

SCHATTENWURFPROGNOSE NR. 216094-04.03

über die optischen Immissionen in der Umgebung von zwei geplanten Windenergieanlagen, eine vom Typ Nordex N149/5.X STE und eine vom Typ Nordex N163/5.X STE, im Windpark Brilon-Madfeld am Standort 59929 Brilon-Madfeld

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1.) Zusammenfassung

Die vorliegende Untersuchung bezieht sich auf den Betrieb von zwei geplanten Windenergieanlagen (WEA), eine vom Typ Nordex N149/5.X STE und eine vom Typ Nordex N163/5.X STE, am Standort 59929 Brilon-Madfeld (Windpark Brilon-Madfeld). Es wird die Schattenausbreitung der astronomisch maximal möglichen Beschattungsdauer nach LAI [1] im Rahmen der Gesamtbelastung an den ermittelten Immissionsorten untersucht. Am Standort sind 42 weitere, bestehende oder beantragte WEA als Vorbelastung zu berücksichtigen.

Bei Normalbetrieb der WEA ergeben die Berechnungen unzulässige Überschreitungen der Immissionsrichtwerte durch den kumulativen periodischen Schattenwurf (Gesamtbelastung mit Einfluss der Zusatzbelastung) an insgesamt 17 untersuchten Immissionsorten. Die jährlichen Grenzwerte der Schattenwurfdauer werden an SR-01 mit maximal 162:52:00 Stunden pro Jahr überschritten (der jährliche Grenzwert wird an 16 Immissionsorten seitens der Gesamtbelastung überschritten). Die täglichen Grenzwerte werden mit maximal 122 Minuten an SR-01 überschritten (der tägliche Grenzwert wird an insgesamt 15 Immissionsorten seitens der Gesamtbelastung überschritten). Eine Überprüfung der Schutzwürdigkeit der an der relevanten Fassadenseite liegenden Räume wurde nicht durchgeführt. Die Untersuchung entspricht der Maximalbetrachtung (worst case) mit Immissionsrichtwerten von 30 Stunden pro Kalenderjahr und 30 Minuten pro Kalendertag.

Zur Einhaltung der Immissionsrichtwerte durch die Gesamtbelastung ist die Installation einer Abschaltvorrichtung bei Schattenschlag erforderlich.

Grundlage der Berechnung sind die in Kapitel 4.3 und 4.4 aufgeführten Anlagendaten.

Nachfolgender Bericht wurde nach bestem Wissen und Gewissen mit größter Sorgfalt erstellt. *

Rheine, 02.10.2020 TS/BB

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2.) Situation und Aufgabenstellung

Die Bürgerwind Hamm-Stemmel GmbH & Co. KG plant die Errichtung von zwei Windenergieanlagen (WEA), eine vom Typ Nordex N149/5.X STE (WEA 01) mit einer Nabenhöhe von 125 m und einer elektrischen Leistung von $P_{el} = 5.700 \text{ kW}$ und eine vom Typ Nordex N163/5.X STE (WEA 02) mit einer Nabenhöhe von 164 m und einer elektrischen Leistung von $P_{el} = 5.700 \text{ kW}$, am Standort 59929 Brilon-Madfeld, Hochsauerlandkreis in Nordrhein-Westfalen. Zum Erlangen der Genehmigung für die Errichtung der neuen Windenergieanlagen ist der Nachweis der Schattenwurfausbreitung notwendig. Für die Berechnungen werden die Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen nach dem Länderausschuss für Immissionsschutz (LAI) [1] angewendet.

In der Umgebung des Standortes befinden sich 42 Windenergieanlagen, die als Vorbelastung an den Immissionsorten zu berücksichtigen sind.

In der Prognose soll ermittelt werden, ob die Gesamtbelastung die Immissionsrichtwerte des kumulativen periodischen Schattenwurfes (Grenzwertüberschreitung der Gesamtbelastung mit Einfluss der Zusatzbelastung) an den umliegenden Immissionspunkten einhält.

In der Nachbarschaft des geplanten Standortes befinden sich mehrere immissionsrelevante Gehöfte und Wohnhäuser, welche um die geplante WEA angeordnet sind. Eine Beurteilung der Schutzwürdigkeit hat nicht stattgefunden.

Die Ergebnisse der Untersuchung sind in Form eines Schattenwurfgutachtens vorzulegen.

