04	08:38 (12) 18:00	07:27 (11) 19:58	07:07 (9) 20:54	06:21 (7) 21:42
7	08:34 16:10	07:55 17:06	08:39 (12) 18:01	07:29 (11) 20:00	07:07 (9) 20:56	06:21 (7) 21:43
8	08:33 16:11	07:53 17:08	08:40 (12) 18:03	07:29 (11) 20:02	07:06 (9) 20:57	06:21 (7) 21:44
9	08:33 16:12	07:51 17:10	08:41 (12) 18:05	07:31 (11) 20:04	07:06 (9) 20:59	06:21 (7) 21:45
10	08:32 16:14	07:50 17:12	08:42 (12) 18:07	07:33 (11) 20:06	07:06 (9) 21:01	06:21 (7) 21:46
11	08:32 16:15	07:48 17:14	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
12	08:31 16:17	07:46 17:16	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
13	08:30 16:19	07:44 17:18	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
14	08:29 16:20	07:41 17:20	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
15	08:28 16:22	07:39 17:22	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
16	08:27 16:24	07:37 17:24	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
17	08:26 16:25	07:35 17:26	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
18	08:25 16:27	07:33 17:28	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
19	08:24 16:29	07:31 17:30	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
20	08:23 16:31	07:29 17:32	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
21	08:22 16:32	07:27 17:34	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
22	08:21 16:34	08:53 (12) 17:36	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
23	08:19 16:36	08:52 (12) 17:38	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
24	08:18 16:38	08:50 (12) 17:40	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
25	08:17 16:40	08:49 (12) 17:42	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
26	08:15 16:42	08:47 (12) 17:44	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
27	08:14 16:44	08:45 (12) 17:46	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
28	08:12 16:46	08:44 (12) 17:48	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
29	08:11 16:48	08:42 (12) 17:50	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
30	08:09 16:49	09:01 (12) 17:52	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
31	08:08 16:51	08:38 (12) 17:54	08:46 (12) 18:09	07:33 (11) 20:06	07:05 (9) 21:03	06:21 (7) 21:46
Sonnenscheinstunden	248	271	365	419	494	511
astr.max.mögl.Beschattung	130	266	269	1103	686	1062

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

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info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I - IO 9

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:47 21:52 37	05:22 (5) 05:59 (5) 21:17	05:59 (6) 06:17 (6) 20:11	07:04 (9) 07:45 (9) 18:56	07:13 16:45	08:09 15:59
2	04:47 21:52 37	05:23 (5) 06:00 (5) 21:16	06:01 (6) 06:17 (6) 20:08	07:04 (9) 07:45 (9) 18:54	07:15 16:43 11	08:11 15:58
3	04:48 21:51 36	05:24 (5) 06:00 (5) 21:14	06:02 (6) 06:16 (6) 20:06	07:04 (9) 07:45 (9) 18:51	07:17 16:41 15	08:12 15:58
4	04:49 21:51 35	05:25 (5) 06:00 (5) 21:12	06:04 (6) 06:16 (6) 20:03	07:04 (9) 07:45 (9) 18:49	07:19 16:39 19	08:14 15:57
5	04:50 21:50 34	05:25 (5) 05:59 (5) 21:10	06:05 (6) 06:46 (7) 20:01	07:03 (9) 07:44 (9) 18:47	07:21 16:37 21	08:15 15:56
6	04:51 21:50 33	05:26 (5) 05:59 (5) 21:08	06:07 (6) 06:49 (7) 19:59	07:03 (9) 07:44 (9) 18:44	07:23 16:35 23	08:17 15:56
7	04:52 21:49 32	05:27 (5) 05:59 (5) 21:06	06:09 (6) 06:51 (7) 19:56	07:03 (9) 07:44 (9) 18:42	07:25 16:33 24	08:18 15:55
8	04:53 21:48 31	05:28 (5) 05:59 (5) 21:04	06:10 (6) 06:52 (7) 19:54	07:03 (9) 07:42 (9) 18:39	07:27 16:31 26	08:19 15:55
9	04:54 21:48 30	05:29 (5) 05:59 (5) 21:02	06:11 (6) 06:53 (7) 19:51	07:04 (9) 07:41 (9) 18:37	07:29 16:29 26	08:21 15:54
10	04:55 21:47 28	05:30 (5) 05:58 (5) 21:00	06:12 (6) 06:55 (7) 19:49	07:06 (9) 07:40 (9) 18:34	07:31 16:28 26	08:22 15:54
11	04:56 21:46 27	05:31 (5) 05:58 (5) 20:58	06:13 (6) 06:56 (7) 19:46	07:08 (10) 07:39 (9) 18:32	07:33 16:26 26	08:23 15:54
12	04:57 21:45 25	05:32 (5) 05:57 (5) 20:56	06:14 (6) 06:57 (7) 19:44	07:09 (10) 07:37 (9) 18:30	07:35 16:24 24	08:24 15:53
13	04:58 21:44 24	05:33 (5) 05:57 (5) 20:54	06:15 (6) 06:58 (7) 19:41	07:11 (10) 07:36 (9) 18:27	07:37 16:22 22	08:25 15:53
14	04:59 21:43 22	05:34 (5) 05:56 (5) 20:52	06:16 (6) 06:59 (7) 19:39	07:13 (10) 07:34 (9) 18:25	07:39 16:21 20	08:26 15:53
15	05:01 21:42 20	05:35 (5) 06:07 (6) 20:50	06:17 (6) 06:56 (7) 19:36	07:15 (10) 07:32 (9) 18:23	07:41 16:19 18	08:27 15:53
16	05:02 21:41 18	05:37 (5) 06:10 (6) 20:47	06:18 (6) 06:55 (7) 19:34	07:16 (10) 07:29 (10) 18:20	07:43 16:18 16	08:28 15:53
17	05:03 21:40 17	05:38 (5) 06:11 (6) 20:45	06:19 (6) 06:56 (7) 19:31	07:18 (10) 07:28 (10) 18:18	07:44 16:16 13	08:29 15:53
18	05:05 21:39 16	05:39 (5) 06:12 (6) 20:43	06:20 (6) 06:56 (7) 19:29	07:20 (10) 07:27 (10) 18:16	07:46 16:15 11	08:30 15:53
19	05:06 21:37 15	05:40 (5) 06:13 (6) 20:41	06:21 (6) 06:55 (7) 19:26	07:22 (10) 07:25 (10) 18:13	07:48 16:13 8	08:31 15:54
20	05:07 21:36 14	05:41 (5) 06:14 (6) 20:39	06:22 (6) 06:56 (7) 19:24	07:24 (10) 18:11	07:50 16:12 6	08:32 15:54
21	05:09 21:35 13	05:42 (5) 06:15 (6) 20:36	06:23 (6) 06:57 (7) 19:21	07:26 (10) 18:09	07:52 16:10 3	08:33 15:54
22	05:10 21:33 12	05:43 (5) 06:16 (6) 20:34	06:24 (6) 06:58 (7) 19:19	07:28 (10) 18:06	07:54 16:09	08:34 15:55
23	05:12 21:32 11	05:44 (5) 06:17 (6) 20:32	06:25 (6) 06:59 (7) 19:16	07:30 (10) 18:04	07:56 16:08	08:35 15:55
24	05:13 21:30 10	05:45 (5) 06:18 (6) 20:30	06:26 (6) 07:00 (7) 19:14	07:32 (10) 18:02	07:57 16:06	08:36 15:56
25	05:15 21:29 9	05:46 (5) 06:19 (6) 20:27	06:27 (6) 07:01 (7) 19:11	07:34 (10) 18:00	07:59 16:05	08:37 15:56
26	05:16 21:27 8	05:47 (5) 06:20 (6) 20:25	06:28 (6) 07:02 (7) 19:09	07:36 (10) 17:58	08:01 16:04	08:38 15:57
27	05:18 21:26 7	05:48 (5) 06:21 (6) 20:23	06:29 (6) 07:03 (7) 19:07	07:38 (10) 17:56	08:03 16:03	08:39 15:58
28	05:20 21:24 6	05:49 (5) 06:22 (6) 20:20	06:30 (6) 07:04 (7) 19:04	07:40 (10) 17:54	08:05 16:02	08:40 15:58
29	05:21 21:23 5	05:50 (5) 06:23 (6) 20:18	06:31 (6) 07:05 (7) 19:01	07:42 (10) 17:52	08:07 16:01	08:41 15:59
30	05:23 21:21 4	05:51 (5) 06:24 (6) 20:15	06:32 (6) 07:06 (7) 18:59	07:44 (10) 17:50	08:09 16:00	08:42 16:00
31	05:25 21:19 3	05:52 (5) 06:25 (6) 20:13	06:33 (6) 07:07 (7) 18:56	07:46 (10) 17:48	08:11 16:00	08:43 16:01
Sonnenscheinstunden	514	462	384	330	259	232
astr.max.mögl.Beschattung	826	917	552	233	358	

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: J - IO 10

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

Januar		Februar		März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:36	10:18 (2)	08:06	07:08	06:53	05:43	04:52	04:47	05:26	06:21	07:15	07:13	08:09
2	16:02	26	10:44 (2)	16:53	17:50	19:49	20:45	21:36	21:52	21:17	20:11	18:56	16:45
3	08:35	25	10:18 (2)	08:04	07:06	06:50	05:41	04:51	04:47	05:28	06:23	07:17	08:11
4	16:03	24	10:43 (2)	16:55	17:52	19:51	20:47	21:37	21:52	21:16	20:08	18:54	16:43
5	08:35	23	10:19 (2)	08:03	07:04	06:48	05:39	04:50	04:48	05:29	06:24	07:18	08:12
6	16:04	22	10:43 (2)	16:57	17:54	19:53	20:49	21:38	21:51	21:14	20:06	18:51	16:41
7	08:35	21	10:21 (2)	08:01	07:01	06:45	05:37	04:49	04:49	05:31	06:26	07:20	08:14
8	16:06	20	10:44 (2)	16:59	17:56	19:54	20:50	21:40	21:51	21:12	20:03	18:49	16:39
9	08:35	19	10:21 (2)	07:59	06:59	06:43	05:35	04:48	04:50	05:33	06:28	07:22	08:15
10	16:07	18	10:43 (2)	17:01	17:58	19:56	20:52	21:41	21:50	21:10	20:01	18:47	16:37
11	08:34	17	10:23 (2)	07:57	06:57	06:41	05:32	04:47	04:50	05:35	06:30	07:24	08:17
12	16:08	16	10:43 (2)	17:03	17:59	19:58	20:54	21:42	21:50	21:08	19:59	18:44	16:35
13	08:34	15	10:24 (2)	07:55	06:54	06:38	05:31	04:47	04:51	05:36	06:32	07:26	08:18
14	16:10	14	10:42 (2)	17:05	18:01	20:00	20:56	21:43	21:49	21:06	19:56	18:42	16:33
15	08:33	13	10:25 (2)	07:53	06:52	06:36	05:29	04:46	04:52	05:38	06:33	07:28	08:19
16	16:11	12	10:41 (2)	17:07	18:03	20:02	20:58	21:44	21:48	21:04	19:54	18:39	16:31
17	08:33	11	10:27 (2)	07:52	06:49	06:33	05:27	04:45	04:53	05:40	06:35	07:29	08:21
18	16:12	10	10:40 (2)	17:09	18:05	20:04	20:59	21:45	21:48	21:02	19:51	18:37	16:29
19	08:32	9	10:30 (2)	07:50	06:47	06:31	05:25	04:45	04:55	05:42	06:37	07:31	08:22
20	16:14	8	10:39 (2)	17:12	18:07	20:06	21:01	21:46	21:47	21:00	19:49	18:34	16:28
21	08:32	7		07:48	06:45	06:28	05:23	04:44	04:56	05:43	06:39	07:33	08:23
22	16:15	6		17:14	18:09	20:08	21:03	21:47	21:46	20:58	19:46	18:32	16:26
23	08:31	5		07:46	06:42	06:26	05:21	04:44	04:57	05:45	06:41	07:35	08:24
24	16:17	4		17:16	18:11	20:09	21:05	21:47	21:45	20:56	19:44	18:30	16:24
25	08:30	3		07:44	06:40	06:24	05:19	04:44	04:58	05:47	06:42	07:37	08:25
26	16:18	2		17:18	18:13	20:11	21:07	21:48	21:44	20:54	19:41	18:27	16:22
27	08:29	1		07:42	06:37	06:21	05:17	04:43	04:59	05:49	06:44	07:39	08:27
28	16:20			17:20	18:15	20:13	21:08	21:49	21:43	20:52	19:39	18:25	16:21
29	08:28			07:39	06:35	06:19	05:16	04:43	05:00	05:50	06:46	07:41	08:27
30	16:22			17:22	18:17	20:15	21:10	21:49	21:42	20:50	19:36	18:22	16:19
31	08:27			07:37	06:32	06:17	05:14	04:43	05:02	05:52	06:48	07:43	08:28
1	16:23			17:24	18:19	20:17	21:12	21:50	21:41	20:47	19:34	18:20	16:18
2	08:26			07:35	06:30	06:14	05:12	04:43	05:03	05:54	06:49	07:44	08:29
3	16:25			17:26	18:21	20:19	21:13	21:51	21:40	20:45	19:31	18:18	16:16
4	08:25			07:33	06:27	06:12	05:11	04:42	05:04	05:56	06:51	07:46	08:30
5	16:27			17:28	18:23	20:21	21:15	21:51	21:39	20:43	19:29	18:15	16:14
6	08:24			07:31	06:25	06:10	05:09	04:42	05:06	05:58	06:53	07:48	08:31
7	16:29			17:30	18:24	20:23	21:17	21:52	21:37	20:41	19:26	18:13	16:13
8	08:23			07:29	06:23	06:07	05:07	04:42	05:07	05:59	06:55	07:50	08:32
9	16:30			17:32	18:26	20:24	21:18	21:52	21:36	20:39	19:24	18:11	16:12
10	08:22			07:27	06:20	06:05	05:06	04:43	05:09	06:01	06:57	07:52	08:32
11	16:32			17:34	18:28	20:26	21:20	21:52	21:35	20:36	19:21	18:09	16:10
12	08:21			07:24	06:18	06:03	05:04	04:43	05:10	06:03	06:58	07:54	08:33
13	16:34			17:36	18:30	20:28	21:22	21:52	21:33	20:34	19:19	18:06	16:09
14	08:19			07:22	06:15	06:00	05:03	04:43	05:12	06:05	07:00	07:56	08:33
15	16:36			17:38	18:32	20:30	21:23	21:53	21:32	20:32	19:16	18:04	16:08
16	08:18			07:20	06:13	05:58	05:02	04:43	05:13	06:07	07:02	07:58	08:34
17	16:38			17:40	18:34	20:32	21:25	21:53	21:31	20:30	19:14	18:02	16:06
18	08:17			07:18	06:10	05:56	05:00	04:43	05:15	06:08	07:04	08:00	08:35
19	16:40			17:42	18:36	20:34	21:26	21:53	21:29	20:27	19:11	18:00	16:05
20	08:15			07:15	06:08	05:54	04:59	04:44	05:16	06:10	07:06	08:02	08:35
21	16:42			17:44	18:38	20:36	21:28	21:53	21:27	20:25	19:09	17:58	16:04
22	08:14			07:13	06:05	05:51	04:58	04:44	05:18	06:12	07:07	07:54	08:35
23	16:44			17:46	18:39	20:37	21:29	21:53	21:26	20:23	19:06	17:55	16:03
24	08:12			07:11	06:03	05:49	04:56	04:45	05:19	06:14	07:09	07:56	08:35
25	16:45			17:48	18:41	20:39	21:31	21:53	21:24	20:20	19:04	17:53	16:02
26	08:11				06:00	05:47	04:55	04:45	05:21	06:16	07:11	07:58	08:35
27	16:47				18:43	20:41	21:32	21:53	21:23	20:18	19:01	17:51	16:01
28	08:09				05:58	05:45	04:54	04:46	05:23	06:17	07:13	08:08	08:35
29	16:49				18:45	20:43	21:33	21:52	21:21	20:15	18:59	16:49	16:00
30	08:08				06:55		04:53		05:24	06:19		07:11	08:35
31	16:51				19:47		21:35		21:19	20:13		16:47	16:01
Sonnenscheinstunden		248	271	365	419	494	511	515	462	384	330	259	232
astr.max.mögl.Beschattung		196											716

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: ZusatzbelastungSchattenrezeptor: K - IO 11

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender2019
Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35	12:57 (6) 08:06	15:13 (4) 07:08	15:25 (4) 06:53	18:28 (2) 05:43	04:52
	16:02	62 15:27 (5) 16:53	52 16:05 (4) 17:50	55 16:54 (3) 19:49	47 19:15 (2) 20:45	21:36
2	08:35	12:57 (6) 08:04	15:13 (4) 07:06	15:28 (4) 06:50	18:28 (2) 05:41	04:51
	16:03	64 15:28 (5) 16:55	53 16:06 (4) 17:52	48 16:53 (3) 19:51	48 19:16 (2) 20:47	21:37
3	08:35	12:58 (6) 08:02	15:13 (4) 07:04	15:31 (4) 06:48	18:26 (2) 05:39	04:50
	16:04	63 15:29 (5) 16:57	55 16:08 (4) 17:54	36 16:50 (3) 19:53	50 19:16 (2) 20:48	21:38
4	08:35	12:58 (6) 08:01	15:13 (4) 07:01	15:37 (3) 06:45	18:26 (2) 05:36	04:49
	16:06	64 15:30 (5) 16:59	55 16:08 (4) 17:56	10 16:47 (3) 19:54	51 19:17 (2) 20:50	21:39
5	08:35	12:59 (6) 07:59	15:12 (4) 06:59	06:43	18:25 (2) 05:34	04:48
	16:07	65 15:32 (5) 17:01	57 16:09 (4) 17:57	19:56	52 19:17 (2) 20:52	21:41
6	08:34	13:00 (6) 07:57	15:12 (4) 06:57	06:41	18:24 (2) 05:32	04:47
	16:08	65 15:33 (5) 17:03	57 16:09 (4) 17:59	19:58	53 19:17 (2) 20:54	21:42
7	08:34	13:01 (6) 07:55	15:12 (4) 06:54	06:38	18:24 (2) 05:30	04:47
	16:10	64 15:34 (5) 17:05	58 16:10 (4) 18:01	20:00	53 19:17 (2) 20:56	21:43
8	08:33	13:02 (6) 07:53	15:12 (4) 06:52	06:36	18:23 (2) 05:29	04:46
	16:11	64 15:35 (5) 17:07	58 16:10 (4) 18:03	20:02	53 19:16 (2) 20:58	21:44
9	08:33	13:03 (6) 07:51	15:12 (4) 06:49	06:33	18:23 (2) 05:27	04:45
	16:12	62 15:35 (5) 17:09	58 16:10 (4) 18:05	20:04	53 19:16 (2) 20:59	21:45
10	08:32	13:04 (6) 07:49	15:11 (4) 06:47	06:31	18:23 (2) 05:25	04:45
	16:14	61 15:35 (5) 17:11	65 16:43 (3) 18:07	20:06	53 19:16 (2) 21:01	21:46
11	08:32	13:06 (6) 07:47	15:11 (4) 06:45	06:28	18:22 (2) 05:23	04:44
	16:15	59 15:37 (5) 17:14	70 16:45 (3) 18:09	20:08	53 19:15 (2) 21:03	21:46
12	08:31	13:08 (6) 07:45	15:11 (4) 06:42	06:26	18:23 (2) 05:21	04:44
	16:17	56 15:37 (5) 17:16	75 16:48 (3) 18:11	20:09	52 19:15 (2) 21:05	21:47
13	08:30	13:09 (6) 07:43	15:11 (4) 06:40	06:24	18:23 (2) 05:19	04:44
	16:18	55 15:37 (5) 17:18	79 16:50 (3) 18:13	20:11	52 19:15 (2) 21:06	21:48
14	08:29	13:11 (6) 07:41	15:11 (4) 06:37	06:21	18:23 (2) 05:17	04:43
	16:20	52 15:38 (5) 17:20	82 16:52 (3) 18:15	20:13	51 19:14 (2) 21:08	21:49
15	08:28	13:13 (6) 07:39	15:12 (4) 06:35	06:19	18:23 (2) 05:16	04:43
	16:22	47 15:37 (5) 17:22	85 16:55 (3) 18:17	20:15	51 19:14 (2) 21:10	21:49
16	08:27	13:16 (6) 07:37	15:11 (4) 06:32	06:16	18:24 (2) 05:14	04:43
	16:23	42 15:38 (5) 17:24	87 16:56 (3) 18:19	20:17	49 19:13 (2) 21:12	21:50
17	08:26	15:08 (5) 07:35	15:12 (4) 06:30	17:51 (1) 06:14	18:23 (2) 05:12	04:43
	16:25	31 15:39 (4) 17:26	89 16:58 (3) 18:21	5 17:56 (1) 20:19	48 19:11 (2) 21:13	21:50
18	08:25	15:09 (5) 07:33	15:12 (4) 06:27	17:48 (1) 06:12	18:24 (2) 05:11	04:42
	16:27	35 15:44 (4) 17:28	89 16:59 (3) 18:22	10 17:58 (1) 20:21	47 19:11 (2) 21:15	21:51
19	08:24	15:09 (5) 07:31	15:13 (4) 06:25	17:46 (1) 06:09	18:25 (2) 05:09	04:42
	16:29	37 15:46 (4) 17:30	89 17:00 (3) 18:24	14 18:00 (1) 20:22	45 19:10 (2) 21:17	21:51
20	08:23	15:10 (5) 07:29	15:13 (4) 06:22	17:44 (1) 06:07	18:26 (2) 05:07	04:42
	16:30	39 15:49 (4) 17:32	88 16:59 (3) 18:26	17 18:01 (1) 20:24	43 19:09 (2) 21:18	21:52
21	08:22	15:11 (5) 07:26	15:14 (4) 06:20	17:43 (1) 06:05	18:26 (2) 05:06	04:43
	16:32	41 15:52 (4) 17:34	88 17:00 (3) 18:28	21 18:04 (1) 20:26	41 19:07 (2) 21:20	21:52
22	08:21	15:11 (5) 07:24	15:15 (4) 06:18	17:41 (1) 06:03	18:28 (2) 05:04	04:43
	16:34	42 15:53 (4) 17:36	86 17:00 (3) 18:30	24 18:05 (1) 20:28	38 19:06 (2) 21:21	21:52
23	08:19	15:13 (5) 07:22	15:15 (4) 06:15	17:41 (1) 06:00	18:29 (2) 05:03	04:43
	16:36	42 15:55 (4) 17:38	83 16:59 (3) 18:32	27 18:08 (1) 20:30	35 19:04 (2) 21:23	21:53
24	08:18	15:13 (5) 07:20	15:17 (4) 06:13	17:39 (1) 05:58	18:31 (2) 05:02	04:43
	16:38	43 15:56 (4) 17:40	81 16:59 (3) 18:34	30 18:09 (1) 20:32	32 19:03 (2) 21:25	21:53
25	08:17	15:15 (5) 07:18	15:18 (4) 06:10	17:39 (1) 05:56	18:33 (2) 05:00	04:43
	16:40	43 15:58 (4) 17:42	78 16:59 (3) 18:36	30 18:09 (1) 20:34	28 19:01 (2) 21:26	21:53
26	08:15	15:16 (5) 07:15	15:19 (4) 06:08	17:39 (2) 05:54	18:35 (2) 04:59	04:44
	16:42	43 15:59 (4) 17:44	74 16:58 (3) 18:38	30 18:09 (2) 20:36	23 18:58 (2) 21:28	21:53
27	08:14	15:16 (4) 07:13	15:21 (4) 06:05	17:37 (2) 05:51	18:39 (2) 04:58	04:44
	16:43	44 16:00 (4) 17:46	69 16:57 (3) 18:39	34 18:11 (2) 20:37	16 18:55 (2) 21:29	21:53
28	08:12	15:16 (4) 07:11	15:22 (4) 06:03	17:34 (2) 05:49	18:46 (2) 04:56	04:45
	16:45	46 16:02 (4) 17:48	63 16:55 (3) 18:41	38 18:12 (2) 20:39	2 18:48 (2) 21:30	21:53
29	08:11	15:15 (4)	06:00	17:33 (2) 05:47	04:55	04:45
	16:47	48 16:03 (4)	18:43	41 18:14 (2) 20:41	21:32	21:52
30	08:09	15:15 (4)	05:58	17:31 (2) 05:45	04:54	04:46
	16:49	49 16:04 (4)	18:45	43 18:14 (2) 20:43	21:33	21:52
31	08:08	15:14 (4)	06:55	18:30 (2)	04:53	
	16:51	51 16:05 (4)	19:47	45 19:15 (2)	21:35	
Sonnenscheinstunden	248	271	365	419	494	511
astr.max.mögl.Beschattung	1579	2023	558	1219		

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat
Sonnenaufgang (SS:MM)
Sonnenuntergang (SS:MM)
Minuten mit Schatten

Zeitpunkt (SS:MM) Schattenanfang
Zeitpunkt (SS:MM) Schattenende
(WEA mit erstem Schatten)
(WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** K - IO 11

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender 2019
 Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
 Die Sonne scheint täglich von Sonnenauf- bis -untergang
 Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
 Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember	
1	04:46 21:52	05:26 21:17	06:21 20:11	18:22 (2) 07:15	07:13 16:45	14:40 (4) 08:09	12:50 (6)
2	04:47 21:52	05:28 21:15	06:23 20:08	18:21 (2) 07:16	07:15 16:43	14:40 (4) 08:11	12:49 (6)
3	04:48 21:51	05:29 21:14	06:24 20:06	18:21 (2) 07:18	07:17 16:41	14:40 (4) 08:12	12:48 (6)
4	04:49 21:51	05:31 21:12	06:26 20:03	18:20 (2) 07:20	07:19 16:39	14:40 (4) 08:14	12:48 (6)
5	04:50 21:50	05:33 21:10	06:28 20:01	18:20 (2) 07:22	07:21 16:37	14:42 (4) 08:15	12:47 (6)
6	04:50 21:50	05:35 21:08	06:30 19:58	18:20 (2) 07:24	07:23 16:35	14:42 (4) 08:17	12:47 (6)
7	04:51 21:49	05:36 21:06	06:32 19:56	18:20 (2) 07:26	07:25 16:33	14:42 (4) 08:18	12:47 (6)
8	04:52 21:48	05:38 21:04	06:33 19:54	18:19 (2) 07:27	07:27 16:31	14:42 (4) 08:19	12:47 (6)
9	04:53 21:48	05:40 21:02	06:35 19:51	18:20 (2) 07:29	07:29 16:29	14:43 (4) 08:21	12:47 (6)
10	04:54 21:47	05:42 21:00	06:37 19:49	18:20 (2) 07:31	07:31 16:28	14:43 (4) 08:22	12:46 (6)
11	04:56 21:46	05:43 20:58	06:39 19:46	18:19 (2) 07:33	07:33 17:11 (3)	14:45 (4) 08:23	12:47 (6)
12	04:57 21:45	05:45 20:56	06:40 19:44	18:20 (2) 07:35	07:35 17:21 (3)	14:45 (4) 08:24	12:47 (6)
13	04:58 21:44	05:47 20:54	06:42 19:41	18:21 (2) 07:37	07:37 17:26 (3)	14:46 (4) 08:25	12:47 (6)
14	04:59 21:43	05:49 20:52	06:44 19:39	18:22 (2) 07:39	07:39 17:27 (3)	14:47 (4) 08:26	12:47 (6)
15	05:00 21:42	05:50 20:50	06:46 19:36	18:22 (2) 07:41	07:41 17:28 (3)	14:48 (4) 08:27	12:48 (6)
16	05:02 21:41	05:52 20:47	06:48 19:34	18:23 (2) 07:42	07:42 17:29 (3)	14:49 (4) 08:28	12:48 (6)
17	05:03 21:40	05:54 20:45	06:49 19:31	18:24 (2) 07:44	07:44 17:30 (3)	14:49 (5) 08:29	12:48 (6)
18	05:04 21:39	05:56 20:43	06:51 19:29	18:26 (2) 07:46	07:46 17:30 (3)	14:48 (5) 08:30	12:49 (6)
19	05:06 21:37	05:58 20:41	06:53 19:26	18:26 (1) 07:48	07:48 17:30 (3)	14:48 (5) 08:31	12:48 (6)
20	05:07 21:36	05:59 20:39	06:55 19:24	18:26 (1) 07:50	07:50 17:30 (3)	14:48 (5) 08:32	12:49 (6)
21	05:09 21:35	06:01 20:36	06:57 19:21	18:26 (1) 07:52	07:52 17:30 (3)	14:48 (5) 08:33	12:50 (6)
22	05:10 21:33	06:03 20:34	06:58 19:19	18:26 (1) 07:54	07:54 17:30 (3)	14:47 (5) 08:33	12:51 (6)
23	05:12 21:32	06:05 20:32	07:00 19:16	18:27 (1) 07:56	07:56 17:30 (3)	14:47 (5) 08:33	12:51 (6)
24	05:13 21:30	06:07 20:29	07:02 19:14	18:26 (1) 07:58	07:58 17:30 (3)	14:47 (5) 08:34	12:51 (6)
25	05:15 21:29	06:08 20:27	07:04 19:11	18:27 (1) 08:00	08:00 17:29 (3)	14:46 (5) 08:34	12:51 (6)
26	05:16 21:27	06:10 20:25	07:06 19:09	18:29 (1) 08:02	08:02 17:28 (3)	14:46 (5) 08:35	12:52 (6)
27	05:18 21:26	06:12 20:22	07:07 19:06	18:31 (1) 07:04	07:04 17:28 (3)	14:41 (4) 08:35	12:53 (6)
28	05:19 21:24	06:14 20:20	07:09 19:04	18:34 (1) 07:06	07:06 17:26 (3)	14:41 (4) 08:35	12:53 (6)
29	05:21 21:22	06:15 20:18	07:11 19:01	18:38 (1) 07:07	07:07 17:25 (3)	15:17 (5) 08:35	12:52 (5)
30	05:23 21:21	06:17 20:15	07:13 18:59	18:38 (1) 07:09	07:09 17:23 (3)	15:18 (5) 08:35	12:53 (5)
31	05:24 21:19	06:19 20:13	18:23 (2) 19:15 (2)	07:11 16:47	07:11 16:18 (3)	15:18 (5) 08:35	12:55 (6)
Sonnenscheinstunden	515	462	384	330	259	232	1917
astr.max.mögl.Beschattung			585	1064	1529	1482	1917

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: L - IO 12

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	[Januar	[Februar	[März	[April	[Mai	[Juni										
1	08:35	08:06	07:08	16:49 (11)	06:53	19:09 (10)	05:43	19:41 (7)	04:52	20:50 (6)						
	16:02	16:53	17:50	31	17:20 (11)	19:49	14	19:23 (9)	20:45	29	20:10 (5)	21:36	13	21:03 (6)		
2	08:35	08:04	07:06	16:49 (11)	06:50	19:06 (10)	05:41	19:41 (7)	04:51	20:49 (6)						
	16:03	16:55	17:52	31	17:20 (11)	19:51	20	19:26 (9)	20:47	29	20:10 (5)	21:37	15	21:04 (6)		
3	08:35	08:02	07:04	16:48 (11)	06:48	19:03 (10)	05:39	19:42 (7)	04:50	20:49 (6)						
	16:05	16:57	17:54	31	17:19 (11)	19:52	24	19:27 (10)	20:48	28	20:10 (5)	21:38	16	21:05 (6)		
4	08:35	08:01	07:01	16:48 (11)	06:45	19:01 (10)	05:36	19:42 (7)	04:49	20:49 (6)						
	16:06	16:59	3	16:30 (12)	17:55	32	17:20 (11)	19:54	28	19:29 (9)	20:50	27	20:09 (7)	21:39	18	21:07 (6)
5	08:34	07:59	16:25 (12)	06:59	16:48 (11)	06:43	19:00 (10)	05:34	19:42 (7)	04:48	20:48 (6)					
	16:07	17:01	8	16:33 (12)	17:57	31	17:19 (11)	19:56	30	19:30 (10)	20:52	26	20:08 (7)	21:40	20	21:08 (6)
6	08:34	07:57	16:24 (12)	06:56	16:48 (11)	06:40	18:58 (10)	05:32	19:42 (7)	04:47	20:47 (6)					
	16:08	17:03	11	16:35 (12)	17:59	30	17:18 (11)	19:58	32	19:30 (10)	20:54	26	20:08 (7)	21:42	21	21:08 (6)
7	08:34	07:55	16:23 (12)	06:54	16:48 (11)	06:38	18:57 (10)	05:30	19:43 (7)	04:47	20:48 (6)					
	16:10	17:05	14	16:37 (12)	18:01	29	17:17 (11)	20:00	34	19:31 (10)	20:56	24	20:07 (7)	21:43	22	21:10 (6)
8	08:33	07:53	16:22 (12)	06:52	16:49 (11)	06:36	18:56 (10)	05:29	19:43 (7)	04:46	20:47 (6)					
	16:11	17:07	16	16:38 (12)	18:03	27	17:16 (11)	20:02	35	19:31 (10)	20:57	23	20:06 (7)	21:44	23	21:10 (6)
9	08:33	07:51	16:22 (12)	06:49	16:50 (11)	06:33	18:55 (10)	05:27	19:44 (7)	04:45	20:47 (6)					
	16:12	17:09	19	16:41 (12)	18:05	24	17:14 (11)	20:04	37	19:32 (10)	20:59	20	20:04 (7)	21:45	24	21:11 (6)
10	08:32	07:49	16:21 (12)	06:47	16:52 (11)	06:31	18:55 (10)	05:25	19:46 (7)	04:45	20:47 (6)					
	16:14	17:11	22	16:43 (12)	18:07	21	17:13 (11)	20:06	37	19:32 (10)	21:01	18	20:04 (7)	21:45	25	21:12 (6)
11	08:31	07:47	16:21 (12)	06:44	16:54 (11)	06:28	18:54 (10)	05:23	19:48 (7)	04:44	20:47 (6)					
	16:15	17:13	24	16:45 (12)	18:09	18	17:12 (11)	20:07	37	19:31 (10)	21:03	14	20:02 (7)	21:46	26	21:13 (6)
12	08:31	07:45	16:22 (12)	06:42	16:56 (11)	06:26	18:54 (10)	05:21	19:49 (7)	04:44	20:47 (6)					
	16:17	17:16	23	16:45 (12)	18:11	12	17:08 (11)	20:09	38	19:32 (10)	21:05	10	19:59 (7)	21:47	26	21:13 (6)
13	08:30	07:43	16:22 (12)	06:40	06:24	18:54 (10)	05:19	19:44	26	21:13 (6)						
	16:18	17:18	23	16:45 (12)	18:13	20:11	38	19:32 (10)	21:06	21:48	26	21:13 (6)				
14	08:29	07:41	16:22 (12)	06:37	06:21	18:53 (10)	05:17	19:43	27	21:14 (6)						
	16:20	17:20	23	16:45 (12)	18:15	20:13	38	19:31 (10)	21:08	21:49	27	21:14 (6)				
15	08:28	07:39	16:22 (12)	06:35	06:19	18:53 (10)	05:16	19:43	27	21:14 (6)						
	16:22	17:22	22	16:44 (12)	18:17	20:15	38	19:31 (10)	21:10	21:49	27	21:14 (6)				
16	08:27	07:37	16:23 (12)	06:32	06:16	18:53 (10)	05:14	19:43	27	21:14 (6)						
	16:23	17:24	20	16:43 (12)	18:19	20:17	37	19:30 (10)	21:11	21:50	28	21:15 (6)				
17	08:26	07:35	16:24 (12)	06:30	06:14	18:53 (10)	05:12	19:43	27	21:15 (6)						
	16:25	17:26	19	16:43 (12)	18:21	20:19	36	19:29 (10)	21:13	21:50	27	21:15 (6)				
18	08:25	07:33	16:26 (12)	06:27	06:12	18:54 (10)	05:11	19:43	27	21:15 (6)						
	16:27	17:28	15	16:41 (12)	18:22	20:21	34	19:28 (10)	21:15	21:51	27	21:15 (6)				
19	08:24	07:31	16:28 (12)	06:25	06:09	18:54 (10)	05:09	19:42	27	21:15 (6)						
	16:29	17:30	12	16:40 (12)	18:24	20:22	34	19:28 (10)	21:16	21:51	27	21:15 (6)				
20	08:23	07:29	06:22	18:26	06:07	18:55 (10)	05:07	19:42	27	21:16 (6)						
	16:30	17:32	18:26	06:20	06:05	18:55 (10)	05:06	19:43	27	21:16 (6)						
21	08:22	07:26	16:59 (11)	18:28	20:26	19:59 (5)	21:20	21:52	28	21:16 (6)						
	16:32	17:34	8	17:07 (11)	18:28	06:03	18:56 (10)	05:04	19:43	27	21:16 (6)					
22	08:21	07:24	16:57 (11)	06:17	20:28	20:01 (5)	21:21	21:52	28	21:16 (6)						
	16:34	17:36	13	17:10 (11)	18:30	06:00	18:58 (10)	05:03	19:43	27	21:16 (6)					
23	08:19	07:22	16:54 (11)	06:15	20:30	20:03 (5)	21:23	21:52	28	21:16 (6)						
	16:36	17:38	17	17:11 (11)	18:32	05:58	19:00 (10)	05:02	19:43	27	21:16 (6)					
24	08:18	07:20	16:53 (11)	06:13	20:32	20:05 (5)	21:24	21:53	28	21:17 (6)						
	16:38	17:40	21	17:14 (11)	18:34	05:56	19:02 (10)	05:00	19:43	27	21:17 (6)					
25	08:17	07:17	16:52 (11)	06:10	20:34	20:07 (5)	21:26	21:53	27	21:16 (6)						
	16:40	17:42	24	17:16 (11)	18:36	05:54	19:06 (10)	04:59	19:44	27	21:17 (6)					
26	08:15	07:15	16:50 (11)	06:08	20:35	20:08 (5)	21:27	21:53	27	21:17 (6)						
	16:42	17:44	28	17:18 (11)	18:37	05:51	19:43 (7)	04:58	19:44	27	21:17 (6)					
27	08:14	07:13	16:50 (11)	06:05	20:37	20:10 (5)	21:29	21:53	27	21:17 (6)						
	16:43	17:46	29	17:19 (11)	18:39	05:49	19:42 (7)	04:56	19:45	27	21:17 (6)					
28	08:12	07:11	16:49 (11)	06:03	20:39	20:11 (5)	21:30	21:52	27	21:16 (6)						
	16:45	17:48	30	17:19 (11)	18:41	19:41 (7)	04:55	20:56 (6)	04:45	20:50 (6)						
29	08:11	07:10	16:47	06:00	18:16 (9)	05:47	19:41 (7)	04:55	20:56 (6)	27	21:17 (6)					
	16:47	17:50	3	18:19 (9)	20:41	20:11 (5)	21:32	20:53 (6)	04:46	20:51 (6)						
30	08:09	07:09	16:49	05:58	18:13 (9)	05:45	19:41 (7)	04:54	21:33	8	21:01 (6)	21:52	27	21:18 (6)		
	16:49	17:52	7	18:20 (9)	20:43	20:11 (5)	21:33	20:52 (6)	21:52	27	21:18 (6)					
31	08:07	07:07	16:47	05:55	19:11 (9)	05:43	20:11 (5)	21:34	21:52	10	21:02 (6)	21:52	27	21:18 (6)		
	16:51	17:54	11	19:22 (9)	20:43	20:11 (5)	21:34	21:52	21:52	10	21:02 (6)	21:52	27	21:18 (6)		
Sonneneinstrahlung	248	271	365	338	419	494	296	511	740							
astr.max.mögl.Beschattung		444														

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)		Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: L - IO 12

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember	
1	04:47	20:51 (6)	05:26		06:21	18:53 (10)	07:15		07:13	15:51 (12)	08:09	
	21:52	26 21:17 (6)	21:17		20:10	38 19:31 (10)	18:56		16:45	24 16:15 (12)	15:59	
2	04:47	20:51 (6)	05:28		20:01 (7)	06:23	18:53 (10)	07:16		07:15	15:51 (12)	08:11
	21:51	26 21:17 (6)	21:15	9	20:10 (7)	20:08	37 19:30 (10)	18:54		16:43	22 16:13 (12)	15:58
3	04:48	20:52 (6)	05:29		19:58 (7)	06:24	18:53 (10)	07:18	17:34 (11)	07:17	15:51 (12)	08:12
	21:51	26 21:18 (6)	21:14	14	20:12 (7)	20:06	37 19:30 (10)	18:51	13 17:47 (11)	16:41	20 16:11 (12)	15:57
4	04:49	20:52 (6)	05:31		19:57 (7)	06:26	18:52 (10)	07:20	17:31 (11)	07:19	15:51 (12)	08:14
	21:51	25 21:17 (6)	21:12	17	20:14 (7)	20:03	37 19:29 (10)	18:49	19 17:50 (11)	16:39	18 16:09 (12)	15:57
5	04:50	20:52 (6)	05:33		19:55 (7)	06:28	18:52 (10)	07:22	17:28 (11)	07:21	15:53 (12)	08:15
	21:50	24 21:16 (6)	21:10	19	20:14 (7)	20:01	36 19:28 (10)	18:46	22 17:50 (11)	16:37	15 16:08 (12)	15:56
6	04:51	20:53 (6)	05:35		19:54 (7)	06:30	18:53 (10)	07:24	17:27 (11)	07:23	15:54 (12)	08:16
	21:50	23 21:16 (6)	21:08	22	20:16 (7)	19:58	35 19:28 (10)	18:44	24 17:51 (11)	16:35	11 16:05 (12)	15:55
7	04:51	20:54 (6)	05:36		19:53 (7)	06:32	18:54 (10)	07:26	17:25 (11)	07:25	15:55 (12)	08:18
	21:49	22 21:16 (6)	21:06	24	20:17 (7)	19:56	33 19:27 (10)	18:42	27 17:52 (11)	16:33	8 16:03 (12)	15:55
8	04:52	20:54 (6)	05:38		19:52 (7)	06:33	18:54 (10)	07:27	17:24 (11)	07:27	15:56 (12)	08:19
	21:48	21 21:15 (6)	21:04	25	20:17 (7)	19:53	31 19:25 (10)	18:39	29 17:53 (11)	16:31	5 16:01 (12)	15:54
9	04:53	20:55 (6)	05:40		19:51 (7)	06:35	18:55 (10)	07:29	17:23 (11)	07:29	15:58 (12)	08:21
	21:47	19 21:14 (6)	21:02	27	20:18 (7)	19:51	29 19:24 (9)	18:37	30 17:53 (11)	16:29	1 15:59 (12)	15:54
10	04:55	20:56 (6)	05:42		19:50 (7)	06:37	18:56 (10)	07:31	17:23 (11)	07:31		08:22
	21:47	18 21:14 (6)	21:00	27	20:17 (7)	19:49	26 19:22 (10)	18:34	31 17:54 (11)	16:28		15:54
11	04:56	20:57 (6)	05:43		19:50 (7)	06:39	18:57 (10)	07:33	17:22 (11)	07:33		08:23
	21:46	16 21:13 (6)	20:58	28	20:18 (5)	19:46	22 19:19 (10)	18:32	32 17:54 (11)	16:26		15:53
12	04:57	20:57 (6)	05:45		19:50 (7)	06:40	18:59 (10)	07:35	17:22 (11)	07:35		08:24
	21:45	15 21:12 (6)	20:56	29	20:19 (5)	19:44	18 19:17 (9)	18:29	32 17:54 (11)	16:24		15:53
13	04:58	20:58 (6)	05:47		19:49 (7)	06:42	19:02 (9)	07:37	17:22 (11)	07:37		08:25
	21:44	13 21:11 (6)	20:54	30	20:19 (5)	19:41	13 19:15 (9)	18:27	31 17:53 (11)	16:22		15:53
14	04:59	21:00 (6)	05:49		19:49 (7)	06:44	19:03 (9)	07:39	17:22 (11)	07:39		08:26
	21:43	10 21:10 (6)	20:52	30	20:19 (5)	19:39	10 19:13 (9)	18:25	31 17:53 (11)	16:21		15:53
15	05:00	21:01 (6)	05:50		19:50 (7)	06:46	19:04 (9)	07:40	17:22 (11)	07:41		08:27
	21:42	8 21:09 (6)	20:49	30	20:20 (5)	19:36	5 19:09 (9)	18:22	30 17:52 (11)	16:19		15:53
16	05:02	21:06 (6)	05:52		19:49 (7)	06:48		07:42	17:22 (11)	07:42		08:28
	21:41	2 21:08 (6)	20:47	30	20:19 (5)	19:34		18:20	30 17:52 (11)	16:17		15:53
17	05:03		05:54		19:49 (7)	06:49		07:44	17:22 (11)	07:44		08:29
	21:40		20:45	28	20:17 (5)	19:31		18:18	28 17:50 (11)	16:16		15:53
18	05:04		05:56		19:16 (10)	06:51		07:46	17:23 (11)	07:46		08:30
	21:38		20:43	26	20:15 (5)	19:29		18:15	25 17:48 (11)	16:14		15:53
19	05:06		05:58		19:09 (10)	06:53		07:48	17:24 (11)	07:48		08:31
	21:37		20:41	37	20:13 (5)	19:26		18:13	21 17:45 (11)	16:13		15:53
20	05:07		05:59		19:06 (10)	06:55		07:50	17:25 (11)	07:50		08:31
	21:36		20:38	39	20:11 (5)	19:24		18:11	18 17:43 (11)	16:12		15:54
21	05:09		06:01		19:04 (10)	06:57		07:52	17:27 (11)	07:52		08:32
	21:35		20:36	40	20:09 (5)	19:21		18:09	14 17:41 (11)	16:10		15:54
22	05:10		06:03		19:02 (10)	06:58		07:54	17:29 (11)	07:54		08:33
	21:33		20:34	40	20:06 (5)	19:19		18:06	9 17:38 (11)	16:09		15:54
23	05:12		06:05		19:00 (10)	07:00		07:56	17:33 (11)	07:55		08:33
	21:32		20:32	38	20:04 (5)	19:16		18:04	3 17:36 (11)	16:08		15:55
24	05:13		06:06		18:59 (10)	07:02		07:58	16:58 (12)	07:57		08:34
	21:30		20:29	35	20:02 (7)	19:14		18:02	10 17:08 (12)	16:06		15:55
25	05:15		06:08		18:57 (10)	07:04		08:00	16:56 (12)	07:59		08:34
	21:29		20:27	33	19:30 (10)	19:11		18:00	14 17:10 (12)	16:05		15:56
26	05:16		06:10		18:57 (10)	07:05		08:02	16:54 (12)	08:01		08:34
	21:27		20:25	34	19:31 (10)	19:09		17:57	18 17:12 (12)	16:04		15:57
27	05:18		06:12		18:56 (10)	07:07		07:03	15:53 (12)	08:02		08:35
	21:26		20:22	35	19:31 (10)	19:06		16:55	20 16:13 (12)	16:03		15:57
28	05:19		06:14		18:55 (10)	07:09		07:05	15:52 (12)	08:04		08:35
	21:24		20:20	37	19:32 (10)	19:04		16:53	21 16:13 (12)	16:02		15:58
29	05:21		06:15		18:54 (10)	07:11		07:07	15:52 (12)	08:06		08:35
	21:22		20:18	37	19:31 (10)	19:01		16:51	23 16:15 (12)	16:01		15:59
30	05:23		06:17		18:54 (10)	07:13		07:09	15:52 (12)	08:07		08:35
	21:21		20:15	38	19:32 (10)	18:59		16:49	23 16:15 (12)	16:00		16:00
31	05:24		06:19		18:54 (10)			07:11	15:51 (12)			08:35
	21:19		20:13	38	19:32 (10)			16:47	24 16:15 (12)			16:01
Sonneneinstrahlung		514	462			384		330		259		232
astr.max.mögl.Beschattung		294		896		407		652		124		