3.) **Berechnungs- und Beurteilungsgrundlagen**

Für die Berechnung und Bearbeitung werden folgende Vorschriften, Normen und Unterlagen herangezogen:

- [1] Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen (WEA-Schattenwurf-Hinweise), verabschiedet auf der 103. Sitzung des Länderausschusses für Immissionsschutz (LAI), 06. - 08.05.2002
- [2] Bundes-Immissionsschutzgesetz in der Fassung der Bekanntmachung vom 17. Mai 2013 (BGBl. S. 1274), das durch Artikel 1 des Gesetzes vom 20. November 2014 (BGBl. S. 1740) geändert worden ist
- [3] WindPRO 3.4.388, Herausgeber EMD International A/S (DK)
- [4] Ausschnitt aus der Deutschen Grundkarte in digitaler Form im Maßstab 1:5.000 (DGK5) (untere linke Ecke: RW = 474.000, HW = 5.694.000; obere rechte Ecke: RW = 482.000, HW = 5.702.000), Herausgeber: Bezirksregierung Köln, Dezernat 74 - Geodatenzentrum, Geodateninfrastruktur, Geobasis NRW © 2017
- [5] Ortstermin zur Besichtigung der Immissionspunkte am 23.02.2017 durch KÖTTER Consulting Engineers GmbH & Co. KG, Herrn Dipl.-Ing. Martin Westermann

4.) Berechnungsvoraussetzungen für optische Immissionen

4.1. Grundlagen

Die optischen Immissionen von WEA beziehen sich auf den dynamischen Rotorschlag (periodischer Schattenwurf). Der statische, vom Turm erzeugte Schatten bildet keinen relevanten und zu berücksichtigenden Effekt, da primär die frequentierenden Lichtwechsel als Immissionen gelten und beim Menschen zu Belästigungswirkungen führen können [2].

Die Schattenlänge einer WEA hängt stark von der jeweiligen Jahreszeit ab. So sind die Einwirkbereiche in den Wintermonaten länger, da der Sonnenstand zu einem späteren Zeitpunkt morgens und zu einem früheren Zeitpunkt abends niedriger ist als in den Sommermonaten. Die Berechnung berücksichtigt einen Sonnenstand von mindestens 3°.

Eine Untersuchung der optischen Immissionen soll an Immissionsorten mit schutzwürdigen Räumen oder an Bereichen, die planungsrechtlich Potential für eine entsprechende Bebauung geben, stattfinden [1]. Die Schutzwürdigkeit besteht bei:

- Wohnräumen
- Schlafräumen
- Unterrichtsräumen
- Büroräumen, Praxisräumen, Arbeitsräumen etc.

An den einzelnen Immissionsorten wurde die Schutzwürdigkeit nicht untersucht. Für alle Fassadenseiten wird eine worst-case-Betrachtung durchgeführt.

Eine Unterscheidung zwischen Kern- und Halbschatten findet in der Berechnung des worst-case-Szenarios keine Anwendung.

4.2. Astronomisch maximal mögliche Beschattungsdauer

Auf Grundlage der Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen des Länderausschusses für Immissionsschutz (LAI), Arbeitskreis Lichtimmissionen [1], sind die Berechnungen für eine Maximalbetrachtung durch die astronomisch maximal möglichen Beschattungszeiten durchzuführen.

Sofern die Grenzwerte für die astronomisch maximal mögliche Beschattungsdauer

30 Stunden / Jahr und

30 Minuten / Tag

von allen WEA im Umkreis an den Immissionsorten überschritten werden, wird davon ebenfalls eine Überschreitung der realen Beschattungszeiten abgeleitet (8 Stunden / Jahr). In entsprechenden Fällen werden Abschaltvorrichtungen in den WEA installiert und zeitliche Strategien entwickelt.

Die folgenden Annahmen werden für eine Betrachtung der astronomisch maximal möglichen Beschattungsdauer vorausgesetzt:

- Die Sonne scheint durchgehend täglich von Sonnenauf- bis -untergang.
- Ausreichender Wind für eine dauerhafte Bewegung der Rotoren (100 % Verfügbarkeit).
- Die WEA sind immer in Betrieb und stehen mit der Rotorfläche immer senkrecht zur Sonneneinstrahlungsrichtung.
- Minimale relevante Sonnenhöhe über Horizont mit 3°.
- Es werden keine Hindernisse angenommen, die eine abschirmende Wirkung besitzen.
- An den Gebäuden mit schutzwürdigen Räumen werden die Schattenrezeptoren im Gewächshausmodus platziert, d. h. der Schatten wirkt von allen Seiten ein.