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: M - IO 13

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	
1	08:35	08:06	07:08	16:54 (12)	06:53	18:35 (11)	05:43
	16:02	16:53	17:50	28	17:22 (12)	19:49	39
2	08:35	08:04	07:06	16:54 (12)	06:50	18:35 (11)	05:41
	16:03	16:55	17:52	29	17:23 (12)	19:51	39
3	08:35	08:02	07:04	16:54 (12)	06:48	18:34 (11)	05:39
	16:05	16:57	17:54	28	17:22 (12)	19:52	40
4	08:35	08:01	07:01	16:54 (12)	06:45	18:35 (11)	05:37
	16:06	16:59	17:56	28	17:22 (12)	19:54	39
5	08:34	07:59	06:59	16:53 (12)	06:43	18:35 (11)	05:34
	16:07	17:01	17:57	28	17:21 (12)	19:56	39
6	08:34	07:57	06:56	16:54 (12)	06:40	18:34 (11)	05:32
	16:08	17:03	17:59	27	17:21 (12)	19:58	38
7	08:34	07:55	06:54	16:54 (12)	06:38	18:35 (11)	05:30
	16:10	17:05	18:01	26	17:20 (12)	20:00	37
8	08:33	07:53	06:52	16:55 (12)	06:36	18:35 (11)	05:29
	16:11	17:07	18:03	24	17:19 (12)	20:02	36
9	08:33	07:51	06:49	16:55 (12)	06:33	18:36 (11)	05:27
	16:12	17:09	18:05	22	17:17 (12)	20:04	34
10	08:32	07:49	06:47	16:57 (12)	06:31	18:37 (11)	05:25
	16:14	17:11	18:07	19	17:16 (12)	20:06	32
11	08:31	07:47	06:44	17:00 (12)	06:28	18:37 (11)	05:23
	16:15	17:14	18:09	14	17:14 (12)	20:07	30
12	08:31	07:45	06:42	17:03 (12)	06:26	18:38 (11)	05:21
	16:17	17:16	18:11	6	17:09 (12)	20:09	28
13	08:30	07:43	06:40	18:13	20:11	18:40 (11)	05:19
	16:18	17:18	18:13	24	19:04 (11)	21:06	24
14	08:29	07:41	06:37	18:15	20:13	18:41 (11)	05:17
	16:20	17:20	18:15	20	19:01 (11)	21:08	20
15	08:28	07:39	06:35	18:17	20:15	18:44 (11)	05:16
	16:22	17:22	18:17	15	18:59 (11)	21:10	15
16	08:27	07:37	06:32	18:19	20:17	20:36 (10)	05:14
	16:23	17:24	18:19	20:19	21:11	20:25 (10)	05:12
17	08:26	07:35	06:30	18:21	20:21	20:39 (10)	05:10
	16:25	17:26	18:21	20:23	21:13	20:43 (10)	05:08
18	08:25	07:33	06:27	18:22	20:25	20:47 (10)	05:06
	16:27	17:28	18:22	20:27	21:15	20:51 (10)	05:04
19	08:24	07:31	06:25	18:24	20:29	20:55 (10)	05:02
	16:29	17:30	18:24	20:31	21:16	20:59 (10)	05:00
20	08:23	07:29	06:22	18:26	20:33	21:03 (10)	04:58
	16:30	17:32	18:26	20:35	21:18	21:07 (10)	04:56
21	08:22	07:26	06:20	18:28	20:37	21:12 (10)	04:54
	16:32	17:34	18:28	20:39	21:20	21:16 (10)	04:52
22	08:21	07:24	17:05 (12)	18:30	20:41	21:20 (10)	04:50
	16:34	17:36	17:01 (12)	18:32	20:43	21:22 (10)	04:48
23	08:19	07:22	17:11 (12)	18:34	20:45	21:24 (10)	04:46
	16:36	17:38	17:13 (12)	18:36	20:47	21:26 (10)	04:44
24	08:18	07:20	17:15 (12)	18:38	20:49	21:28 (10)	04:42
	16:38	17:40	17:17 (12)	18:40	20:51	21:30 (10)	04:40
25	08:17	07:17	17:19 (12)	18:42	20:53	21:32 (10)	04:38
	16:40	17:42	17:21 (12)	18:44	20:55	21:34 (10)	04:36
26	08:15	07:15	17:23 (12)	18:46	20:57	21:36 (10)	04:34
	16:42	17:44	17:25 (12)	18:48	20:59	21:38 (10)	04:32
27	08:14	07:13	17:27 (12)	18:50	21:01	21:40 (10)	04:30
	16:43	17:46	17:29 (12)	18:52	21:03	21:42 (10)	04:28
28	08:12	07:11	17:31 (12)	18:54	21:05	21:44 (10)	04:26
	16:45	17:48	17:33 (12)	18:56	21:07	21:46 (10)	04:24
29	08:11		17:35 (12)	18:58	21:09	21:48 (10)	04:22
	16:47		17:37 (12)	19:00	21:11	21:50 (10)	04:20
30	08:09		17:39 (12)	19:02	21:13	21:52 (10)	04:18
	16:49		17:41 (12)	19:04	21:15	21:54 (10)	04:16
31	08:07		17:43 (12)	19:06	21:17	21:56 (10)	04:14
	16:51		17:45 (12)	19:08	21:19	21:58 (10)	04:12
Sonnenscheinstunden	248	271	365	419	494	511	1738
astr.max.mögl.Beschattung		119	568	635	737		

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kisdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: M - IO 13

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember			
1	04:47		20:18 (10)	05:26		06:21	18:38 (11)	07:15		07:13	08:09			
	21:52	60	21:18 (7)	21:17		20:10	26	19:04 (11)	18:56		16:45	15:59		
2	04:47		20:19 (10)	05:28		06:23		18:36 (11)	07:16		07:15	08:11		
	21:51	59	21:18 (7)	21:15		20:08	30	19:06 (11)	18:54		16:43	15:58		
3	04:48		20:19 (10)	05:29		06:24		18:35 (11)	07:18	17:41 (12)	07:17	08:12		
	21:51	59	21:18 (7)	21:14		20:06	32	19:07 (11)	18:51	8	17:49 (12)	16:41	15:57	
4	04:49		20:19 (10)	05:31	20:06 (9)	06:26		18:33 (11)	07:20		17:37 (12)	07:19	08:14	
	21:51	57	21:16 (7)	21:12	10	20:16 (9)	34	19:07 (11)	18:49	15	17:52 (12)	16:39	15:57	
5	04:50		20:19 (10)	05:33		20:03 (9)	06:28		18:32 (11)	07:22		17:34 (12)	07:21	08:15
	21:50	57	21:16 (7)	21:10	14	20:17 (9)	35	19:07 (11)	18:46	19	17:53 (12)	16:37	15:56	
6	04:51		20:20 (10)	05:35		20:02 (9)	06:30		18:31 (11)	07:24		17:32 (12)	07:23	08:16
	21:49	56	21:16 (7)	21:08	17	20:19 (9)	37	19:08 (11)	18:44	22	17:54 (12)	16:35	15:56	
7	04:51		20:20 (10)	05:36		20:01 (9)	06:32		18:31 (11)	07:26		17:31 (12)	07:25	08:18
	21:49	56	21:16 (7)	21:06	19	20:20 (9)	37	19:08 (11)	18:42	24	17:55 (12)	16:33	15:55	
8	04:52		20:20 (10)	05:38		20:00 (9)	06:33		18:29 (11)	07:27		17:30 (12)	07:27	08:19
	21:48	55	21:15 (7)	21:04	20	20:20 (9)	39	19:08 (11)	18:39	26	17:56 (12)	16:31	15:55	
9	04:53		20:21 (10)	05:40		19:59 (9)	06:35		18:29 (11)	07:29		17:29 (12)	07:29	08:20
	21:47	53	21:14 (7)	21:02	22	20:21 (9)	39	19:08 (11)	18:37	27	17:56 (12)	16:29	15:54	
10	04:55		20:21 (10)	05:42		19:58 (9)	06:37		18:29 (11)	07:31		17:28 (12)	07:31	08:22
	21:47	53	21:14 (7)	21:00	23	20:21 (9)	39	19:08 (11)	18:34	28	17:56 (12)	16:28	15:54	
11	04:56		20:21 (10)	05:43		19:58 (9)	06:39		18:27 (11)	07:33		17:28 (12)	07:33	08:23
	21:46	52	21:13 (7)	20:58	24	20:22 (9)	40	19:07 (11)	18:32	28	17:56 (12)	16:26	15:53	
12	04:57		20:21 (10)	05:45		19:58 (9)	06:40		18:27 (11)	07:35		17:28 (12)	07:35	08:24
	21:45	51	21:12 (7)	20:56	24	20:22 (9)	39	19:06 (11)	18:30	28	17:56 (12)	16:24	15:53	
13	04:58		20:22 (10)	05:47		19:57 (9)	06:42		18:28 (11)	07:37		17:28 (12)	07:37	08:25
	21:44	49	21:11 (7)	20:54	24	20:21 (9)	38	19:06 (11)	18:27	28	17:56 (12)	16:22	15:53	
14	04:59		20:22 (10)	05:49		19:57 (9)	06:44		18:28 (11)	07:39		17:28 (12)	07:39	08:26
	21:43	48	21:10 (7)	20:52	25	20:22 (9)	38	19:06 (11)	18:25	28	17:56 (12)	16:21	15:53	
15	05:00		20:22 (10)	05:50		19:57 (9)	06:46		18:27 (11)	07:40		17:28 (12)	07:41	08:27
	21:42	47	21:09 (7)	20:49	25	20:22 (9)	37	19:04 (11)	18:22	27	17:55 (12)	16:19	15:53	
16	05:02		20:23 (10)	05:52		19:56 (9)	06:48		18:28 (11)	07:42		17:28 (12)	07:42	08:28
	21:41	46	21:09 (7)	20:47	23	20:19 (9)	35	19:03 (11)	18:20	25	17:53 (12)	16:18	15:53	
17	05:03		20:23 (10)	05:54		19:57 (9)	06:49		18:28 (11)	07:44		17:29 (12)	07:44	08:29
	21:40	43	21:08 (7)	20:45	20	20:17 (9)	34	19:02 (11)	18:18	21	17:50 (12)	16:16	15:53	
18	05:04		20:24 (10)	05:56		19:58 (9)	06:51		18:29 (11)	07:46		17:30 (12)	07:46	08:30
	21:38	37	21:01 (10)	20:43	17	20:15 (9)	32	19:01 (11)	18:15	18	17:48 (12)	16:14	15:53	
19	05:06		20:24 (10)	05:58		19:58 (9)	06:53		18:29 (11)	07:48		17:31 (12)	07:48	08:31
	21:37	36	21:00 (10)	20:41	15	20:13 (9)	30	18:59 (11)	18:13	14	17:45 (12)	16:13	15:53	
20	05:07		20:25 (10)	05:59		19:59 (9)	06:55		18:31 (11)	07:50		17:32 (12)	07:50	08:31
	21:36	35	21:00 (10)	20:38	12	20:11 (9)	26	18:57 (11)	18:11	11	17:43 (12)	16:12	15:54	
21	05:09		20:25 (10)	06:01		20:00 (9)	06:57		18:33 (11)	07:52		17:35 (12)	07:52	08:32
	21:35	34	20:59 (10)	20:36	9	20:09 (9)	22	18:55 (11)	18:09	6	17:41 (12)	16:10	15:54	
22	05:10		20:26 (10)	06:03		20:01 (9)	06:58		18:35 (11)	07:54		07:54	08:33	
	21:33	32	20:58 (10)	20:34	5	20:06 (9)	17	18:52 (11)	18:06		16:09	15:54		
23	05:12		20:27 (10)	06:05		07:00		18:38 (11)	07:56		07:55	08:33		
	21:32	31	20:58 (10)	20:32		19:16	9	18:47 (11)	18:04		16:08	15:55		
24	05:13		20:28 (10)	06:07		07:02			07:58		07:57	08:34		
	21:30	29	20:57 (10)	20:29		19:14			18:02		16:06	15:55		
25	05:15		20:29 (10)	06:08		07:04			08:00		07:59	08:34		
	21:29	28	20:57 (10)	20:27		19:11			18:00		16:05	15:56		
26	05:16		20:30 (10)	06:10		07:06			08:02		08:01	08:34		
	21:27	25	20:55 (10)	20:25		19:09			17:57		16:04	15:57		
27	05:18		20:31 (10)	06:12		07:07			07:03		08:02	08:35		
	21:26	22	20:53 (10)	20:22		19:06			16:55		16:03	15:57		
28	05:20		20:33 (10)	06:14		07:09			07:05		08:04	08:35		
	21:24	19	20:52 (10)	20:20		19:04			16:53		16:02	15:58		
29	05:21		20:35 (10)	06:15	18:47 (11)	07:11			07:07		08:06	08:35		
	21:22	14	20:49 (10)	20:18	11	18:58 (11)	07:13		16:51		16:01	15:59		
30	05:23		20:39 (10)	06:17		18:43 (11)	07:13		07:09		08:07	08:35		
	21:21	7	20:46 (10)	20:15	18	19:01 (11)	18:59		16:49		16:00	16:00		
31	05:24			06:19		18:41 (11)			07:11			08:35		
	21:19			20:13	22	19:03 (11)			16:47			16:01		
Sonnenscheinstunden		514		462			384		330		259	232		
astr.max.mögl.Beschattung		1250		399			745		403					

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N - IO 14

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender 2019
Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
Die Sonne scheint täglich von Sonnenauf- bis -untergang
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 16:02	08:06 16:53	07:08 17:50	16:32 (12) 17:09 (12)	06:53 19:49	18:31 (11) 19:15 (11)
2	08:35 16:03	08:04 16:55	07:06 17:52	16:32 (12) 17:09 (12)	06:50 19:51	18:30 (11) 19:16 (11)
3	08:35 16:05	08:02 16:57	07:04 17:54	16:32 (12) 17:08 (12)	06:48 19:52	18:28 (11) 19:16 (11)
4	08:35 16:06	08:01 16:59	07:01 17:56	16:32 (12) 17:08 (12)	06:45 19:54	18:27 (11) 19:17 (11)
5	08:34 16:07	07:59 17:01	06:59 17:57	16:32 (12) 17:06 (12)	06:43 19:56	18:27 (11) 19:18 (11)
6	08:34 16:08	07:57 17:03	06:57 17:59	16:33 (12) 17:06 (12)	06:41 19:58	18:25 (11) 19:18 (11)
7	08:34 16:10	07:55 17:05	06:54 18:01	16:33 (12) 17:04 (12)	06:38 20:00	18:24 (11) 19:19 (11)
8	08:33 16:11	07:53 17:07	06:52 18:03	16:35 (12) 17:03 (12)	06:36 20:02	18:23 (11) 19:19 (11)
9	08:33 16:12	07:51 17:09	06:49 18:05	16:36 (12) 17:01 (12)	06:33 20:04	18:23 (11) 19:19 (11)
10	08:32 16:14	07:49 17:12	06:47 18:07	16:38 (12) 16:59 (12)	06:31 20:06	18:22 (11) 19:20 (11)
11	08:31 16:15	07:47 17:14	06:44 18:09	16:41 (12) 16:57 (12)	06:28 20:07	18:21 (11) 19:19 (11)
12	08:31 16:17	07:45 17:16	06:42 18:11	16:45 (12) 16:51 (12)	06:26 20:09	18:21 (11) 19:19 (11)
13	08:30 16:18	07:43 17:18	06:40 18:13	06:24 20:11	06:24 20:11	18:21 (11) 19:20 (11)
14	08:29 16:20	07:41 17:20	06:37 18:15	06:21 20:13	06:21 20:13	18:20 (11) 19:19 (11)
15	08:28 16:22	07:39 17:22	06:35 18:17	06:19 20:15	06:19 20:15	18:20 (11) 19:19 (11)
16	08:27 16:23	07:37 17:24	06:32 18:19	06:16 20:17	06:16 20:17	18:21 (11) 19:19 (11)
17	08:26 16:25	07:35 17:26	06:30 18:21	06:14 20:19	06:14 20:19	18:20 (11) 19:17 (11)
18	08:25 16:27	07:33 17:28	06:27 18:22	06:12 20:21	06:12 20:21	18:20 (11) 19:17 (11)
19	08:24 16:29	07:31 17:30	06:25 18:24	06:09 20:22	06:09 20:22	18:21 (11) 19:17 (11)
20	08:23 16:30	07:29 17:32	06:22 18:26	06:07 20:24	06:07 20:24	18:21 (11) 19:16 (11)
21	08:22 16:32	07:26 17:34	06:20 18:28	06:05 20:26	06:05 20:26	18:21 (11) 19:15 (11)
22	08:21 16:34	07:24 17:36	06:17 18:30	06:03 20:28	06:03 20:28	18:21 (11) 19:14 (11)
23	08:19 16:36	07:22 17:38	06:15 18:32	06:00 20:30	06:00 20:30	18:22 (11) 19:14 (11)
24	08:18 16:38	07:20 17:40	06:13 18:34	05:58 20:32	05:58 20:32	18:23 (11) 19:13 (11)
25	08:17 16:40	07:17 17:42	06:10 18:36	05:56 20:34	05:56 20:34	18:24 (11) 19:12 (11)
26	08:15 16:42	07:15 17:44	06:08 18:38	05:54 20:35	05:54 20:35	18:25 (11) 19:11 (11)
27	08:14 16:44	07:13 17:46	06:05 18:39	05:51 20:37	05:51 20:37	18:26 (11) 19:10 (11)
28	08:12 16:45	07:11 17:48	06:03 18:41	05:49 20:39	05:49 20:39	18:27 (11) 19:09 (11)
29	08:11 16:47		06:00 18:43	05:47 20:41	05:47 20:41	18:27 (11) 19:07 (11)
30	08:09 16:49		05:58 18:45	05:45 20:43	05:45 20:43	18:28 (11) 19:05 (11)
31	08:07 16:51		05:55 19:47	05:42 19:14 (11)	05:42 19:14 (11)	18:28 (11) 19:05 (11)
Sonnenscheinstunden	248	271	365	419	494	511
astr.max.mögl.Beschattung		379	503	1559	843	325

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)
	Minuten mit Schatten		

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N - IO 14

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember			
1	04:47	21:08 (5)	05:26		20:13 (9)	06:21	18:20 (11)	07:15		07:13	08:09			
	21:52	10	21:18 (5)	21:17	31	20:44 (9)	20:11	58	19:18 (11)	18:56	16:45	15:59		
2	04:47		21:08 (5)	05:28		20:14 (9)	06:23		18:20 (11)	07:16		07:15	08:11	
	21:51	10	21:18 (5)	21:15	30	20:44 (9)	20:08	58	19:18 (11)	18:54		16:43	15:58	
3	04:48		21:09 (5)	05:29		20:14 (9)	06:24		18:20 (11)	07:18	17:23 (12)	07:17	08:12	
	21:51	9	21:18 (5)	21:14	29	20:43 (9)	20:06	58	19:18 (11)	18:51	8	17:31 (12)	16:41	15:57
4	04:49		21:09 (5)	05:31		20:15 (9)	06:26		18:20 (11)	07:20		17:19 (12)	07:19	08:14
	21:51	7	21:16 (5)	21:12	27	20:42 (9)	20:03	56	19:16 (11)	18:49	16	17:35 (12)	16:39	15:57
5	04:50		21:10 (5)	05:33		20:14 (9)	06:28		18:20 (11)	07:22		17:15 (12)	07:21	08:15
	21:50	6	21:16 (5)	21:10	26	20:40 (9)	20:01	56	19:16 (11)	18:46	21	17:36 (12)	16:37	15:56
6	04:51		21:11 (5)	05:35		20:15 (9)	06:30		18:20 (11)	07:24		17:13 (12)	07:23	08:17
	21:50	5	21:16 (5)	21:08	24	20:39 (9)	19:58	55	19:15 (11)	18:44	25	17:38 (12)	16:35	15:56
7	04:51		21:12 (5)	05:36		20:17 (9)	06:32		18:21 (11)	07:26		17:11 (12)	07:25	08:18
	21:49	4	21:16 (5)	21:06	20	20:37 (9)	19:56	54	19:15 (11)	18:42	28	17:39 (12)	16:33	15:55
8	04:52		21:13 (5)	05:38		20:17 (9)	06:33		18:20 (11)	07:27		17:09 (12)	07:27	08:19
	21:48	2	21:15 (5)	21:04	18	20:35 (9)	19:53	53	19:13 (11)	18:39	31	17:40 (12)	16:31	15:55
9	04:54		20:24 (9)	05:40		18:52 (11)	06:35		18:21 (11)	07:29		17:08 (12)	07:29	08:21
	21:47	7	20:31 (9)	21:02	24	20:33 (9)	19:51	51	19:12 (11)	18:37	33	17:41 (12)	16:29	15:54
10	04:55		20:22 (9)	05:42		18:47 (11)	06:37		18:22 (11)	07:31		17:07 (12)	07:31	08:22
	21:47	11	20:33 (9)	21:00	30	20:31 (9)	19:49	49	19:11 (11)	18:34	34	17:41 (12)	16:28	15:54
11	04:56		20:21 (9)	05:43		18:44 (11)	06:39		18:22 (11)	07:33		17:06 (12)	07:33	08:23
	21:46	13	20:34 (9)	20:58	31	20:29 (9)	19:46	47	19:09 (11)	18:32	36	17:42 (12)	16:26	15:53
12	04:57		20:20 (9)	05:45		18:42 (11)	06:40		18:23 (11)	07:35		17:06 (12)	07:35	08:24
	21:45	15	20:35 (9)	20:56	29	19:11 (11)	19:44	45	19:08 (11)	18:30	36	17:42 (12)	16:24	15:53
13	04:58		20:19 (9)	05:47		18:39 (11)	06:42		18:24 (11)	07:37		17:05 (12)	07:37	08:25
	21:44	17	20:36 (9)	20:54	33	19:12 (11)	19:41	42	19:06 (11)	18:27	37	17:42 (12)	16:22	15:53
14	04:59		20:18 (9)	05:49		18:37 (11)	06:44		18:26 (11)	07:39		17:05 (12)	07:39	08:26
	21:43	19	20:37 (9)	20:52	36	19:13 (11)	19:39	38	19:04 (11)	18:25	37	17:42 (12)	16:21	15:53
15	05:01		20:17 (9)	05:50		18:36 (11)	06:46		18:26 (11)	07:40		17:05 (12)	07:41	08:27
	21:42	21	20:38 (9)	20:49	39	19:15 (11)	19:36	35	19:01 (11)	18:22	37	17:42 (12)	16:19	15:53
16	05:02		20:18 (9)	05:52		18:33 (11)	06:48		18:29 (11)	07:42		17:04 (12)	07:42	08:28
	21:41	21	20:39 (9)	20:47	42	19:15 (11)	19:34	30	18:59 (11)	18:20	38	17:42 (12)	16:18	15:53
17	05:03		20:17 (9)	05:54		18:32 (11)	06:49		18:31 (11)	07:44		17:04 (12)	07:44	08:29
	21:40	23	20:40 (9)	20:45	44	19:16 (11)	19:31	25	18:56 (11)	18:18	37	17:41 (12)	16:16	15:53
18	05:04		20:16 (9)	05:56		18:31 (11)	06:51		18:35 (11)	07:46		17:05 (12)	07:46	08:30
	21:38	24	20:40 (9)	20:43	47	19:18 (11)	19:29	17	18:52 (11)	18:15	36	17:41 (12)	16:14	15:53
19	05:06		20:15 (9)	05:58		18:29 (11)	06:53			07:48		17:05 (12)	07:48	08:31
	21:37	26	20:41 (9)	20:41	49	19:18 (11)	19:26			18:13	35	17:40 (12)	16:13	15:53
20	05:07		20:16 (9)	05:59		18:29 (11)	06:55			07:50		17:05 (12)	07:50	08:31
	21:36	26	20:42 (9)	20:38	49	19:18 (11)	19:24			18:11	34	17:39 (12)	16:12	15:54
21	05:09		20:15 (9)	06:01		18:28 (11)	06:57			07:52		17:06 (12)	07:52	08:32
	21:35	27	20:42 (9)	20:36	51	19:19 (11)	19:21			18:09	32	17:38 (12)	16:10	15:54
22	05:10		20:14 (9)	06:03		18:26 (11)	06:58			07:54		17:06 (12)	07:54	08:33
	21:33	28	20:42 (9)	20:34	53	19:19 (11)	19:19			18:06	31	17:37 (12)	16:09	15:54
23	05:12		20:14 (9)	06:05		18:26 (11)	07:00			07:56		17:07 (12)	07:55	08:33
	21:32	29	20:43 (9)	20:32	53	19:19 (11)	19:16			18:04	29	17:36 (12)	16:08	15:55
24	05:13		20:14 (9)	06:07		18:25 (11)	07:02			07:58		17:08 (12)	07:57	08:34
	21:30	29	20:43 (9)	20:29	55	19:20 (11)	19:14			18:02	25	17:33 (12)	16:06	15:56
25	05:15		20:14 (9)	06:08		18:24 (11)	07:04			08:00		17:10 (12)	07:59	08:34
	21:29	30	20:44 (9)	20:27	55	19:19 (11)	19:11			18:00	21	17:31 (12)	16:05	15:56
26	05:16		20:13 (9)	06:10		18:23 (11)	07:06			08:02		17:12 (12)	08:01	08:34
	21:27	31	20:44 (9)	20:25	57	19:20 (11)	19:09			17:57	17	17:29 (12)	16:04	15:57
27	05:18		20:14 (9)	06:12		18:23 (11)	07:07			07:03		16:15 (12)	08:02	08:35
	21:26	30	20:44 (9)	20:22	57	19:20 (11)	19:06			16:55	11	16:26 (12)	16:03	15:58
28	05:20		20:13 (9)	06:14		18:22 (11)	07:09			07:05			08:04	08:35
	21:24	31	20:44 (9)	20:20	58	19:20 (11)	19:04			16:53			16:02	15:58
29	05:21		20:13 (9)	06:15		18:21 (11)	07:11			07:07			08:06	08:35
	21:22	31	20:44 (9)	20:18	58	19:19 (11)	19:01			16:51			16:01	15:59
30	05:23		20:13 (9)	06:17		18:21 (11)	07:13			07:09			08:07	08:35
	21:21	31	20:44 (9)	20:15	58	19:19 (11)	18:59			16:49			16:00	16:00
31	05:24		20:14 (9)	06:19		18:21 (11)				07:11				08:35
	21:19	30	20:44 (9)	20:13	58	19:19 (11)				16:47				16:01
Sonnenscheinstunden	514			462			384		330		725		259	232
astr.max.mögl.Beschattung	603			1271			827							

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: O - IO 15

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März		April		Mai		Juni				
1	08:35 16:02	08:06 16:53	07:08 17:50		06:53 19:49	24	18:23 (12) 18:47 (12)	05:43 20:45	32	19:41 (11) 20:13 (11)	04:52 21:36	73	21:03 (9) 19:35 (11)
2	08:35 16:03	08:04 16:55	07:06 17:52		06:50 19:51	20	18:25 (12) 18:45 (12)	05:41 20:47	34	19:41 (11) 20:15 (11)	04:51 21:37	74	21:04 (9) 19:36 (11)
3	08:35 16:05	08:02 16:57	07:04 17:54		06:48 19:52	14	18:27 (12) 18:41 (12)	05:39 20:48	37	19:39 (11) 20:16 (11)	04:50 21:38	72	21:04 (9) 19:37 (11)
4	08:35 16:06	08:01 16:59	07:01 17:56		06:45 19:54			05:37 20:50	39	19:38 (11) 20:17 (11)	04:49 21:39	72	21:05 (9) 19:37 (11)
5	08:34 16:07	07:59 17:01	06:59 17:57		06:43 19:56			05:35 20:52	41	19:37 (11) 20:18 (11)	04:48 21:40	71	21:05 (9) 19:37 (11)
6	08:34 16:08	07:57 17:03	06:57 17:59		06:41 19:58			05:33 20:54	43	19:36 (11) 20:19 (11)	04:48 21:42	72	21:05 (9) 19:38 (11)
7	08:34 16:10	07:55 17:05	06:54 18:01		06:38 20:00			05:31 20:56	44	19:35 (11) 20:19 (11)	04:47 21:43	72	21:06 (9) 19:38 (11)
8	08:33 16:11	07:53 17:07	06:52 18:03		06:36 20:02			05:29 20:57	46	19:34 (11) 20:20 (11)	04:46 21:44	70	21:05 (9) 19:39 (11)
9	08:33 16:12	07:51 17:09	06:49 18:05		06:33 20:04			05:27 20:59	47	19:34 (11) 20:21 (11)	04:46 21:45	70	21:06 (9) 19:39 (11)
10	08:32 16:14	07:49 17:12	06:47 18:07		06:31 20:06			05:25 21:01	48	19:33 (11) 20:21 (11)	04:45 21:45	69	21:05 (9) 19:40 (11)
11	08:31 16:15	07:47 17:14	06:44 18:09		06:28 20:07			05:23 21:03	48	19:33 (11) 20:21 (11)	04:44 21:46	68	21:06 (9) 19:41 (11)
12	08:31 16:17	07:45 17:16	06:42 18:11	11	17:35 (12) 17:46 (12)			05:21 21:05	49	19:32 (11) 20:21 (11)	04:44 21:47	68	21:07 (9) 19:40 (11)
13	08:30 16:18	07:43 17:18	06:40 18:13	17	17:32 (12) 17:49 (12)			05:19 21:06	50	19:32 (11) 20:22 (11)	04:44 21:48	68	21:06 (9) 19:41 (11)
14	08:29 16:20	07:41 17:20	06:37 18:15	21	17:29 (12) 17:50 (12)			05:17 21:08	50	19:32 (11) 20:22 (11)	04:43 21:49	67	21:06 (9) 19:41 (11)
15	08:28 16:22	07:39 17:22	06:35 18:17	25	17:27 (12) 17:52 (12)			05:16 21:10	51	19:32 (11) 20:23 (11)	04:43 21:49	67	21:07 (9) 19:42 (11)
16	08:27 16:23	07:37 17:24	06:32 18:19	29	17:25 (12) 17:54 (12)			05:14 21:11	51	19:31 (11) 20:22 (11)	04:43 21:50	66	21:07 (9) 19:42 (11)
17	08:26 16:25	07:35 17:26	06:30 18:21	31	17:24 (12) 17:55 (12)			05:12 21:13	51	19:32 (11) 20:23 (11)	04:43 21:50	66	21:07 (9) 19:43 (11)
18	08:25 16:27	07:33 17:28	06:27 18:22	33	17:22 (12) 17:55 (12)			05:11 21:15	51	19:31 (11) 20:22 (11)	04:43 21:51	65	21:07 (9) 19:43 (11)
19	08:24 16:29	07:31 17:30	06:25 18:24	34	17:22 (12) 17:56 (12)			05:09 21:16	51	19:32 (11) 20:23 (11)	04:43 21:51	66	21:08 (9) 19:43 (11)
20	08:23 16:30	07:29 17:32	06:22 18:26	35	17:21 (12) 17:56 (12)			05:07 21:18	54	19:31 (11) 20:47 (9)	04:43 21:52	66	21:08 (9) 19:43 (11)
21	08:22 16:32	07:26 17:34	06:20 18:28	37	17:20 (12) 17:57 (12)			05:06 21:20	58	19:32 (11) 20:49 (9)	04:43 21:52	66	21:08 (9) 19:43 (11)
22	08:21 16:34	07:24 17:36	06:17 18:30	37	17:19 (12) 17:56 (12)			05:04 21:21	61	19:32 (11) 20:51 (9)	04:43 21:52	66	21:08 (9) 19:44 (11)
23	08:19 16:36	07:22 17:38	06:15 18:32	37	17:19 (12) 17:56 (12)			05:03 21:23	61	19:32 (11) 20:51 (9)	04:43 21:52	66	21:09 (9) 19:44 (11)
24	08:18 16:38	07:20 17:40	06:13 18:34	37	17:19 (12) 17:56 (12)			05:02 21:24	64	19:32 (11) 20:53 (9)	04:43 21:52	66	21:09 (9) 19:44 (11)
25	08:17 16:40	07:17 17:42	06:10 18:36	37	17:19 (12) 17:56 (12)			05:00 21:26	64	19:33 (11) 20:54 (9)	04:44 21:53	66	21:09 (9) 19:45 (11)
26	08:15 16:42	07:15 17:44	06:08 18:38	35	17:19 (12) 17:54 (12)			04:59 21:27	67	19:33 (11) 20:56 (9)	04:44 21:53	65	21:09 (9) 19:44 (11)
27	08:14 16:44	07:13 17:46	06:05 18:39	35	17:19 (12) 17:54 (12)		19:55 (11) 20:03 (11)	04:58 21:29	69	19:33 (11) 20:57 (9)	04:44 21:53	66	21:09 (9) 19:44 (11)
28	08:12 16:45	07:11 17:48	06:03 18:41	34	17:19 (12) 17:53 (12)		19:50 (11) 20:08 (11)	04:56 21:30	70	19:34 (11) 20:59 (9)	04:45 21:52	66	21:09 (9) 19:44 (11)
29	08:11 16:47		06:00 18:43	32	17:20 (12) 17:52 (12)		19:46 (11) 20:09 (11)	04:55 21:32	70	19:34 (11) 21:00 (9)	04:45 21:52	67	21:10 (9) 19:45 (11)
30	08:09 16:49		05:58 18:45	30	17:20 (12) 17:50 (12)		19:43 (11) 20:11 (11)	04:54 21:33	70	19:35 (11) 21:01 (9)	04:46 21:52	67	21:10 (9) 19:45 (11)
31	08:07 16:51		06:55 19:47	27	18:22 (12) 18:49 (12)			04:53 21:34	71	19:35 (11) 21:02 (9)			
Sonnenscheinstunden	248	271	365		419			494		511			
astr.max.mögl.Beschattung			614		135			1642		2043			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
	Minuten mit Schatten	

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: O - IO 15

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember	
1	04:47		19:44 (11)	05:26	19:42 (11)	06:21		07:15	18:09 (12)	07:13	08:09	
	21:52	68	21:10 (9)	21:17	50	20:32 (11)	20:10	18:56	20	18:29 (12)	16:45	15:59
2	04:47		19:45 (11)	05:28		19:43 (11)	06:23	07:16		18:11 (12)	07:15	08:11
	21:51	67	21:10 (9)	21:15	49	20:32 (11)	20:08	18:54	16	18:27 (12)	16:43	15:58
3	04:48		19:45 (11)	05:29		19:43 (11)	06:24	07:18		18:15 (12)	07:17	08:12
	21:51	68	21:11 (9)	21:14	48	20:31 (11)	20:06	18:51	9	18:24 (12)	16:41	15:58
4	04:49		19:44 (11)	05:31		19:43 (11)	06:26	07:20			07:19	08:14
	21:51	69	21:10 (9)	21:12	48	20:31 (11)	20:03	18:49			16:39	15:57
5	04:50		19:44 (11)	05:33		19:43 (11)	06:28	07:22			07:21	08:15
	21:50	70	21:11 (9)	21:10	47	20:30 (11)	20:01	18:46			16:37	15:56
6	04:51		19:44 (11)	05:35		19:44 (11)	06:30	07:24			07:23	08:16
	21:49	70	21:11 (9)	21:08	46	20:30 (11)	19:58	18:44			16:35	15:56
7	04:52		19:44 (11)	05:36		19:45 (11)	06:32	07:26			07:25	08:18
	21:49	70	21:11 (9)	21:06	44	20:29 (11)	19:56	18:42			16:33	15:55
8	04:52		19:44 (11)	05:38		19:45 (11)	06:33	07:27			07:27	08:19
	21:48	72	21:12 (9)	21:04	43	20:28 (11)	19:53	18:39			16:31	15:55
9	04:54		19:44 (11)	05:40		19:46 (11)	06:35	07:29			07:29	08:20
	21:47	71	21:12 (9)	21:02	42	20:28 (11)	19:51	18:37			16:29	15:54
10	04:55		19:44 (11)	05:42		19:46 (11)	06:37	18:24 (12)	07:31		07:31	08:22
	21:47	72	21:12 (9)	21:00	40	20:26 (11)	19:49	9	18:33 (12)	18:34	16:28	15:54
11	04:56		19:44 (11)	05:43		19:47 (11)	06:39	18:19 (12)	07:33		07:33	08:23
	21:46	72	21:12 (9)	20:58	38	20:25 (11)	19:46	17	18:36 (12)	18:32	16:26	15:53
12	04:57		19:43 (11)	05:45		19:49 (11)	06:40	18:16 (12)	07:35		07:35	08:24
	21:45	74	21:12 (9)	20:56	35	20:24 (11)	19:44	22	18:38 (12)	18:30	16:24	15:53
13	04:58		19:43 (11)	05:47		19:49 (11)	06:42	18:14 (12)	07:37		07:37	08:25
	21:44	73	21:11 (9)	20:54	33	20:22 (11)	19:41	25	18:39 (12)	18:27	16:22	15:53
14	04:59		19:43 (11)	05:49		19:51 (11)	06:44	18:13 (12)	07:39		07:39	08:26
	21:43	72	21:10 (9)	20:52	29	20:20 (11)	19:39	28	18:41 (12)	18:25	16:21	15:53
15	05:01		19:43 (11)	05:50		19:53 (11)	06:46	18:10 (12)	07:40		07:41	08:27
	21:42	70	21:09 (9)	20:49	25	20:18 (11)	19:36	31	18:41 (12)	18:22	16:19	15:53
16	05:02		19:43 (11)	05:52		19:55 (11)	06:48	18:09 (12)	07:42		07:42	08:28
	21:41	70	21:09 (9)	20:47	20	20:15 (11)	19:34	33	18:42 (12)	18:20	16:18	15:53
17	05:03		19:43 (11)	05:54		19:59 (11)	06:49	18:08 (12)	07:44		07:44	08:29
	21:40	70	21:08 (9)	20:45	12	20:11 (11)	19:31	34	18:42 (12)	18:18	16:16	15:53
18	05:05		19:42 (11)	05:56			06:51	18:07 (12)	07:46		07:46	08:30
	21:38	69	21:06 (9)	20:43			19:29	36	18:43 (12)	18:15	16:14	15:53
19	05:06		19:42 (11)	05:58			06:53	18:06 (12)	07:48		07:48	08:31
	21:37	67	21:05 (9)	20:41			19:26	36	18:42 (12)	18:13	16:13	15:53
20	05:07		19:43 (11)	05:59			06:55	18:05 (12)	07:50		07:50	08:31
	21:36	64	21:04 (9)	20:38			19:24	37	18:42 (12)	18:11	16:12	15:54
21	05:09		19:42 (11)	06:01			06:57	18:05 (12)	07:52		07:52	08:32
	21:35	64	21:03 (9)	20:36			19:21	37	18:42 (12)	18:09	16:10	15:54
22	05:10		19:42 (11)	06:03			06:58	18:05 (12)	07:54		07:54	08:33
	21:33	61	21:01 (9)	20:34			19:19	37	18:42 (12)	18:06	16:09	15:55
23	05:12		19:42 (11)	06:05			07:00		18:04 (12)	07:56	07:55	08:33
	21:32	61	21:01 (9)	20:32			19:16	37	18:41 (12)	18:04	16:08	15:55
24	05:13		19:42 (11)	06:07			07:02		18:04 (12)	07:58	07:57	08:34
	21:30	58	20:59 (9)	20:29			19:14	36	18:40 (12)	18:02	16:06	15:56
25	05:15		19:42 (11)	06:08			07:04		18:04 (12)	08:00	07:59	08:34
	21:29	54	20:58 (9)	20:27			19:11	36	18:40 (12)	18:00	16:05	15:56
26	05:16		19:42 (11)	06:10			07:06		18:05 (12)	08:02	08:01	08:34
	21:27	51	20:33 (11)	20:25			19:09	34	18:39 (12)	17:57	16:04	15:57
27	05:18		19:42 (11)	06:12			07:07		18:05 (12)	07:03	08:02	08:35
	21:26	51	20:33 (11)	20:22			19:06	33	18:38 (12)	16:55	16:03	15:58
28	05:20		19:42 (11)	06:14			07:09		18:05 (12)	07:05	08:04	08:35
	21:24	51	20:33 (11)	20:20			19:04	31	18:36 (12)	16:53	16:02	15:58
29	05:21		19:42 (11)	06:15			07:11		18:06 (12)	07:07	08:06	08:35
	21:22	50	20:32 (11)	20:18			19:01	28	18:34 (12)	16:51	16:01	15:59
30	05:23		19:42 (11)	06:17			07:13		18:07 (12)	07:09	08:07	08:35
	21:21	51	20:33 (11)	20:15			18:59	25	18:32 (12)	16:49	16:00	16:00
31	05:24		19:43 (11)	06:19								08:35
	21:19	50	20:33 (11)	20:13						16:47		16:01
Sonnenscheinstunden		514		462			384		330		259	232
astr.max.mögl.Beschattung		2000		649			642		45			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende
			(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH

Bremerhavener Heerstraße 10

DE-28717 Bremen

+49 (0) 421 79 400 600

info@th-ingenieure.de

Berechnet:

20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: P - IO 16

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März		April		Mai		Juni	
1	08:35	08:06	07:08		06:53		05:43		19:18 (11)	04:52
	16:02	16:53	17:50		19:49		20:45	15	20:16 (9)	21:36
2	08:35	08:04	07:06		06:50		05:41		19:22 (11)	04:51
	16:03	16:55	17:52		19:51		20:47	11	20:18 (9)	21:37
3	08:35	08:02	07:04		06:48		05:39		20:12 (9)	04:50
	16:05	16:57	17:54		19:52		20:48	9	20:21 (9)	21:38
4	08:35	08:01	07:01		06:45		05:37		20:11 (9)	04:49
	16:06	16:59	17:55		19:54		20:50	11	20:22 (9)	21:39
5	08:34	07:59	06:59		06:43		05:34		20:10 (9)	04:48
	16:07	17:01	17:57		19:56		20:52	14	20:24 (9)	21:40
6	08:34	07:57	06:56		06:40		05:32		20:09 (9)	04:48
	16:08	17:03	17:59		19:58		20:54	16	20:25 (9)	21:42
7	08:34	07:55	06:54		06:38		05:30		20:08 (9)	04:47
	16:10	17:05	18:01		20:00		20:56	19	20:27 (9)	21:43
8	08:33	07:53	06:52		17:37 (12)	06:36	19:23 (11)	05:29	20:08 (9)	04:46
	16:11	17:07	18:03	1	17:38 (12)	20:02	19:36 (11)	20:57	20:28 (9)	21:44
9	08:33	07:51	06:49		17:31 (12)	06:33	19:20 (11)	05:27	20:07 (9)	04:45
	16:12	17:09	18:05	9	17:40 (12)	20:04	19:38 (11)	20:59	20:30 (9)	21:45
10	08:32	07:49	06:47		17:29 (12)	06:31	19:18 (11)	05:25	20:08 (9)	04:45
	16:14	17:11	18:07	13	17:42 (12)	20:06	19:40 (11)	21:01	20:30 (9)	21:45
11	08:31	07:47	06:44		17:28 (12)	06:28	19:16 (11)	05:23	20:07 (9)	04:44
	16:15	17:14	18:09	17	17:45 (12)	20:07	19:41 (11)	21:03	20:30 (9)	21:46
12	08:31	07:45	06:42		17:26 (12)	06:26	19:15 (11)	05:21	20:07 (9)	04:44
	16:17	17:16	18:11	20	17:46 (12)	20:09	19:43 (11)	21:05	20:29 (9)	21:47
13	08:30	07:43	06:40		17:25 (12)	06:24	19:14 (11)	05:19	20:08 (9)	04:44
	16:18	17:18	18:13	24	17:49 (12)	20:11	19:44 (11)	21:06	20:30 (9)	21:48
14	08:29	07:41	06:37		17:24 (12)	06:21	19:12 (11)	05:17	20:08 (9)	04:43
	16:20	17:20	18:15	26	17:50 (12)	20:13	19:44 (11)	21:08	20:29 (9)	21:49
15	08:28	07:39	06:35		17:24 (12)	06:19	19:11 (11)	05:16	20:09 (9)	04:43
	16:22	17:22	18:17	27	17:51 (12)	20:15	19:45 (11)	21:10	20:29 (9)	21:49
16	08:27	07:37	06:32		17:23 (12)	06:16	19:11 (11)	05:14	20:10 (9)	04:43
	16:23	17:24	18:19	27	17:50 (12)	20:17	19:45 (11)	21:11	20:28 (9)	21:50
17	08:26	07:35	06:30		17:23 (12)	06:14	19:10 (11)	05:12	20:11 (9)	04:43
	16:25	17:26	18:21	27	17:50 (12)	20:19	19:45 (11)	21:13	20:28 (9)	21:50
18	08:25	07:33	06:27		17:22 (12)	06:12	19:10 (11)	05:11	20:11 (9)	04:43
	16:27	17:28	18:22	27	17:49 (12)	20:20	19:45 (11)	21:15	20:26 (9)	21:51
19	08:24	07:31	06:25		17:23 (12)	06:09	19:10 (11)	05:09	20:13 (9)	04:43
	16:29	17:30	18:24	26	17:49 (12)	20:22	19:45 (11)	21:16	20:25 (9)	21:51
20	08:23	07:29	06:22		17:23 (12)	06:07	19:10 (11)	05:07	20:14 (9)	04:43
	16:30	17:32	18:26	25	17:48 (12)	20:24	19:45 (11)	21:18	20:23 (9)	21:52
21	08:22	07:26	06:20		17:24 (12)	06:05	19:09 (11)	05:06	20:18 (9)	04:43
	16:32	17:34	18:28	23	17:47 (12)	20:26	19:44 (11)	21:20	20:20 (9)	21:52
22	08:21	07:24	06:17		17:24 (12)	06:03	19:09 (11)	05:04		04:43
	16:34	17:36	18:30	21	17:45 (12)	20:28	19:43 (11)	21:21		21:52
23	08:19	07:22	06:15		17:25 (12)	06:00	19:09 (11)	05:03		04:43
	16:36	17:38	18:32	19	17:44 (12)	20:30	19:43 (11)	21:23		21:52
24	08:18	07:20	06:13		17:27 (12)	05:58	19:10 (11)	05:02		04:43
	16:38	17:40	18:34	14	17:41 (12)	20:32	19:42 (11)	21:24		21:52
25	08:17	07:17	06:10		17:30 (12)	05:56	19:11 (11)	05:00		04:44
	16:40	17:42	18:36	8	17:38 (12)	20:34	19:42 (11)	21:26		21:53
26	08:15	07:15	06:08			05:54	19:11 (11)	04:59		04:44
	16:42	17:44	18:37			20:35	19:41 (11)	21:27		21:53
27	08:14	07:13	06:05			05:51	19:12 (11)	04:58		04:44
	16:43	17:46	18:39			20:37	19:40 (11)	21:29		21:53
28	08:12	07:11	06:03			05:49	19:13 (11)	04:56		04:45
	16:45	17:48	18:41			20:39	19:39 (11)	21:30		21:52
29	08:11		06:00			05:47	19:14 (11)	04:55		04:45
	16:47		18:43			20:41	19:36 (11)	21:32		21:52
30	08:09		05:58			05:45	19:15 (11)	04:54		04:46
	16:49		18:45			20:43	19:34 (11)	21:33		21:52
31	08:07		06:55					04:53	20:55 (10)	
	16:51		19:47					21:34	21:02 (10)	
Sonnenscheinstunden	248	271	365		419		494		511	
astr.max.mögl.Beschattung				354		667		348		760

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender**Berechnung: Zusatzbelastung Schattenrezeptor: P - IO 16****Voraussetzungen für Berechnung des Schattenwurfs**

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember
1	04:47		20:51 (10)	05:26	20:18 (9)	06:21	19:13 (11)	07:15	18:04 (12)	07:13	08:09
	21:52	27	21:18 (7)	21:17	20:40 (9)	20:10	19:43 (11)	18:56	18:29 (12)	16:45	15:59
2	04:47		20:51 (10)	05:28	20:18 (9)	06:23	19:14 (11)	07:16	18:04 (12)	07:15	08:11
	21:51	27	21:18 (7)	21:15	20:41 (9)	20:08	19:41 (11)	18:54	18:27 (12)	16:43	15:58
3	04:48		20:52 (10)	05:29	20:18 (9)	06:24	19:15 (11)	07:18	18:05 (12)	07:17	08:12
	21:51	26	21:18 (10)	21:14	20:40 (9)	20:06	19:39 (11)	18:51	18:25 (12)	16:41	15:57
4	04:49		20:52 (10)	05:31	20:18 (9)	06:26	19:16 (11)	07:20	18:06 (12)	07:19	08:14
	21:51	24	21:16 (10)	21:12	20:41 (9)	20:03	19:36 (11)	18:49	18:22 (12)	16:39	15:57
5	04:50		20:53 (10)	05:33	20:17 (9)	06:28	19:18 (11)	07:22	18:06 (12)	07:21	08:15
	21:50	23	21:16 (10)	21:10	20:40 (9)	20:01	19:34 (11)	18:46	18:19 (12)	16:37	15:56
6	04:51		20:53 (10)	05:35	20:18 (9)	06:30	19:21 (11)	07:24	18:08 (12)	07:23	08:16
	21:49	23	21:16 (10)	21:08	20:39 (9)	19:58	19:32 (11)	18:44	18:17 (12)	16:35	15:56
7	04:51		20:54 (10)	05:36	20:18 (9)	06:32		07:26		07:25	08:18
	21:49	21	21:15 (10)	21:06	20:37 (9)	19:56		18:42		16:33	15:55
8	04:52		20:55 (10)	05:38	20:18 (9)	06:33		07:27		07:27	08:19
	21:48	20	21:15 (10)	21:04	20:35 (9)	19:53		18:39		16:31	15:55
9	04:53		20:56 (10)	05:40	20:19 (9)	06:35		07:29		07:29	08:20
	21:47	18	21:14 (10)	21:02	20:33 (9)	19:51		18:37		16:29	15:54
10	04:55		20:57 (10)	05:42	20:19 (9)	06:37		07:31		07:31	08:22
	21:47	17	21:14 (10)	21:00	20:31 (9)	19:49		18:34		16:28	15:54
11	04:56		20:58 (10)	05:43	20:20 (9)	06:39		07:33		07:33	08:23
	21:46	15	21:13 (10)	20:58	20:29 (9)	19:46		18:32		16:26	15:53
12	04:57		20:59 (10)	05:45	19:33 (11)	06:40		07:35		07:35	08:24
	21:45	13	21:12 (10)	20:56	20:28 (9)	19:44		18:30		16:24	15:53
13	04:58		21:01 (10)	05:47	19:27 (11)	06:42		07:37		07:37	08:25
	21:44	10	21:11 (10)	20:54	20:25 (9)	19:41		18:27		16:22	15:53
14	04:59		21:03 (10)	05:49	19:24 (11)	06:44		07:39		07:39	08:26
	21:43	7	21:10 (10)	20:52	19:42 (11)	19:39		18:25		16:21	15:53
15	05:00			05:50	19:22 (11)	06:46		07:40		07:40	08:27
	21:42			20:49	19:44 (11)	19:36		18:22		16:19	15:53
16	05:02			05:52	19:20 (11)	06:48		07:42		07:42	08:28
	21:41			20:47	19:45 (11)	19:34		18:20		16:18	15:53
17	05:03			05:54	19:19 (11)	06:49		07:44		07:44	08:29
	21:40			20:45	19:46 (11)	19:31		18:18		16:16	15:53
18	05:04			05:56	19:18 (11)	06:51		07:46		07:46	08:30
	21:38			20:43	19:47 (11)	19:29		18:15		16:14	15:53
19	05:06			05:58	19:16 (11)	06:53		07:48		07:48	08:31
	21:37			20:41	19:47 (11)	19:26		18:13		16:13	15:53
20	05:07			05:59	19:16 (11)	06:55	18:16 (12)	07:50		07:50	08:31
	21:36			20:38	19:48 (11)	19:24	18:26 (12)	18:11		16:12	15:54
21	05:09			06:01	19:15 (11)	06:57	18:13 (12)	07:52		07:52	08:32
	21:35			20:36	19:48 (11)	19:21	18:28 (12)	18:09		16:10	15:54
22	05:10			06:03	19:14 (11)	06:58	18:11 (12)	07:54		07:54	08:33
	21:33			20:34	19:48 (11)	19:19	18:30 (12)	18:06		16:09	15:54
23	05:12			06:05	19:13 (11)	07:00	18:08 (12)	07:56		07:55	08:33
	21:32			20:32	19:48 (11)	19:16	18:30 (12)	18:04		16:08	15:55
24	05:13		20:28 (9)	06:07	19:13 (11)	07:02	18:07 (12)	07:58		07:57	08:34
	21:30	2	20:30 (9)	20:29	19:48 (11)	19:14	18:31 (12)	18:02		16:06	15:55
25	05:15		20:25 (9)	06:08	19:12 (11)	07:04	18:06 (12)	08:00		07:59	08:34
	21:29	9	20:34 (9)	20:27	19:48 (11)	19:11	18:32 (12)	18:00		16:05	15:56
26	05:16		20:23 (9)	06:10	19:12 (11)	07:06	18:05 (12)	08:02		08:01	08:34
	21:27	12	20:35 (9)	20:25	19:48 (11)	19:09	18:32 (12)	17:57		16:04	15:57
27	05:18		20:21 (9)	06:12	19:12 (11)	07:07	18:05 (12)	07:03		08:02	08:35
	21:26	15	20:36 (9)	20:22	19:47 (11)	19:06	18:32 (12)	16:55		16:03	15:57
28	05:20		20:21 (9)	06:14	19:13 (11)	07:09	18:03 (12)	07:05		08:04	08:35
	21:24	17	20:38 (9)	20:20	19:47 (11)	19:04	18:31 (12)	16:53		16:02	15:58
29	05:21		20:20 (9)	06:15	19:12 (11)	07:11	18:03 (12)	07:07		08:06	08:35
	21:22	18	20:38 (9)	20:18	19:46 (11)	19:01	18:31 (12)	16:51		16:01	15:59
30	05:23		20:19 (9)	06:17	19:12 (11)	07:13	18:03 (12)	07:09		08:07	08:35
	21:21	20	20:39 (9)	20:15	19:45 (11)	18:59	18:30 (12)	16:49		16:00	16:00
31	05:24		20:19 (9)	06:19	19:13 (11)			07:11			08:35
	21:19	21	20:40 (9)	20:13	19:45 (11)			16:47			16:01
Sonnenscheinstunden		514		462		384		330		259	232
astr. max. mögl. Beschattung		385		788		381		106			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattende
			(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdauf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: Q - IO 17

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar		Februar		März		April		Mai		Juni	
1	08:35	14:30 (6)	08:06	15:51 (4)	07:08	17:03 (2)	06:53	05:43	04:52			
	16:02	27	14:57 (6)	16:17 (4)	17:50	21	17:24 (2)	19:49	20:45	21:36		
2	08:35	14:30 (6)	08:04	15:51 (4)	07:06	17:02 (2)	06:50	05:41	04:51			
	16:03	26	14:56 (6)	16:18 (4)	17:52	23	17:25 (2)	19:51	20:47	21:37		
3	08:35	14:31 (6)	08:02	15:51 (4)	07:04	17:00 (2)	06:48	05:39	04:50			
	16:04	26	14:57 (6)	16:19 (4)	17:54	25	17:25 (2)	19:53	20:48	21:38		
4	08:35	14:31 (6)	08:01	15:51 (4)	07:01	17:00 (2)	06:45	05:36	04:49			
	16:06	26	14:57 (6)	16:19 (4)	17:55	26	17:26 (2)	19:54	20:50	21:39		
5	08:35	14:32 (6)	07:59	15:51 (4)	06:59	16:59 (2)	06:43	05:34	04:48			
	16:07	25	14:57 (6)	16:20 (4)	17:57	27	17:26 (2)	19:56	20:52	21:41		
6	08:34	14:33 (6)	07:57	15:51 (4)	06:57	16:59 (2)	06:40	05:32	04:47			
	16:08	24	14:57 (6)	16:35 (3)	17:59	27	17:26 (2)	19:58	20:54	21:42		
7	08:34	14:34 (6)	07:55	15:52 (4)	06:54	16:58 (2)	06:38	05:30	04:47			
	16:09	24	14:58 (6)	16:37 (3)	18:01	27	17:25 (2)	20:00	20:56	21:43		
8	08:33	14:35 (6)	07:53	15:52 (4)	06:52	16:59 (2)	06:36	05:28	04:46			
	16:11	23	14:58 (6)	16:39 (3)	18:03	27	17:26 (2)	20:02	20:58	21:44		
9	08:33	14:35 (6)	07:51	15:52 (4)	06:49	16:59 (2)	06:33	05:27	04:45			
	16:12	23	14:58 (6)	16:40 (3)	18:05	26	17:25 (2)	20:04	20:59	21:45		
10	08:32	14:36 (6)	07:49	15:52 (4)	06:47	16:59 (2)	06:31	05:25	04:45			
	16:14	21	14:57 (6)	16:43 (3)	18:07	25	17:24 (2)	20:06	21:01	21:46		
11	08:31	14:38 (6)	07:47	15:53 (4)	06:44	17:00 (2)	06:28	05:23	04:44			
	16:15	20	14:58 (6)	16:45 (3)	18:09	24	17:24 (2)	20:07	21:03	21:46		
12	08:31	14:39 (6)	07:45	15:55 (4)	06:42	17:00 (2)	06:26	05:21	04:44			
	16:17	19	14:58 (6)	16:47 (3)	18:11	22	17:22 (2)	20:09	21:05	21:47		
13	08:30	14:40 (6)	07:43	15:56 (4)	06:40	17:02 (2)	06:24	05:19	04:43			
	16:18	17	14:57 (6)	16:48 (3)	18:13	19	17:21 (2)	20:11	21:06	21:48		
14	08:29	14:41 (6)	07:41	15:58 (4)	06:37	17:03 (2)	06:21	05:17	04:43			
	16:20	16	14:57 (6)	16:48 (3)	18:15	15	17:18 (2)	20:13	21:08	21:49		
15	08:28	14:42 (6)	07:39	16:01 (4)	06:35	17:07 (2)	06:19	05:16	04:43			
	16:22	13	14:55 (6)	16:48 (3)	18:17	7	17:14 (2)	20:15	21:10	21:49		
16	08:27	14:45 (6)	07:37	16:27 (3)	06:32		06:16	05:14	04:43			
	16:23	8	14:53 (6)	16:46 (3)	18:19		20:17	21:12	21:50			
17	08:26		07:35	16:28 (3)	06:30		06:14	05:12	04:43			
	16:25		17:26	16:46 (3)	18:21		20:19	21:13	21:50			
18	08:25		07:33	16:30 (3)	06:27		06:12	05:11	04:42			
	16:27		17:28	16:45 (3)	18:22		20:21	21:15	21:51			
19	08:24		07:31	16:31 (3)	06:25		06:09	05:09	04:42			
	16:29		17:30	16:44 (3)	18:24		20:22	21:17	21:51			
20	08:23		07:29	16:34 (3)	06:22		06:07	05:07	04:42			
	16:30		17:32	16:40 (3)	18:26		20:24	21:18	21:52			
21	08:22		07:26		06:20		06:05	05:06	04:42			
	16:32		17:34		18:28		20:26	21:20	21:52			
22	08:21		07:24		06:17		06:03	05:04	04:43			
	16:34		17:36		18:30		20:28	21:21	21:52			
23	08:19		07:22		06:15		06:00	05:03	04:43			
	16:36		17:38		18:32		20:30	21:23	21:52			
24	08:18		07:20		06:13		05:58	05:01	04:43			
	16:38	6	16:06 (4)		18:34		20:32	21:25	21:53			
25	08:17		07:18		06:10		05:56	05:00	04:43			
	16:40	12	16:09 (4)		18:36		20:34	21:26	21:53			
26	08:15		07:15	17:11 (2)	06:08		05:54	04:59	04:44			
	16:41	14	16:10 (4)	17:17 (2)	18:38		20:35	21:28	21:53			
27	08:14		07:13	17:07 (2)	06:05		05:51	04:57	04:44			
	16:43	18	16:12 (4)	17:20 (2)	18:39		20:37	21:29	21:53			
28	08:12		07:11	17:04 (2)	06:03		05:49	04:56	04:45			
	16:45	21	16:15 (4)	17:21 (2)	18:41		20:39	21:30	21:53			
29	08:11		07:10		06:00		05:47	04:55	04:45			
	16:47	22	16:15 (4)		18:43		20:41	21:32	21:52			
30	08:09		07:09		05:58		05:45	04:54	04:46			
	16:49	24	16:16 (4)		18:45		20:43	21:33	21:52			
31	08:07		07:08		06:55			04:53				
	16:51	26	16:17 (4)		19:47			21:34				
Sonnenscheinstunden	248		271		365		419	494		511		
astr.max.mögl.Beschattung	481		616		341							

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende
			(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: Q - IO 17