Die Berechnung der optischen Immissionen erfolgt mit Hilfe des Berechnungsprogramms WindPRO, Version 3.4.388 [3]. Als Immissionspunkt wird ein Schattenrezeptor (SR) an der kritischen Fensterseite der jeweiligen Gebäude mit schutzwürdigen Räumen angesetzt. Im Modell wird dieser mit einer Breite x Höhe von 0,1 m x 0,1 m in 2 m Höhe über Grund platziert.

Die Sonne wird als Punktquelle angesehen und die Rotorfläche als Kreisfläche im Zuge der Maximalbetrachtung betrachtet.

4.3. Windenergieanlagen der Vorbelastung

In der nahen Umgebung des Standortes befinden sich 42 Windenergieanlagen, die als Vorbelastung zu berücksichtigen sind. Die WEA-Typen und die Nabenhöhen sind vom Hochsauerlandkreis vorgegeben. Die UTM/ETRS89-Koordinaten (Zone 32) befinden sich im SHADOW-Hauptergebnis in Anlage A2.

Typ	Enercon E-82 E2 TES
Bezeichnung	WEA 01 bis WEA 04, WEA 06, WEA L-01 bis WEA L-04
Hersteller	Enercon GmbH
Nabenhöhe h_N [m]	138,4
Rotordurchmesser [m]	82,0
Nennleistung [kW]	2.300
Maximale Blatttiefe [m]	3,58 [3]
Schattenbereich [m]	1.599

(Teil 1 von Tabelle 1)

Typ	Enercon E-40
Bezeichnung	WEA 05
Hersteller	Enercon GmbH
Nabenhöhe h_N [m]	48,0
Rotordurchmesser [m]	40,0
Nennleistung [kW]	500
Maximale Blatttiefe [m]	1,96 [3]
Schattenbereich [m]	898

(Teil 2 von Tabelle 1)

Typ	Nordex N29
Bezeichnung	WEA 07 und WEA 08
Hersteller	Nordex Energy GmbH
Nabenhöhe h_N [m]	50,0
Rotordurchmesser [m]	29,0
Nennleistung [kW]	250
Maximale Blatttiefe [m]	1,20 [3]
Schattenbereich [m]	2.500

(Teil 3 von Tabelle 1)

Typ	DEWind
Bezeichnung	WEA 09
Hersteller	DEWind AG
Nabenhöhe h_N [m]	91,5
Rotordurchmesser [m]	64,3
Nennleistung [kW]	1.250
Maximale Blatttiefe [m]	2,40 [3]
Schattenbereich [m]	2.500

(Teil 4 von Tabelle 1)

Typ	FL MD 77
Bezeichnung	WEA 11, WEA 13
Hersteller	Fuhrländer AG
Nabenhöhe h_N [m]	100,0
Rotordurchmesser [m]	77,0
Nennleistung [kW]	1.500
Maximale Blatttiefe [m]	3,2 [3]
Schattenbereich [m]	2.500

(Teil 5 von Tabelle 1)

Typ	E-66/20.70
Bezeichnung	WEA 12, WEA 28 bis WEA 36
Hersteller	Enercon GmbH
Nabenhöhe h_N [m]	98,0
Rotordurchmesser [m]	70,0
Nennleistung [kW]	2.000
Maximale Blatttiefe [m]	3,3 [3]
Schattenbereich [m]	2.500

(Teil 6 von Tabelle 1)

Typ	Enercon E-82
Bezeichnung	WEA 14 bis WEA 19
Hersteller	Enercon GmbH
Nabenhöhe h_N [m]	98,3
Rotordurchmesser [m]	82,0
Nennleistung [kW]	2.000
Maximale Blatttiefe [m]	3,46 [3]
Schattenbereich [m]	1.550

(Teil 7 von Tabelle 1)

Typ	Enercon E-48
Bezeichnung	WEA 20
Hersteller	Enercon GmbH
Nabenhöhe h_N [m]	75,6
Rotordurchmesser [m]	48,0
Nennleistung [kW]	800
Maximale Blatttiefe [m]	2,19 [3]
Schattenbereich [m]	1.047

(Teil 8 von Tabelle 1)

Typ	Nordex N131/3300
Bezeichnung	WEA 03
Hersteller	Nordex Energy GmbH
Nabenhöhe h_N [m]	164,0
Rotordurchmesser [m]	131,0
Nennleistung [kW]	3.300
Maximale Blatttiefe [m]	3,94 [3]
Schattenbereich [m]	1.719

(Teil 9 von Tabelle 1)

Typ	E-138 EP3 E2	
Bezeichnung	WEA ZB 01 bis WEA ZB05	WEA 01 bis WEA 04
Hersteller	Enercon GmbH	
Nabenhöhe h_N [m]	160,0	
Rotordurchmesser [m]	138,3	
Nennleistung [kW]	4.200	
Maximale Blatttiefe [m]	3,93	
Schattenbereich [m]	1.679	

Tabelle 1: Anlagendaten der Windenergieanlagen der Vorbelastung am Standort Brilon-Madfeld

4.4. Windenergieanlagen der Zusatzbelastung

Die relevante Zusatzbelastung im Windpark Brilon-Madfeld besteht aus einer Nordex N149/5.X (WEA 01) mit 125 m Nabenhöhe und 149 m Rotordurchmesser und einer Nordex N163/5.X (WEA 02) mit 164 m Nabenhöhe und 163 m Rotordurchmesser. Die Nabenhöhen sind vom Auftraggeber vorgegeben. Die UTM/ETRS89-Koordinaten (Zone 32) befinden sich im SHADOW-Hauptergebnis in Anlage A2.

Typ	Nordex N149/5.X	Nordex N163/5.X
Bezeichnung	WEA 01	WEA 02
Hersteller	Nordex Energy GmbH	Nordex Energy GmbH
Nabenhöhe h_N [m]	125,0	164,0
Rotordurchmesser [m]	149,0	163,0
Nennleistung [kW]	5.700	5.700
Maximale Blatttiefe [m]	4,15 [3]	4,15 [3]
Schattenbereich [m]	1.808	1.784

Tabelle 2: Anlagendaten der geplanten WEA im Windpark Brilon-Madfeld

Der Schattenbereich berechnet sich aus den Abmaßen der WEA (Rotordurchmesser, Nabenhöhe und Blatttiefe) und dem variierenden Sonnenstand.

4.5. Immissionsorte

Die Aufnahme der relevanten Immissionsorte, die die Grenzwerte überschreiten, erfolgt auf Grundlage der Schattenausbreitungsdarstellung. Demnach werden alle Gebäude mit schutzwürdigen Räumen oberhalb und im Bereich der jährlichen und täglichen Grenzwerte der Gesamtbelastung, bei denen die Zusatzbelastung einen Einfluss hat, im Rahmen der weiteren Untersuchung der einzelnen Schattenwurfzeiten aufgenommen. In Abstimmung mit dem Auftraggeber wird die Anzahl der Immissionsorte aufgrund der nahezu gleichen Belastungswerte sowie der konzentrierten Lage im Ortsteil Radlinghausen auf 17 maßgebliche Schattenrezeptoren reduziert.

Die Tabelle 3 zeigt eine Auswahl untersuchter Schattenrezeptoren mit deren Adressen und den UTM/ETRS89-Koordinaten (Zone 32) auf.

Die vollständigen Ergebnisse sind im Anhang dargestellt.

Bezeichnung	Adresse	UTM-Koordinaten	
		Ost	Nord
SR-01	Radlinghauser Straße 4, 59929 Brilon	478.592	5.698.307
SR-02	Radlinghauser Straße 7, 59929 Brilon	479.104	5.698.105
SR-03	Almer Straße 41, 59929 Brilon	479.342	5.698.373
SR-04	Lohweg 1, 59929 Brilon	479.507	5.698.903
SR-05	Almer Straße 39, 59929 Brilon	479.591	5.698.231
SR-06	Radlinghauser Straße 3, 59929 Brilon	479.591	5.698.027
SR-07	Radlinghauser Straße 1, 59929 Brilon	479.673	5.698.098
SR-08	Almer Straße 26, 59929 Brilon	479.708	5.698.284
SR-09	Almer Straße 24, 59929 Brilon	479.817	5.698.224
SR-10	Almer Straße 29, 59929 Brilon	480.048	5.698.117
SR-11	Stemmelstraße 22, 59929 Brilon	479.934	5.697.873
SR-12	Am Ruhberg 16, 59929 Brilon	477.039	5.697.758
SR-13	Am Ruhberg 10, 59929 Brilon	477.098	5.697.781
SR-14	Radlinghauser Straße 15, 59929 Brilon	477.169	5.697.849
SR-15	Radlinghauser Straße 11, 59929 Brilon	477.234	5.697.877
SR-16	Radlinghauser Straße 15, 59929 Brilon	477.215	5.697.900
SR-17	Radlinghauser Straße 3, 59929 Brilon	477.350	5.697.950

Tabelle 3: Relevante Immissionsorte am Standort Brilon-Madfeld

Aus den Koordinaten der untersuchten Immissionsorte (IO) und der WEA der Zusatzbelastung, s. Anlage A, ergeben sich folgende horizontale Abstände:

Bezeichnung	WEA 01	WEA 02
SR-01	544	900
SR-02	553	996
SR-03	908	1353
SR-04	1413	1858
SR-05	1035	1460
SR-06	962	1360
SR-07	1061	1465
SR-08	1164	1587
SR-09	1239	1651
SR-10	1426	1815
SR-11	1273	1628
SR-12	1626	1366
SR-13	1567	1314
SR-14	1498	1266
SR-15	1435	1215
SR-16	1456	1241
SR-17	1328	1139

Tabelle 4: Horizontale Abstände der Zusatzbelastung im Windpark Brilon-Madfeld zu den untersuchten Immissionsorten (Angaben auf volle Meter gerundet)

5.) Berechnung der Schattenwurfimmissionen

Auf Grundlage des Kapitels 4.) wurden folgende Ergebnisse ermittelt. In den Berechnungen wurden keine vorhandenen Abschaltzeiten berücksichtigt, sie stellen somit das worst-case-Szenario dar.

5.1. Astronomisch maximal mögliche Beschattungsdauer der Vorbelastung

Im Folgenden wird die maximal mögliche jährliche Schattenwurfdauer (Grenzwert 30 Stunden/Jahr) und maximal mögliche tägliche Schattendauer (30 Minuten/Tag) der Vorbelastung mit 42 WEA dargestellt:

Immissi- onsorte	Maximal mögli- che Schatten- dauer jährlich VB [h/a]	Grenzwertüber- schreitung 30 h/a VB [h/a]	Maximal mögli- che Schatten- dauer täglich VB [min/d]	Grenzwertüber- schreitung 30 min/d VB [min/d]
SR-01	68:12:00	38:12:00	00:53	00:23
SR-02	63:04:00	33:04:00	00:47	00:17
SR-03	27:56:00	--	00:23	--
SR-04	13:34:00	--	00:22	--
SR-05	40:11:00	10:11:00	00:31	00:01
SR-06	30:10:00	0:10:00	00:43	00:13
SR-07	26:09:00	--	00:39	00:09
SR-08	29:33:00	--	00:28	--
SR-09	19:30:00	--	00:32	00:02
SR-10	11:46:00	--	00:29	--
SR-11	13:04:00	--	00:27	--
SR-12	51:08:00	21:08:00	00:32	00:02
SR-13	45:18:00	15:18:00	00:24	--
SR-14	46:37:00	16:37:00	00:25	--
SR-15	50:44:00	20:44:00	00:35	00:05
SR-16	50:42:00	20:42:00	00:33	00:03
SR-17	34:58:00	4:58:00	00:31	00:01

Tabelle 5: Schattenwurfzeiten der Vorbelastung; Überschreitung der Grenzwerte an den Immissionsorten

Die 42 WEA der Vorbelastung führen an insgesamt 12 Schattenrezeptoren zu unzulässigen Überschreitungen der Grenzwerte. Die jährlichen Grenzwerte der Schattenwurfdauer werden an SR-01 mit maximal 38:12:00 Stunden pro Jahr überschritten. Die täglichen Grenzwerte werden mit maximal 23 Minuten an SR-01 überschritten.

5.2. Astronomisch maximal mögliche Beschattungsdauer der Zusatzbelastung

Im Folgenden wird die maximal mögliche jährliche Schattenwurfdauer (Grenzwert 30 Stunden/Jahr) und maximal mögliche tägliche Schattendauer (30 Minuten/Tag) der Zusatzbelastung durch die beiden geplanten WEA 01 und WEA 02 im Windpark Brilon-Madfeld dargestellt:

Immissionsorte	Maximal mögliche Schattenwurfdauer jährlich ZB [h/a]	Grenzwertüberschreitung 30 h/a ZB [h/a]	Maximal mögliche Schattenwurfdauer täglich ZB [min/d]	Grenzwertüberschreitung 30 min/d ZB [min/d]
SR-01	124:40:00	94:40:00	01:51	01:21
SR-02	78:32:00	48:32:00	01:02	00:32
SR-03	39:43:00	9:43:00	00:42	00:12
SR-04	9:09:00	--	00:21	--
SR-05	32:02:00	2:02:00	00:51	00:21
SR-06	33:50:00	3:50:00	00:45	00:15
SR-07	29:04:00	--	00:46	00:16
SR-08	26:10:00	--	00:47	00:17
SR-09	22:35:00	--	00:43	00:13
SR-10	8:56:00	--	00:24	--
SR-11	19:57:00	--	00:27	--
SR-12	17:46:00	--	00:27	--
SR-13	19:24:00	--	00:29	--
SR-14	21:34:00	--	00:29	--
SR-15	23:42:00	--	00:31	00:01
SR-16	22:58:00	--	00:30	--
SR-17	28:01:00	--	00:33	00:03

Tabelle 6: Schattenwurfzeiten der Zusatzbelastung; Überschreitung der Grenzwerte an den Immissionsorten

Die WEA der Zusatzbelastung führt an insgesamt zehn Schattenrezeptoren zu unzulässigen Überschreitungen der Grenzwerte. Die jährlichen Grenzwerte der Schattenwurfdauer werden an SR-01 mit maximal 94:40:00 Stunden pro Jahr überschritten. Die täglichen Grenzwerte werden mit maximal 81 Minuten an SR-01 überschritten.

5.3. Astronomisch maximal mögliche Beschattungsdauer der Gesamtbelastung

Tabelle 7 zeigt die auf Basis der Schattenwurfzeiten von Vor- und Zusatzbelastung kumulativ überschrittenen Grenzwerte.

Immissionsorte	Maximal mögliche Schattenwurfdauer jährlich GB [h/a]	Grenzwertüberschreitung 30 h/a GB [h/a]	Maximal mögliche Schattenwurfdauer täglich GB [min/d]	Grenzwertüberschreitung 30 min/d GB [min/d]
SR-01	192:52:00	162:52:00	02:32	02:02
SR-02	141:27:00	111:27:00	01:14	00:44
SR-03	75:25:00	45:25:00	00:47	00:17
SR-04	175:19:00	145:19:00	01:56	01:26
SR-05	71:39:00	41:39:00	00:53	00:23
SR-06	62:40:00	32:40:00	00:45	00:15
SR-07	53:39:00	23:39:00	00:46	00:16
SR-08	55:10:00	25:10:00	00:48	00:18
SR-09	41:07:00	11:07:00	00:43	00:13
SR-10	20:01:00	--	00:29	--
SR-11	33:01:00	3:01:00	00:42	00:12
SR-12	65:39:00	35:39:00	00:32	00:02
SR-13	59:55:00	29:55:00	00:31	00:01
SR-14	61:48:00	31:48:00	00:29	--
SR-15	67:11:00	37:11:00	00:35	00:05
SR-16	67:18:00	37:18:00	00:33	00:03
SR-17	60:44:00	30:44:00	00:49	00:19

Tabelle 7: Schattenwurfzeiten der Gesamtbelastung; Überschreitung der Grenzwerte an den Immissionsorten

Die Berechnung zeigt an allen Schattenrezeptoren, mit Ausnahme von SR-10, unzulässige Überschreitungen durch periodischen Schattenwurf der Gesamtbelastung bei mindestens einem zu berücksichtigenden Grenzwert auf. Das Ergebnis stellt eine Maximalbeurteilung dar. Die jährlichen Grenzwerte der Schattenwurfdauer werden an SR-01 mit maximal 162:52:00 Stunden pro Jahr überschritten. Die