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	July	August	September	Oktober	November	Dezember
1	04:46 21:52	05:26 21:17	06:21 20:11	07:15 18:56	17:43 (2) 16:45	15:23 (4) 16:15 (3)
2	04:47 21:52	05:28 21:15	06:23 20:08	07:16 18:54	17:41 (2) 16:43	15:22 (4) 16:13 (3)
3	04:48 21:51	05:29 21:14	06:24 20:06	07:18 18:51	17:39 (2) 16:41	15:22 (4) 16:11 (3)
4	04:49 21:51	05:31 21:12	06:26 20:03	07:20 18:49	17:38 (2) 16:39	15:21 (4) 16:09 (3)
5	04:50 21:50	05:33 21:10	06:28 20:01	07:22 18:46	17:36 (2) 16:37	15:22 (4) 16:07 (3)
6	04:50 21:50	05:35 21:08	06:30 19:58	07:24 18:44	17:35 (2) 16:35	15:21 (4) 16:05 (3)
7	04:51 21:49	05:36 21:06	06:32 19:56	07:26 18:42	17:35 (2) 16:33	15:21 (4) 16:03 (3)
8	04:52 21:48	05:38 21:04	06:33 19:53	07:27 18:39	17:34 (2) 16:31	15:21 (4) 16:01 (3)
9	04:53 21:48	05:40 21:02	06:35 19:51	07:29 18:37	17:34 (2) 16:29	15:21 (4) 16:00 (3)
10	04:54 21:47	05:42 21:00	06:37 19:49	07:31 18:34	17:34 (2) 16:27	15:21 (4) 16:00 (3)
11	04:56 21:46	05:43 20:58	06:39 19:46	07:33 18:32	17:34 (2) 16:26	15:23 (4) 16:00 (3)
12	04:57 21:45	05:45 20:56	06:40 19:44	07:35 18:29	17:33 (2) 16:24	15:23 (4) 16:00 (3)
13	04:58 21:44	05:47 20:54	06:42 19:41	07:37 18:27	17:32 (2) 16:22	15:24 (4) 16:00 (3)
14	04:59 21:43	05:49 20:52	06:44 19:39	07:39 18:25	17:32 (2) 16:21	15:24 (4) 16:00 (3)
15	05:00 21:42	05:50 20:50	06:46 19:36	07:41 18:22	17:32 (2) 16:19	15:25 (4) 16:00 (3)
16	05:02 21:41	05:52 20:47	06:48 19:34	07:42 18:20	17:32 (2) 16:17	15:26 (4) 16:00 (3)
17	05:03 21:40	05:54 20:45	06:49 19:31	07:44 18:18	17:32 (2) 16:16	15:28 (4) 16:00 (3)
18	05:04 21:39	05:56 20:43	06:51 19:29	07:46 18:15	17:32 (2) 16:14	15:29 (4) 16:00 (3)
19	05:06 21:37	05:58 20:41	06:53 19:26	07:48 18:13	17:32 (2) 16:13	15:32 (4) 16:00 (3)
20	05:07 21:36	05:59 20:39	06:55 19:24	07:50 18:11	17:32 (2) 16:11	15:34 (4) 16:00 (3)
21	05:09 21:35	06:01 20:36	06:57 19:21	07:52 18:09	17:32 (2) 16:10	15:36 (4) 16:00 (3)
22	05:10 21:33	06:03 20:34	06:58 19:19	07:54 18:06	17:32 (2) 16:09	15:38 (4) 16:00 (3)
23	05:12 21:32	06:05 20:32	07:00 19:16	07:56 18:04	17:32 (2) 16:07	15:40 (4) 16:00 (3)
24	05:13 21:30	06:06 20:29	07:02 19:14	07:58 18:02	17:32 (2) 16:06	15:42 (4) 16:00 (3)
25	05:15 21:29	06:08 20:27	07:04 19:11	08:00 18:00	16:59 (3) 16:05	15:44 (4) 16:00 (3)
26	05:16 21:27	06:10 20:25	07:06 19:09	08:02 17:57	16:58 (3) 16:04	15:46 (4) 16:00 (3)
27	05:18 21:26	06:12 20:22	07:07 19:06	08:04 16:55	16:57 (3) 16:03	14:25 (6) 15:57
28	05:19 21:24	06:14 20:20	07:09 19:04	08:06 16:53	16:56 (3) 16:02	14:27 (6) 15:58
29	05:21 21:22	06:15 20:18	07:11 19:01	08:08 16:51	16:55 (3) 16:01	14:29 (6) 15:59
30	05:23 21:21	06:17 20:15	07:13 18:59	08:10 16:49	16:54 (3) 16:00	14:31 (6) 16:00
31	05:24 21:19	06:19 20:13		08:12 16:47	16:53 (3) 16:00	14:33 (6) 16:01
Sonnenscheinstunden	515	462	384	330	259	232
astr. max. mögl. Beschattung			9	584	566	792

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	----------------------------------	--------------------------------	---------------------------	----------------------------

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** R - IO 18

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni		
1	08:35 16:02	08:06 16:53	16:09 (4) 16:23 (4)	07:08 17:50	17:00 (2) 17:20 (2)	06:53 19:49	05:43 20:45	04:52 21:36
2	08:35 16:03	08:04 16:55	16:09 (4) 16:25 (4)	07:06 17:52	17:01 (2) 17:20 (2)	06:50 19:51	05:41 20:47	04:51 21:37
3	08:35 16:04	08:02 16:57	16:10 (4) 16:28 (4)	07:04 17:53	17:01 (2) 17:18 (2)	06:48 19:52	05:38 20:48	04:50 21:38
4	08:35 16:06	08:01 16:59	16:10 (4) 16:30 (4)	07:01 17:55	17:03 (2) 17:17 (2)	06:45 19:54	05:36 20:50	04:49 21:39
5	08:35 16:07	07:59 17:01	16:10 (4) 16:31 (4)	06:59 17:57	17:04 (2) 17:14 (2)	06:43 19:56	05:34 20:52	04:48 21:41
6	08:34 16:08	07:57 17:03	16:10 (4) 16:31 (4)	06:57 17:59		06:40 19:58	05:32 20:54	04:47 21:42
7	08:34 16:09	07:55 17:05	16:10 (4) 16:30 (4)	06:54 18:01		06:38 20:00	05:30 20:56	04:47 21:43
8	08:33 16:11	07:53 17:07	16:11 (4) 16:30 (4)	06:52 18:03		06:36 20:02	05:28 20:58	04:46 21:44
9	08:33 16:12	07:51 17:09	16:11 (4) 16:28 (4)	06:49 18:05		06:33 20:04	05:26 20:59	04:45 21:45
10	08:32 16:14	07:49 17:11	16:12 (4) 16:28 (4)	06:47 18:07		06:31 20:06	05:25 21:01	04:45 21:46
11	08:31 16:15	07:47 17:13	16:14 (4) 16:26 (4)	06:44 18:09		06:28 20:07	05:23 21:03	04:44 21:46
12	08:31 16:17	07:45 17:15	16:16 (4) 16:24 (4)	06:42 18:11		06:26 20:09	05:21 21:05	04:44 21:47
13	08:30 16:18	07:43 17:17		06:40 18:13		06:24 20:11	05:19 21:06	04:43 21:48
14	08:29 16:20	07:41 17:20		06:37 18:15		06:21 20:13	05:17 21:08	04:43 21:49
15	08:28 16:22	07:39 17:22		06:35 18:17		06:19 20:15	05:16 21:10	04:43 21:49
16	08:27 16:23	07:37 17:24		06:32 18:19		06:16 20:17	05:14 21:12	04:43 21:50
17	08:26 16:25	07:35 17:26		06:30 18:21		06:14 20:19	05:12 21:13	04:42 21:50
18	08:25 16:27	07:33 17:28		06:27 18:22		06:12 20:21	05:10 21:15	04:42 21:51
19	08:24 16:28	07:31 17:30		06:25 18:24		06:09 20:22	05:09 21:17	04:42 21:51
20	08:23 16:30	07:29 17:32		06:22 18:26		06:07 20:24	05:07 21:18	04:42 21:52
21	08:22 16:32	07:26 17:34		06:20 18:28		06:05 20:26	05:06 21:20	04:42 21:52
22	08:21 16:34	07:24 17:36	17:05 (2) 17:10 (2)	06:17 18:30		06:02 20:28	05:04 21:21	04:43 21:52
23	08:19 16:36	07:22 17:38	17:03 (2) 17:11 (2)	06:15 18:32		06:00 20:30	05:03 21:23	04:43 21:52
24	08:18 16:38	07:20 17:40	17:02 (2) 17:14 (2)	06:13 18:34		05:58 20:32	05:01 21:25	04:43 21:53
25	08:17 16:40	07:17 17:42	17:02 (2) 17:16 (2)	06:10 18:36		05:56 20:34	05:00 21:26	04:43 21:53
26	08:15 16:41	07:15 17:44	17:01 (2) 17:18 (2)	06:08 18:37		05:53 20:35	04:59 21:28	04:44 21:53
27	08:14 16:43	07:13 17:46	17:01 (2) 17:20 (2)	06:05 18:39		05:51 20:37	04:57 21:29	04:44 21:53
28	08:12 16:45	16:13 (4) 16:15 (4)	07:11 17:48	06:03 18:41		05:49 20:39	04:56 21:30	04:45 21:53
29	08:11 16:47	16:12 (4) 16:17 (4)		06:00 18:43		05:47 20:41	04:55 21:32	04:45 21:52
30	08:09 16:49	16:11 (4) 16:19 (4)		05:58 18:45		05:45 20:43	04:54 21:33	04:46 21:52
31	08:07 16:51	16:10 (4) 16:21 (4)		06:55 19:47			04:53 21:34	
Sonnenscheinstunden	248		271	365		419	494	511
astr.max.mögl.Beschattung	26		297	80				

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	(WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)
	Minuten mit Schatten		

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung **Schattenrezeptor:** R - IO 18

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober		November		Dezember
1	04:46	05:26	06:21	07:15		07:13	15:44 (4)	08:09
	21:52	21:17	20:11	18:56		16:45	15:55 (4)	15:59
2	04:47	05:28	06:23	07:16		07:15	15:42 (4)	08:11
	21:52	21:15	20:08	18:54		16:43	15:57 (4)	15:58
3	04:48	05:29	06:24	07:18		07:17	15:41 (4)	08:12
	21:51	21:14	20:06	18:51		16:41	15:58 (4)	15:57
4	04:49	05:31	06:26	07:20		07:19	15:40 (4)	08:14
	21:51	21:12	20:03	18:49		16:39	15:59 (4)	15:57
5	04:49	05:33	06:28	07:22		07:21	15:40 (4)	08:15
	21:50	21:10	20:01	18:46		16:37	16:00 (4)	15:56
6	04:50	05:35	06:30	07:24		07:23	15:40 (4)	08:17
	21:50	21:08	19:58	18:44		16:35	16:00 (4)	15:55
7	04:51	05:36	06:32	07:26		07:25	15:40 (4)	08:18
	21:49	21:06	19:56	18:42		16:33	16:00 (4)	15:55
8	04:52	05:38	06:33	07:27		07:27	15:39 (4)	08:19
	21:48	21:04	19:53	18:39		16:31	16:00 (4)	15:54
9	04:53	05:40	06:35	07:29		07:29	15:39 (4)	08:21
	21:48	21:02	19:51	18:37		16:29	15:59 (4)	15:54
10	04:54	05:41	06:37	07:31		17:39 (2)	15:40 (4)	08:22
	21:47	21:00	19:49	18:34	10	17:49 (2)	16:27	15:57 (4)
11	04:56	05:43	06:39	07:33		17:37 (2)	15:41 (4)	08:23
	21:46	20:58	19:46	18:32	14	17:51 (2)	16:26	15:56 (4)
12	04:57	05:45	06:40	07:35		17:35 (2)	15:41 (4)	08:24
	21:45	20:56	19:44	18:29	17	17:52 (2)	16:24	15:54 (4)
13	04:58	05:47	06:42	07:37		17:34 (2)	15:42 (4)	08:25
	21:44	20:54	19:41	18:27	19	17:53 (2)	16:22	15:53 (4)
14	04:59	05:49	06:44	07:39		17:34 (2)	15:43 (4)	08:26
	21:43	20:52	19:39	18:25	19	17:53 (2)	16:21	15:50 (4)
15	05:00	05:50	06:46	07:40		17:33 (2)	15:44 (4)	08:27
	21:42	20:50	19:36	18:22	20	17:53 (2)	16:19	15:48 (4)
16	05:02	05:52	06:48	07:42		17:33 (2)	16:17	15:53
	21:41	20:47	19:34	18:20	19	17:52 (2)	16:17	15:53
17	05:03	05:54	06:49	07:44		17:33 (2)	16:16	15:53
	21:40	20:45	19:31	18:18	17	17:50 (2)	16:16	15:53
18	05:04	05:56	06:51	07:46		17:33 (2)	16:14	15:53
	21:39	20:43	19:29	18:15	15	17:48 (2)	16:14	15:53
19	05:06	05:57	06:53	07:48		17:33 (2)	16:13	15:53
	21:37	20:41	19:26	18:13	12	17:45 (2)	16:13	15:53
20	05:07	05:59	06:55	07:50		17:34 (2)	16:11	15:54
	21:36	20:39	19:24	18:11	9	17:43 (2)	16:11	15:54
21	05:09	06:01	06:56	07:52		17:35 (2)	16:10	15:54
	21:35	20:36	19:21	18:08	5	17:40 (2)	16:10	15:54
22	05:10	06:03	06:58	07:54		17:37 (2)	16:09	15:54
	21:33	20:34	19:19	18:06	1	17:38 (2)	16:09	15:54
23	05:12	06:05	07:00	07:56			16:07	15:55
	21:32	20:32	19:16	18:04			16:07	15:55
24	05:13	06:06	07:02	07:58			16:06	15:55
	21:30	20:29	19:14	18:02			16:06	15:55
25	05:15	06:08	07:04	08:00			16:05	15:56
	21:29	20:27	19:11	18:00			16:05	15:56
26	05:16	06:10	07:05	08:02			16:04	15:57
	21:27	20:25	19:09	17:57			16:04	15:57
27	05:18	06:12	07:07	08:04			16:03	15:57
	21:26	20:22	19:06	16:55			16:03	15:57
28	05:19	06:14	07:09	08:05			16:02	15:58
	21:24	20:20	19:04	16:53			16:02	15:58
29	05:21	06:15	07:11	08:07			16:01	15:59
	21:22	20:18	19:01	16:51			16:01	15:59
30	05:23	06:17	07:13	08:09			16:00	16:00
	21:21	20:15	18:59	16:49			16:00	16:00
31	05:24	06:19		07:11		15:47 (4)		16:01
	21:19	20:13		16:47	6	15:53 (4)		16:01
Sonnenscheinstunden	515	462	384	330	183	259	229	232
astr. max. mögl. Beschattung								

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kisdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S - IO 19

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35	08:06	15:34 (8) 07:08	06:53	05:43	04:52
	16:02	16:53	15:55 (8) 17:50	19:49	20:45	21:36
2	08:35	08:04	15:35 (8) 07:06	06:50	05:41	04:51
	16:03	16:55	15:54 (8) 17:52	19:51	20:47	21:37
3	08:35	08:02	15:37 (8) 07:04	06:48	05:38	04:50
	16:04	16:57	15:52 (8) 17:53	19:52	20:48	21:38
4	08:35	08:01	15:40 (8) 07:01	06:45	05:36	04:49
	16:06	16:59	15:51 (8) 17:55	19:54	20:50	21:39
5	08:34	07:59	06:59	17:29 (4) 06:43	05:34	04:48
	16:07	17:01	17:57	17:32 (4) 19:56	20:52	21:41
6	08:34	07:57	06:56	17:27 (4) 06:40	05:32	04:47
	16:08	17:03	17:59	17:34 (4) 19:58	20:54	21:42
7	08:34	15:34 (8) 07:55	06:54	17:24 (4) 06:38	05:30	04:47
	16:09	15:35 (8) 17:05	18:01	17:36 (4) 20:00	20:56	21:43
8	08:33	15:33 (8) 07:53	06:52	17:24 (4) 06:36	05:28	04:46
	16:11	15:36 (8) 17:07	18:03	17:38 (4) 20:02	20:58	21:44
9	08:33	15:31 (8) 07:51	06:49	17:22 (4) 06:33	05:27	04:45
	16:12	15:37 (8) 17:09	18:05	17:40 (4) 20:04	20:59	21:45
10	08:32	15:31 (8) 07:49	16:42 (6) 06:47	17:22 (4) 06:31	05:25	04:45
	16:14	15:39 (8) 17:11	16:43 (6) 18:07	17:42 (4) 20:06	21:01	21:46
11	08:31	15:31 (8) 07:47	16:39 (6) 06:44	17:22 (4) 06:28	05:23	04:44
	16:15	15:41 (8) 17:13	16:45 (6) 18:09	17:43 (4) 20:07	21:03	21:46
12	08:31	15:30 (8) 07:45	16:37 (6) 06:42	17:21 (4) 06:26	05:21	04:44
	16:17	15:43 (8) 17:15	16:48 (6) 18:11	17:42 (4) 20:09	21:05	21:47
13	08:30	15:30 (8) 07:43	16:36 (6) 06:40	17:22 (4) 06:24	05:19	04:43
	16:18	15:45 (8) 17:17	16:50 (6) 18:13	17:42 (4) 20:11	21:06	21:48
14	08:29	15:30 (8) 07:41	16:35 (6) 06:37	17:22 (4) 06:21	05:17	04:43
	16:20	15:47 (8) 17:20	16:52 (6) 18:15	17:41 (4) 20:13	21:08	21:49
15	08:28	15:29 (8) 07:39	16:35 (6) 06:35	17:23 (4) 06:19	05:16	04:43
	16:22	15:48 (8) 17:22	16:55 (6) 18:17	17:40 (4) 20:15	21:10	21:49
16	08:27	15:29 (8) 07:37	16:33 (6) 06:32	17:23 (4) 06:16	05:14	04:43
	16:23	15:50 (8) 17:24	16:55 (6) 18:19	17:38 (4) 20:17	21:12	21:50
17	08:26	15:29 (8) 07:35	16:33 (6) 06:30	17:26 (4) 06:14	05:12	04:42
	16:25	15:52 (8) 17:26	16:56 (6) 18:21	17:36 (4) 20:19	21:13	21:50
18	08:25	15:29 (8) 07:33	16:33 (6) 06:27	06:12	05:11	04:42
	16:27	15:54 (8) 17:28	16:56 (6) 18:22	20:21	21:15	21:51
19	08:24	15:28 (8) 07:31	16:33 (6) 06:25	06:09	05:09	04:42
	16:28	15:54 (8) 17:30	16:56 (6) 18:24	20:22	21:17	21:51
20	08:23	15:29 (8) 07:29	16:33 (6) 06:22	06:07	05:07	04:42
	16:30	15:55 (8) 17:32	16:55 (6) 18:26	20:24	21:18	21:52
21	08:22	15:29 (8) 07:26	16:34 (6) 06:20	06:05	05:06	04:42
	16:32	15:56 (8) 17:34	16:55 (6) 18:28	20:26	21:20	21:52
22	08:21	15:29 (8) 07:24	16:35 (6) 06:17	06:02	05:04	04:43
	16:34	15:56 (8) 17:36	16:55 (6) 18:30	20:28	21:21	21:52
23	08:19	15:29 (8) 07:22	16:35 (6) 06:15	06:00	05:03	04:43
	16:36	15:57 (8) 17:38	16:53 (6) 18:32	20:30	21:23	21:52
24	08:18	15:29 (8) 07:20	16:36 (6) 06:12	05:58	05:01	04:43
	16:38	15:56 (8) 17:40	16:52 (6) 18:34	20:32	21:24	21:53
25	08:17	15:29 (8) 07:17	16:39 (6) 06:10	05:56	05:00	04:43
	16:40	15:56 (8) 17:42	16:50 (6) 18:36	20:34	21:26	21:53
26	08:15	15:30 (8) 07:15	16:43 (6) 06:08	05:53	04:59	04:44
	16:41	15:57 (8) 17:44	16:45 (6) 18:37	20:35	21:27	21:53
27	08:14	15:30 (8) 07:13	06:05	05:51	04:57	04:44
	16:43	15:57 (8) 17:46	18:39	20:37	21:29	21:53
28	08:12	15:30 (8) 07:11	06:03	05:49	04:56	04:45
	16:45	15:56 (8) 17:48	18:41	20:39	21:30	21:53
29	08:11	15:32 (8)	06:00	05:47	04:55	04:45
	16:47	15:57 (8)	18:43	20:41	21:32	21:52
30	08:09	15:32 (8)	05:58	05:45	04:54	04:46
	16:49	15:56 (8)	18:45	20:43	21:33	21:52
31	08:07	15:33 (8)	06:55		04:53	
	16:51	15:56 (8)	19:47		21:34	
Sonnenscheinstunden	248	271	365	419	494	511
astr. max. mögl. Beschattung	501	336	197			

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)
	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

SHADOW - Kalender

Berechnung: Zusatzbelastung
Schattenrezeptor: S - IO 19

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember						
1	04:46	05:26	06:21	07:15	18:01 (4)	07:13	16:08 (6)	08:09	15:11 (8)			
	21:52	21:17	20:10	18:56	20	18:21 (4)	16:45	7	16:15 (6)	15:59	14	15:25 (8)
2	04:47	05:28	06:23	07:16	18:01 (4)	07:15	16:10 (6)	08:11	15:12 (8)			
	21:52	21:15	20:08	18:54	20	18:21 (4)	16:43	3	16:13 (6)	15:58	12	15:24 (8)
3	04:48	05:29	06:24	07:18	18:00 (4)	07:17	16:12 (6)	08:12	15:14 (8)			
	21:51	21:14	20:06	18:51	21	18:21 (4)	16:41		15:57	9	15:23 (8)	
4	04:49	05:31	06:26	07:20	18:00 (4)	07:19	16:14 (6)	08:14	15:14 (8)			
	21:51	21:12	20:03	18:49	21	18:21 (4)	16:39		15:57	8	15:22 (8)	
5	04:50	05:33	06:28	07:22	17:59 (4)	07:21	16:15 (6)	08:15	15:16 (8)			
	21:50	21:10	20:01	18:46	20	18:19 (4)	16:37		15:56	5	15:21 (8)	
6	04:50	05:35	06:30	07:24	17:59 (4)	07:23	16:16 (6)	08:17	15:19 (8)			
	21:50	21:08	19:58	18:44	18	18:17 (4)	16:35		15:55	2	15:21 (8)	
7	04:51	05:36	06:31	07:26	18:00 (4)	07:25	16:17 (6)	08:18	15:21 (8)			
	21:49	21:06	19:56	18:42	14	18:14 (4)	16:33		15:55			
8	04:52	05:38	06:33	07:27	18:00 (4)	07:27	15:11 (8)	08:19	15:25 (8)			
	21:48	21:04	19:53	18:39	12	18:12 (4)	16:31	9	15:20 (8)	15:54		
9	04:53	05:40	06:35	07:29	18:02 (4)	07:29	15:08 (8)	08:21	15:22 (8)			
	21:48	21:02	19:51	18:37	7	18:09 (4)	16:29	14	15:22 (8)	15:54		
10	04:54	05:41	06:37	07:31	18:04 (4)	07:31	15:07 (8)	08:22	15:24 (8)			
	21:47	21:00	19:49	18:34	3	18:07 (4)	16:27	17	15:24 (8)	15:54		
11	04:56	05:43	06:39	07:33	18:07 (4)	07:33	15:05 (8)	08:23	15:25 (8)			
	21:46	20:58	19:46	18:32		16:26	20	15:25 (8)	15:53			
12	04:57	05:45	06:40	07:35		07:35	15:05 (8)	08:24	15:27 (8)			
	21:45	20:56	19:44	18:29		16:24	22	15:27 (8)	15:53			
13	04:58	05:47	06:42	07:37		07:37	15:05 (8)	08:25	15:28 (8)			
	21:44	20:54	19:41	18:27		16:22	23	15:28 (8)	15:53			
14	04:59	05:49	06:44	07:39		07:39	15:04 (8)	08:26	15:30 (8)			
	21:43	20:52	19:39	18:25		16:21	24	15:28 (8)	15:53			
15	05:00	05:50	06:46	07:40		07:41	15:04 (8)	08:27	15:30 (8)			
	21:42	20:49	19:36	18:22		16:19	25	15:29 (8)	15:53			
16	05:02	05:52	06:48	07:42		07:42	15:03 (8)	08:28	15:30 (8)			
	21:41	20:47	19:34	18:20		16:17	26	15:29 (8)	15:53			
17	05:03	05:54	06:49	07:44		07:44	15:03 (8)	08:29	15:30 (8)			
	21:40	20:45	19:31	18:18		16:16	27	15:30 (8)	15:53			
18	05:04	05:56	06:51	07:46	17:10 (6)	07:46	15:03 (8)	08:30	15:30 (8)			
	21:38	20:43	19:29	18:15	11	17:21 (6)	16:14	27	15:30 (8)	15:53		
19	05:06	05:57	06:53	07:48	17:08 (6)	07:48	15:03 (8)	08:31	15:30 (8)			
	21:37	20:41	19:26	18:13	15	17:23 (6)	16:13	27	15:30 (8)	15:53		
20	05:07	05:59	06:55	07:50	17:06 (6)	07:50	15:03 (8)	08:31	15:30 (8)			
	21:36	20:38	19:24	18:11	18	17:24 (6)	16:11	27	15:30 (8)	15:54		
21	05:09	06:01	06:56	07:52	17:05 (6)	07:52	15:04 (8)	08:32	15:31 (8)			
	21:35	20:36	19:21	18:08	20	17:25 (6)	16:10	27	15:31 (8)	15:54		
22	05:10	06:03	06:58	07:54	17:04 (6)	07:54	15:04 (8)	08:33	15:31 (8)			
	21:33	20:34	19:19	18:06	22	17:26 (6)	16:09	27	15:31 (8)	15:54		
23	05:12	06:05	07:00	07:56	17:03 (6)	07:55	15:04 (8)	08:33	15:31 (8)			
	21:32	20:32	19:16	18:04	23	17:26 (6)	16:07	27	15:31 (8)	15:55		
24	05:13	06:06	07:02	07:58	17:03 (6)	07:57	15:05 (8)	08:34	15:31 (8)			
	21:30	20:29	19:14	18:02	23	17:26 (6)	16:06	26	15:31 (8)	15:55		
25	05:15	06:08	07:04	08:00	17:03 (6)	07:59	15:06 (8)	08:34	15:31 (8)			
	21:29	20:27	19:11	18:00	23	17:26 (6)	16:05	25	15:31 (8)	15:56		
26	05:16	06:10	07:05	08:02	17:03 (6)	08:01	15:06 (8)	08:34	15:31 (8)			
	21:27	20:25	19:09	17:57	22	17:25 (6)	16:04	25	15:31 (8)	15:57		
27	05:18	06:12	07:07	18:12 (4)	07:03	16:03 (6)	08:02	15:07 (8)	08:35	15:57		
	21:26	20:22	19:06	18:13 (4)	16:55	22	16:25 (6)	16:03	22	15:29 (8)	15:57	
28	05:19	06:14	07:09	18:06 (4)	07:05	16:03 (6)	08:04	15:08 (8)	08:35	15:58		
	21:24	20:20	19:04	18:17 (4)	16:53	21	16:24 (6)	16:02	20	15:28 (8)	15:58	
29	05:21	06:15	07:11	18:04 (4)	07:07	16:04 (6)	08:06	15:09 (8)	08:35	15:59		
	21:22	20:18	19:01	18:19 (4)	16:51	18	16:22 (6)	16:01	18	15:27 (8)	15:59	
30	05:23	06:17	07:13	18:02 (4)	07:09	16:05 (6)	08:07	15:10 (8)	08:35	16:00		
	21:21	20:15	18:59	18:20 (4)	16:49	15	16:20 (6)	16:00	16	15:26 (8)	16:00	
31	05:24	06:19		07:11	16:06 (6)			08:35	16:01			
	21:19	20:13		16:47	12	16:18 (6)						
Sonnenscheinstunden	515	462	384	330	259	531	232					
astr.max.mögl.Beschattung			45	421							50	

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat

Sonnenaufgang (SS:MM)

Sonnenuntergang (SS:MM)

Minuten mit Schatten

Zeitpunkt (SS:MM) Schattenanfang

Zeitpunkt (SS:MM) Schattenende

(WEA mit erstem Schatten)

(WEA mit letztem Schatten)

Projekt:

19-095-GBK-02

Beschreibung:

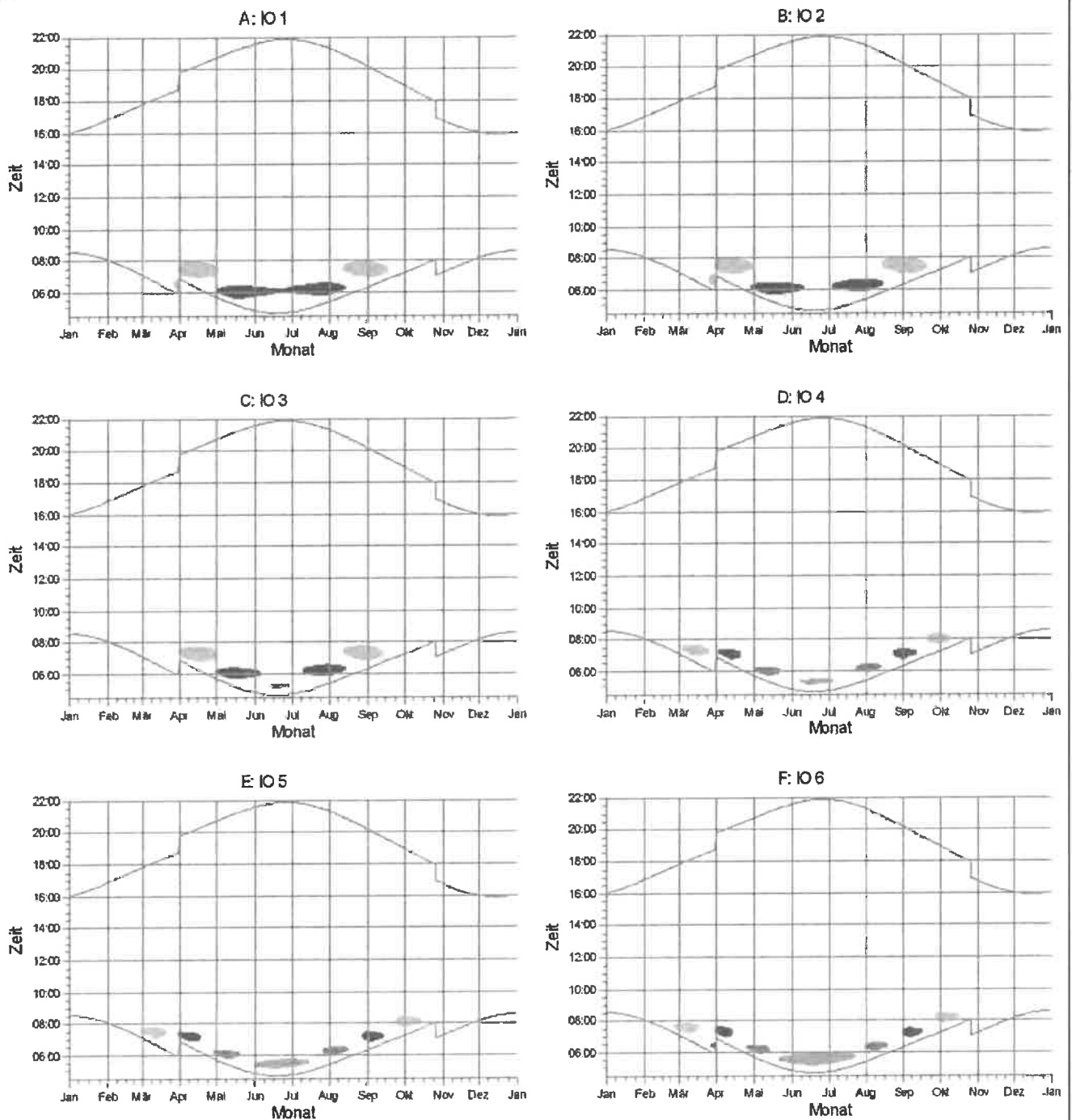
Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kisdorf

Lizenzierter Anwender:

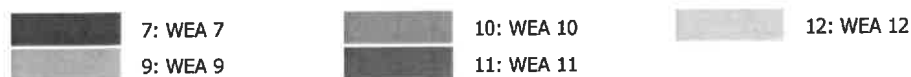
T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung



WEA



Projekt:

19-095-GBK-02

Beschreibung:

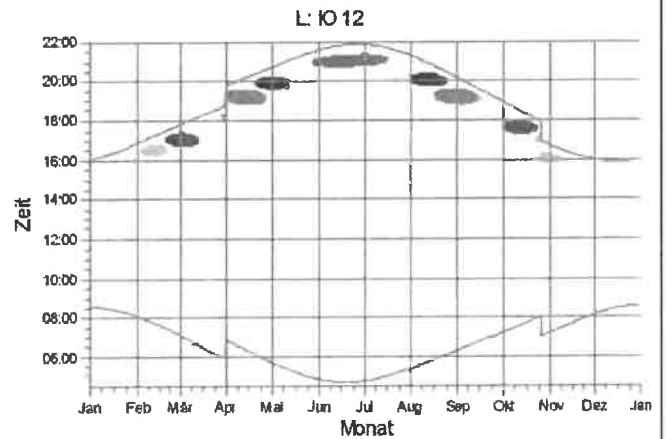
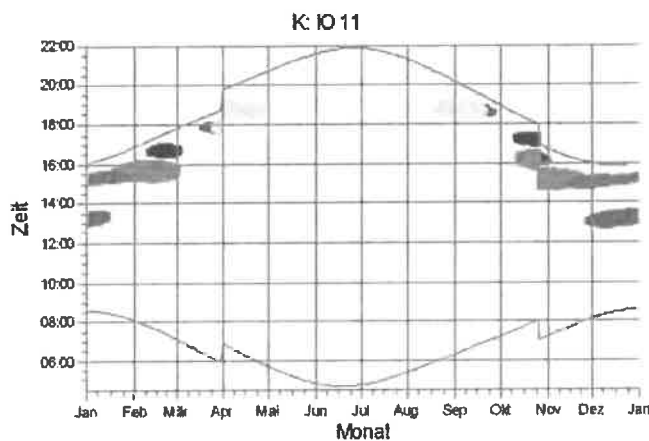
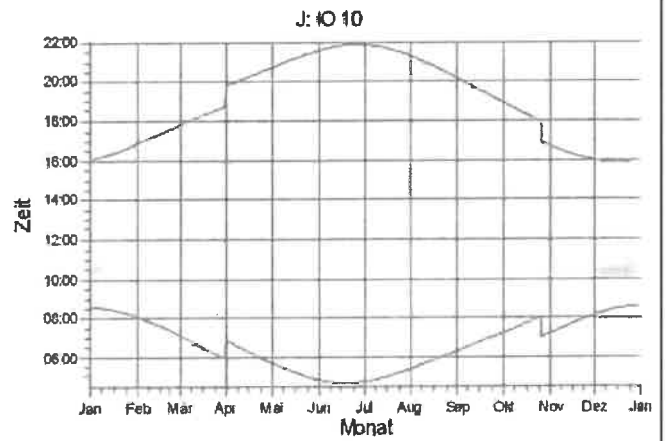
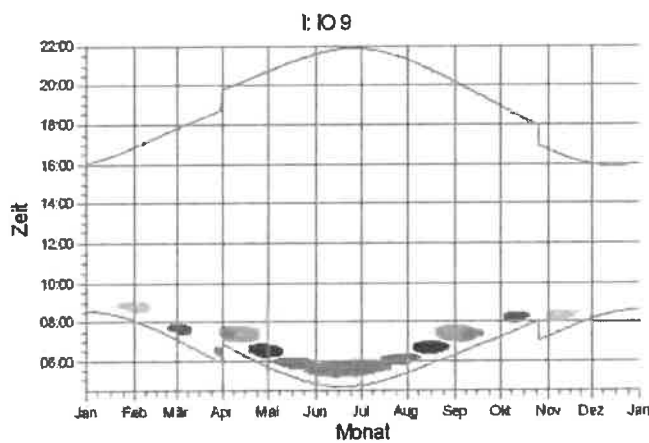
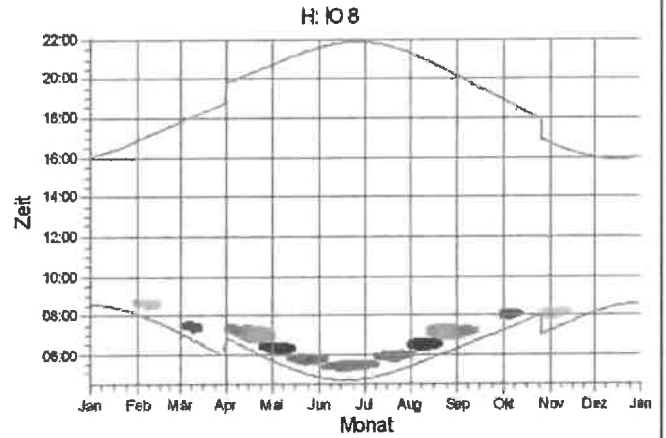
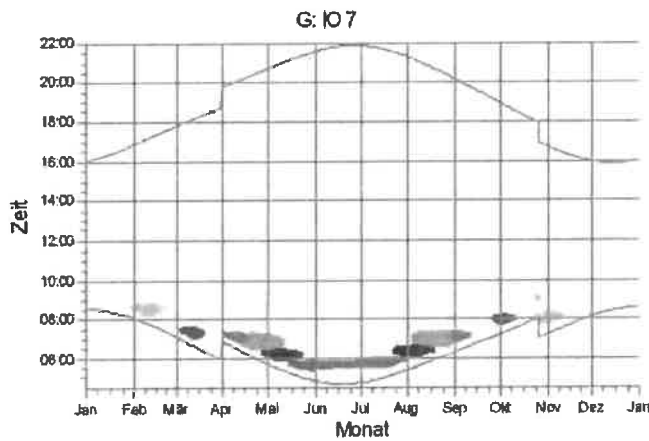
Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kisdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung



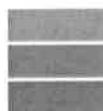
WEA



1: WEA 1

2: WEA 2

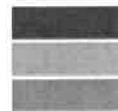
3: WEA 3



4: WEA 4

5: WEA 5

6: WEA 6



7: WEA 7

9: WEA 9

10: WEA 10



11: WEA 11

12: WEA 12

Projekt:

19-095-GBK-02

Beschreibung:

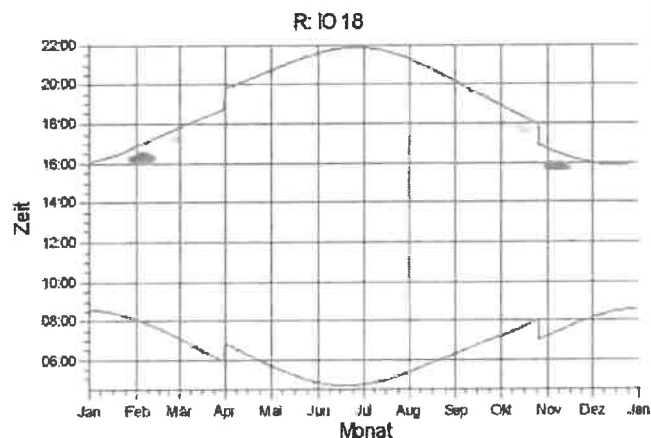
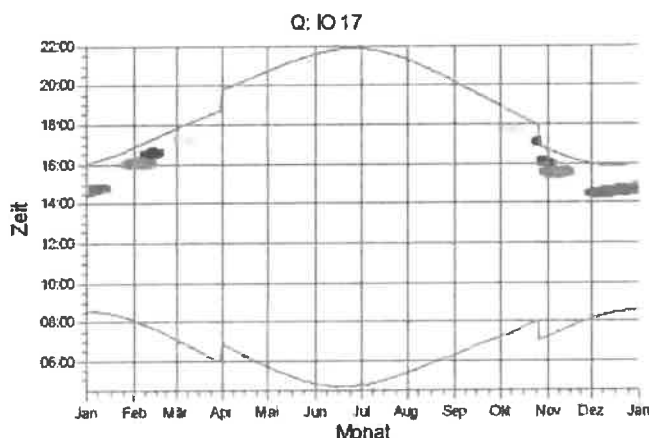
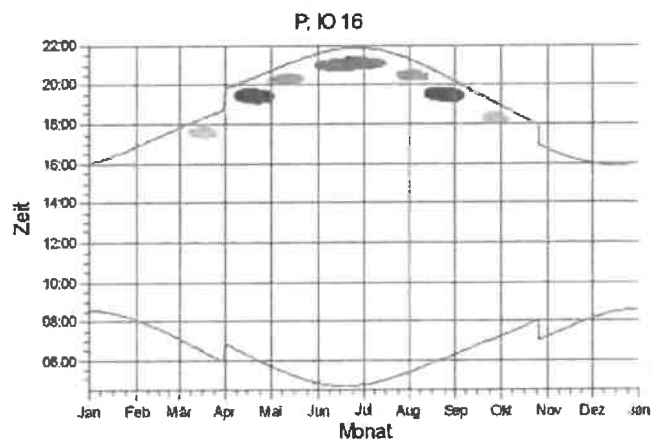
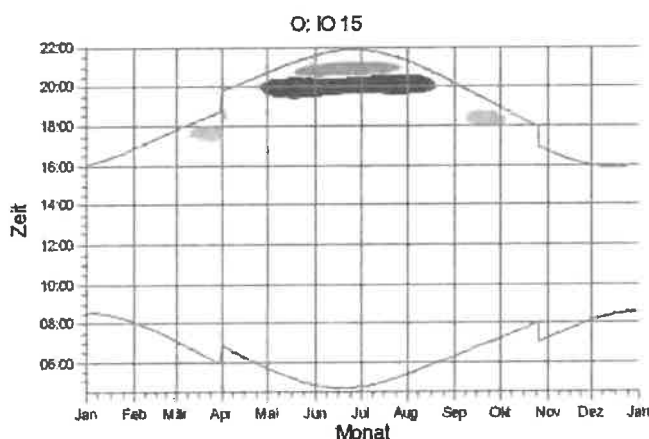
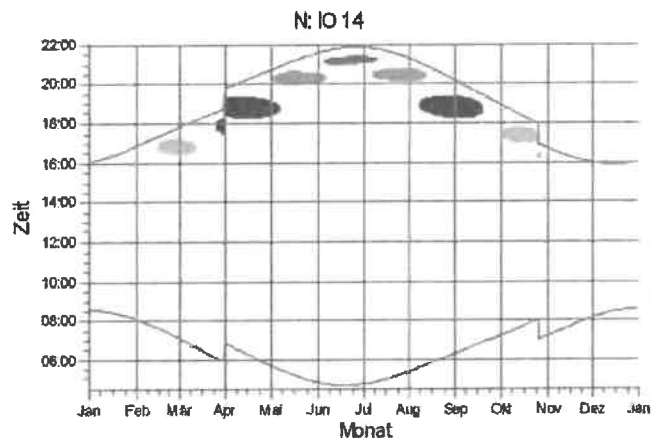
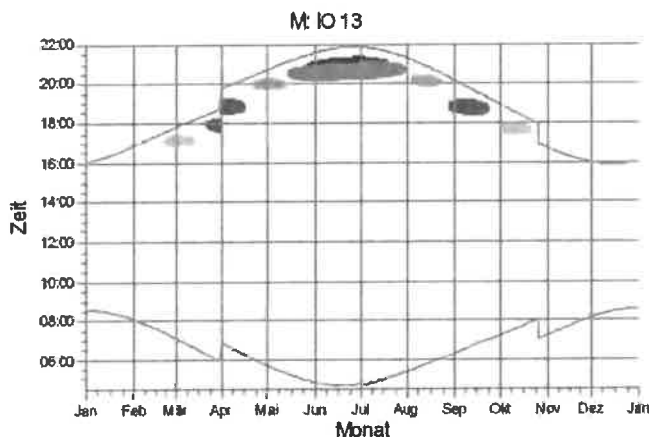
Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung



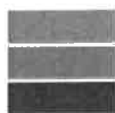
WEA



2: WEA 2

3: WEA 3

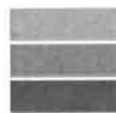
4: WEA 4



5: WEA 5

6: WEA 6

7: WEA 7



9: WEA 9

10: WEA 10

11: WEA 11



12: WEA 12

Projekt:

19-095-GBK-02

Beschreibung:

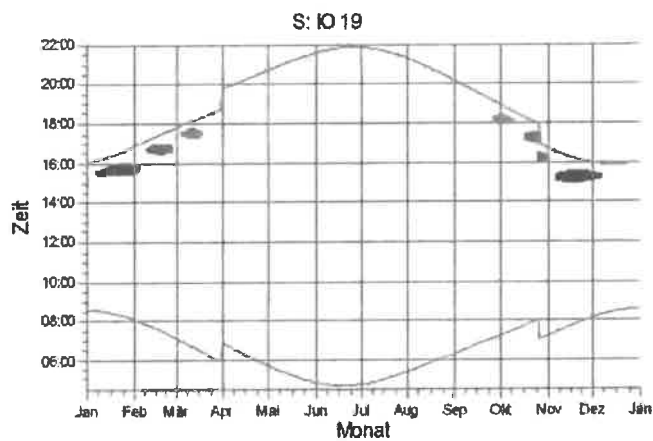
Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
Bremerhavener Heerstraße 10
DE-28717 Bremen
+49 (0) 421 79 400 600
info@th-ingenieure.de
Berechnet:
20.08.2019 10:57/3.2.744

SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung



WEA



4: WEA 4



6: WEA 6



8: WEA 8

Projekt:	Beschreibung:	Lizenzierter Anwender:
19-095-GBK-02	Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kesdorf	T&H Ingenieure GmbH Bremerhavener Heerstraße 10 DE-28717 Bremen +49 (0) 421 79 400 600 info@th-ingenieure.de Berechnet: 20.08.2019 10:57/3.2.744

SHADOW - Kalender pro WEA

Berechnung: Zusatzbelastung WEA: 1 - WEA 1

Voraussetzungen für Berechnung des Schattenwurfs

- Referenzjahr für Kalender 2019
- Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
 - Die Sonne scheint täglich von Sonnenauf- bis -untergang
 - Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
 - Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:35 16:02	08:06 16:53	07:08 17:50	06:53 19:49	18:40-19:02/22 20:45	05:43 21:36	04:47 21:52	05:26 21:17	06:21 20:11	07:15 18:56	07:13 16:45	08:09 15:59
2	08:35 16:03	08:04 16:55	07:06 17:52	06:50 19:51	18:42-19:01/19 20:47	05:41 21:37	04:47 21:52	05:28 21:16	06:23 20:08	07:17 18:54	07:15 16:43	08:11 15:58
3	08:35 16:05	08:03 16:57	07:04 17:54	06:48 19:53	18:43-18:58/15 20:49	05:39 21:38	04:48 21:51	05:30 21:14	06:25 20:06	07:18 18:51	07:17 16:41	08:12 15:58
4	08:35 16:06	08:01 16:59	07:01 17:56	06:45 19:54	18:47-18:54/7 20:50	05:37 21:40	04:49 21:51	05:31 21:12	06:26 20:03	07:20 18:49	07:19 16:39	08:14 15:57
5	08:35 16:07	07:59 17:01	06:59 17:58	06:43 19:56	20:52 20:52	05:35 21:41	04:48 21:50	05:33 21:10	06:28 20:01	07:22 18:47	07:21 16:37	08:15 15:56
6	08:34 16:08	07:57 17:03	06:57 18:00	06:41 19:58	20:52 20:54	05:33 21:42	04:48 21:50	05:35 21:08	06:30 19:59	07:24 18:44	07:23 16:35	08:17 15:56
7	08:34 16:10	07:55 17:05	06:54 18:01	06:38 20:00	20:56 20:56	05:31 21:43	04:47 21:49	05:36 21:06	06:32 19:56	07:26 18:42	07:25 16:33	08:18 15:55
8	08:33 16:11	07:53 17:07	06:52 18:03	06:36 20:02	20:58 20:58	05:29 21:44	04:46 21:48	05:38 21:04	06:33 19:54	07:28 18:39	07:27 16:31	08:19 15:55
9	08:33 16:12	07:51 17:10	06:49 18:05	06:33 20:04	20:57 20:59	05:27 21:45	04:46 21:48	05:40 21:02	06:35 19:51	07:29 18:37	07:29 16:29	08:21 15:54
10	08:32 16:14	07:50 17:12	06:47 18:07	06:31 20:06	20:55 21:01	05:25 21:46	04:45 21:47	05:42 21:00	06:37 19:49	18:39-18:51/12 07:31	07:31 16:28	08:22 15:54
11	08:32 16:15	07:48 17:14	06:45 18:09	06:28 20:08	20:58 21:03	05:23 21:47	04:44 21:46	05:43 20:58	06:39 19:46	18:35-18:52/17 07:33	07:33 16:26	08:23 15:53
12	08:31 16:17	07:46 17:16	06:42 18:11	06:26 20:09	20:59 21:05	05:21 21:47	04:44 21:45	05:45 20:56	06:41 19:44	18:33-18:54/21 07:35	07:35 16:24	08:24 15:53
13	08:30 16:18	07:44 17:18	06:40 18:13	06:24 20:11	20:59 21:07	05:19 21:48	04:44 21:44	05:47 20:54	06:42 19:41	18:32-18:55/23 07:37	07:37 16:22	08:25 15:53
14	08:29 16:20	07:42 17:20	06:37 18:15	06:21 20:13	21:08 21:10	05:17 21:49	04:43 21:43	05:49 20:52	06:44 19:39	18:31-18:56/25 07:39	07:39 16:21	08:26 15:53
15	08:28 16:22	07:39 17:22	06:35 18:17	06:19 20:15	21:10 21:12	05:16 21:49	05:01 21:42	05:50 20:50	06:46 19:36	18:29-18:56/27 07:41	07:41 16:19	08:27 15:53
16	08:27 16:23	07:37 17:24	06:32 18:19	06:17 20:17	21:12 21:12	05:14 21:50	05:02 21:41	05:52 20:47	06:48 19:34	18:28-18:56/28 07:43	07:43 16:18	08:28 15:53
17	08:26 16:25	07:35 17:26	06:30 18:21	06:14 20:19	21:13 21:13	05:12 21:51	05:03 21:40	05:54 20:45	06:49 19:31	18:27-18:57/30 07:44	07:44 16:16	08:29 15:53
18	08:25 16:27	07:33 17:28	06:27 18:23	06:12 20:21	21:15 21:15	05:11 21:51	05:05 21:39	05:56 20:43	06:51 19:29	18:27-18:57/30 07:46	07:46 16:15	08:30 15:53
19	08:24 16:29	07:31 17:30	06:25 18:24	06:10 20:23	21:17 21:17	05:09 21:51	05:06 21:37	05:58 20:41	06:53 19:26	18:26-18:56/30 07:48	07:48 16:13	08:31 15:53
20	08:23 16:30	07:29 17:32	06:23 18:26	06:07 20:24	21:18 21:18	05:07 21:52	05:07 21:36	05:59 20:39	06:55 19:24	18:26-18:55/29 07:50	07:50 16:12	08:32 15:54
21	08:22 16:32	07:27 17:34	06:20 18:28	06:05 20:26	21:20 21:20	05:06 21:52	05:09 21:35	06:01 20:36	06:57 19:21	18:26-18:55/29 07:52	07:52 16:10	08:33 15:54
22	08:21 16:34	07:24 17:36	06:18 18:30	06:03 20:28	21:22 21:22	05:04 21:52	05:10 21:33	06:03 20:34	06:58 19:19	18:26-18:52/26 07:54	07:54 16:09	08:34 15:54
23	08:19 16:36	07:22 17:38	06:15 18:32	06:00 20:30	21:23 21:23	05:03 21:53	05:12 21:32	06:05 20:32	07:00 19:16	18:27-18:50/23 07:56	07:56 16:08	08:35 15:55
24	08:18 16:38	07:20 17:40	06:13 18:34	05:58 20:32	21:25 21:25	05:02 21:53	05:13 21:30	06:07 20:30	07:02 19:14	18:26-18:47/21 07:58	07:58 16:05	08:36 15:56
25	08:17 16:40	07:18 17:42	06:10 18:36	05:56 20:34	21:26 21:26	05:00 21:53	05:15 21:29	06:08 20:27	07:04 19:11	18:27-18:45/18 08:00	08:00 16:01	08:37 15:57
26	08:15 16:42	07:15 17:44	06:08 18:38	05:54 20:36	21:28 21:28	04:59 21:53	05:16 21:27	06:10 20:25	07:06 19:09	18:29-18:42/13 08:02	08:02 16:04	08:38 15:57
27	08:14 16:44	07:13 17:46	06:05 18:39	05:51 20:37	21:29 21:29	04:58 21:53	05:18 21:26	06:12 20:23	07:07 19:06	18:31-18:40/9 08:04	08:04 16:03	08:39 15:58
28	08:12 16:45	07:11 17:48	06:03 18:41	05:49 20:39	21:30 21:30	04:56 21:53	05:20 21:24	06:14 20:20	07:09 19:04	18:34-18:38/4 08:06	08:06 16:02	08:40 15:58
29	08:11 16:47		06:00 18:43	05:47 20:41	21:32 21:32	04:55 21:52	05:21 21:23	06:16 20:18	07:11 19:01		07:08 16:01	08:41 15:59
30	08:09 16:49		05:58 18:45	05:45 20:43	21:33 21:33	04:54 21:52	05:23 21:21	06:17 20:15	07:13 18:59		07:09 16:00	08:42 16:00
31	08:08 16:51		06:55 19:47	04:53 21:35	21:35 21:35	04:53 21:51	05:24 21:19	06:19 20:13			07:11 16:47	08:43 16:01
	248	271	365	419	494	511	515	462	384	415	330	232
Sonnenscheinstunden												
Anzahl Minuten mit Schatten	0	0	344	63	0	0	0	0	415	0	0	0

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten

Projekt:

19-095-GBK-02

Beschreibung:

Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen
im Rahmen des Repowering-Vorhabens im Windpark Kesdorf

Lizenzierter Anwender:

T&H Ingenieure GmbH
 Bremerhavener Heerstraße 10
 DE-28717 Bremen
 +49 (0) 421 79 400 600
 info@th-ingenieure.de
 Berechnet:
 20.08.2019 10:57/3.2.744

SHADOW - Kalender pro WEA

Berechnung: Zusatzbelastung WEA: 2 - WEA 2

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender

2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:35 10:18-10:44/26 16:02	08:06 16:53	07:08 17:00-17:24/24 17:50	06:53 18:28-19:15/47 19:49	05:43 20:45	04:52 21:36
2	08:35 10:18-10:43/25 16:03	08:04 16:55	07:06 17:01-17:25/24 17:52	06:50 18:28-19:16/48 19:51	05:41 20:47	04:51 21:37
3	08:35 10:19-10:43/24 16:05	08:02 16:57	07:04 17:00-17:25/25 17:54	06:48 18:26-19:16/50 19:53	05:39 20:49	04:50 21:38
4	08:35 10:21-10:44/23 16:06	08:01 16:59	07:01 17:00-17:26/26 17:56	06:45 18:26-19:17/51 19:54	05:37 20:50	04:49 21:39
5	08:35 10:21-10:43/22 16:07	07:59 17:01	06:59 16:59-17:26/27 17:58	06:43 18:25-19:17/52 19:56	05:35 20:52	04:48 21:41
6	08:34 10:23-10:43/20 16:08	07:57 17:03	06:57 16:59-17:26/27 17:59	06:41 18:24-19:17/53 19:58	05:32 20:54	04:47 21:42
7	08:34 10:24-10:42/18 16:10	07:55 17:05	06:54 16:58-17:25/27 18:01	06:38 18:24-19:17/53 20:00	05:31 20:56	04:47 21:43
8	08:33 10:25-10:41/16 16:11	07:53 17:07	06:52 16:59-17:26/27 18:03	06:36 18:23-19:16/53 20:02	05:29 20:58	04:46 21:44
9	08:33 10:27-10:40/13 16:12	07:51 17:09	06:49 16:59-17:25/26 18:05	06:33 18:23-19:16/53 20:04	05:27 20:59	04:45 21:45
10	08:32 10:30-10:39/9 16:14	07:50 17:12	06:47 16:59-17:24/25 18:07	06:31 18:23-19:16/53 20:06	05:25 21:01	04:45 21:46
11	08:32 16:15	07:48 17:14	06:45 17:00-17:24/24 18:09	06:28 18:22-19:15/53 20:08	05:23 21:03	04:44 21:46
12	08:31 16:17	07:46 17:16	06:42 17:00-17:22/22 18:11	06:26 18:23-19:15/52 20:09	05:21 21:05	04:44 21:47
13	08:30 16:18	07:44 17:18	06:40 17:02-17:21/19 18:13	06:24 18:23-19:15/52 20:11	05:19 21:06	04:44 21:48
14	08:29 16:20	07:41 17:20	06:37 17:03-17:18/15 18:15	06:21 18:23-19:14/51 20:13	05:17 21:08	04:43 21:49
15	08:28 16:22	07:39 17:22	06:35 17:07-17:14/7 18:17	06:19 18:23-19:14/51 20:15	05:16 21:10	04:43 21:49
16	08:27 16:23	07:37 17:24	06:32 18:19	06:17 18:24-19:13/49 20:17	05:14 21:12	04:43 21:50
17	08:26 16:25	07:35 17:26	06:30 18:21	06:14 18:23-19:11/48 20:19	05:12 21:13	04:43 21:51
18	08:25 16:27	07:33 17:28	06:27 18:23	06:12 18:24-19:11/47 20:21	05:11 21:15	04:43 21:51
19	08:24 16:29	07:31 17:30	06:25 18:24	06:09 18:25-19:10/45 20:22	05:09 21:17	04:42 21:51
20	08:23 16:30	07:29 17:32	06:23 18:26	06:07 18:26-19:09/43 20:24	05:07 21:18	04:43 21:52
21	08:22 16:32	07:27 17:34	06:20 18:28	06:05 18:26-19:07/41 20:26	05:06 21:20	04:43 21:52
22	08:21 16:34	07:24 17:05-17:10/5 17:36	06:18 18:30	06:03 18:28-19:06/38 20:28	05:04 21:21	04:43 21:52
23	08:19 16:36	07:22 17:03-17:11/8 17:38	06:15 18:32	06:00 18:29-19:04/35 20:30	05:03 21:23	04:43 21:53
24	08:18 16:38	07:20 17:02-17:14/12 17:40	06:13 17:46-18:03/17 18:34	05:58 18:31-19:03/32 20:32	05:02 21:25	04:43 21:53
25	08:17 16:40	07:18 17:02-17:16/14 17:42	06:10 17:42-18:07/25 18:36	05:56 18:33-19:01/28 20:34	05:00 21:26	04:43 21:53
26	08:15 16:42	07:15 17:01-17:18/17 17:44	06:08 17:39-18:09/30 18:38	05:54 18:35-18:58/23 20:36	04:59 21:28	04:44 21:53
27	08:14 16:44	07:13 17:01-17:20/19 17:46	06:05 17:37-18:11/34 18:39	05:51 18:39-18:55/16 20:37	04:58 21:29	04:44 21:53
28	08:12 16:45	07:11 17:00-17:21/21 17:48	06:03 17:34-18:12/38 18:41	05:49 18:46-18:48/2 20:39	04:56 21:30	04:45 21:53
29	08:11 16:47		06:00 17:33-18:14/41 18:43	05:47 20:41	04:55 21:32	04:45 21:52
30	08:09 16:49		05:58 17:31-18:14/43 18:45	05:45 20:43	04:54 21:33	04:46 21:52
31	08:08 16:51		06:55 18:30-19:15/45 19:47		04:53 21:35	
Sonnenscheinstunden	248	271	365	419	494	511
Anzahl Minuten mit Schatten	196	96	618	1219	0	0

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten

SHADOW - Kalender pro WEA

Berechnung: Zusatzbelastung WEA: 2 - WEA 2

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender: 2019
 Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:
 Die Sonne scheint täglich von Sonnenauf- bis -untergang
 Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
 Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:47 21:52	05:26 21:17	06:21 18:22-19:14/52 20:11	07:15 17:43-17:58/15 18:56	07:13 16:45	08:09 15:59
2	04:47 21:52	05:28 21:16	06:23 18:21-19:14/53 20:08	07:16 17:41-18:00/19 18:54	07:15 16:43	08:11 15:58
3	04:48 21:51	05:29 21:14	06:24 18:21-19:14/53 20:06	07:18 17:39-18:01/22 18:51	07:17 16:41	08:12 10:15-10:20/5 15:57
4	04:49 21:51	05:31 21:12	06:26 18:20-19:13/53 20:03	07:20 17:38-18:02/24 18:49	07:19 16:39	08:14 10:12-10:23/11 15:57
5	04:50 21:50	05:33 21:10	06:28 18:20-19:13/53 20:01	07:22 17:36-18:01/25 18:47	07:21 16:37	08:15 10:11-10:25/14 15:56
6	04:51 21:50	05:35 21:08	06:30 18:20-19:13/53 19:58	07:24 17:35-18:01/26 18:44	07:23 16:35	08:17 10:10-10:27/17 15:56
7	04:51 21:49	05:36 21:06	06:32 18:20-19:13/53 19:56	07:26 17:35-18:02/27 18:42	07:25 16:33	08:18 10:09-10:28/19 15:55
8	04:52 21:48	05:38 21:04	06:33 18:19-19:11/52 19:54	07:28 17:34-18:01/27 18:39	07:27 16:31	08:19 10:09-10:30/21 15:54
9	04:53 21:48	05:40 21:02	06:35 18:20-19:11/51 19:51	07:29 17:34-18:01/27 18:37	07:29 16:29	08:21 10:09-10:31/22 15:54
10	04:55 21:47	05:42 21:00	06:37 18:20-19:10/50 19:49	07:31 17:34-18:01/27 18:34	07:31 16:28	08:22 10:08-10:31/23 15:54
11	04:56 21:46	05:43 20:58	06:39 18:19-19:09/50 19:46	07:33 17:34-18:00/26 18:32	07:33 16:26	08:23 10:09-10:33/24 15:53
12	04:57 21:45	05:45 20:56	06:41 18:20-19:08/48 19:44	07:35 17:35-17:59/24 18:30	07:35 16:24	08:24 10:08-10:34/26 15:53
13	04:58 21:44	05:47 20:54	06:42 18:21-19:07/46 19:41	07:37 17:34-17:58/24 18:27	07:37 16:22	08:25 10:08-10:35/27 15:53
14	04:59 21:43	05:49 20:52	06:44 18:22-19:06/44 19:39	07:39 17:34-17:57/23 18:25	07:39 16:21	08:26 10:08-10:35/27 15:53
15	05:00 21:42	05:50 20:50	06:46 18:22-19:04/42 19:36	07:41 17:33-17:55/22 18:22	07:41 16:19	08:27 10:09-10:36/27 15:53
16	05:02 21:41	05:52 20:47	06:48 18:23-19:02/39 19:34	07:42 17:33-17:52/19 18:20	07:43 16:18	08:28 10:09-10:37/28 15:53
17	05:03 21:40	05:54 18:46-19:01/15 20:45	06:49 18:24-19:01/37 19:31	07:44 17:33-17:50/17 18:18	07:44 16:16	08:29 10:09-10:37/28 15:53
18	05:04 21:39	05:56 18:43-19:04/21 20:43	06:51 18:26-18:59/33 19:29	07:46 17:33-17:48/15 18:15	07:46 16:14	08:30 10:10-10:38/28 15:53
19	05:06 21:37	05:58 18:39-19:06/27 20:41	06:53 18:27-18:55/28 19:26	07:48 17:33-17:45/12 18:13	07:48 16:13	08:31 10:10-10:39/29 15:53
20	05:07 21:36	05:59 18:37-19:08/31 20:39	06:55 18:30-18:52/22 19:24	07:50 17:34-17:43/9 18:11	07:50 16:12	08:32 10:10-10:39/29 15:54
21	05:09 21:35	06:01 18:35-19:09/34 20:36	06:57 18:33-18:48/15 19:21	07:52 17:35-17:40/5 18:09	07:52 16:10	08:32 10:11-10:40/29 15:54
22	05:10 21:33	06:03 18:33-19:10/37 20:34	06:58 19:19	07:54 17:37-17:38/1 18:06	07:54 16:09	08:33 10:11-10:40/29 15:54
23	05:12 21:32	06:05 18:32-19:11/39 20:32	07:00 19:16	07:56 18:04	07:56 16:08	08:33 10:12-10:41/29 15:55
24	05:13 21:30	06:07 18:30-19:12/42 20:29	07:02 19:14	07:58 18:02	07:57 16:06	08:34 10:12-10:41/29 15:55
25	05:15 21:29	06:08 18:28-19:12/44 20:27	07:04 19:11	08:00 18:00	07:59 16:05	08:34 10:13-10:42/29 15:56
26	05:16 21:27	06:10 18:27-19:13/46 20:25	07:06 19:09	08:02 17:58	08:01 16:04	08:35 10:13-10:42/29 15:57
27	05:18 21:26	06:12 18:27-19:14/47 20:22	07:07 19:06	07:04 16:55	08:03 16:03	08:35 10:14-10:42/28 15:57
28	05:20 21:24	06:14 18:26-19:15/49 20:20	07:09 19:04	07:06 16:53	08:04 16:02	08:35 10:14-10:42/28 15:58
29	05:21 21:23	06:16 18:24-19:14/50 20:18	07:11 19:01	07:07 16:51	08:06 16:01	08:35 10:15-10:43/28 15:59
30	05:23 21:21	06:17 18:24-19:15/51 20:15	07:13 17:46-17:55/9 18:59	07:09 16:49	08:08 16:00	08:35 10:16-10:43/27 16:00
31	05:24 21:19	06:19 18:23-19:15/52 20:13		07:11 16:47		08:35 10:17-10:43/26 16:01
Sonnenscheinstunden	515	462	384	330	259	232
Anzahl Minuten mit Schatten	0	585	936	436	0	716

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten

Projekt: 19-095-GBK-02	Beschreibung: Schattenwurfgutachten für die Errichtung und den Betrieb neuer Windenergieanlagen im Rahmen des Repowering-Vorhabens im Windpark Kesdorf	Lizenzierter Anwender: T&H Ingenieure GmbH Bremerhavener Heerstraße 10 DE-28717 Bremen +49 (0) 421 79 400 600 info@th-ingenieure.de Berechnet: 20.08.2019 10:57/3.2.744
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SHADOW - Kalender pro WEA

Berechnung: Zusatzbelastung WEA: 3 - WEA 3

Voraussetzungen für Berechnung des Schattenwurfs

Referenzjahr für Kalender 2019

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:35 16:02	08:06 16:53	07:08 16:30-16:54/24 17:50	06:53 19:49	05:43 20:45	04:52 21:36	04:47 21:52	05:26 21:17	06:21 20:11	07:15 18:56	07:13 15:56-16:15/19 16:45	08:09 15:59
2	08:35 16:03	08:04 16:55	07:06 16:31-16:53/22 17:52	06:50 19:51	05:41 20:47	04:51 21:37	04:47 21:52	05:28 21:16	06:23 20:08	07:17 18:54	07:15 15:57-16:13/16 16:43	08:11 15:58
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Anzahl Minuten mit Schatten 0 570 73 0 0 0 0 0 0 0 582 70 0												

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten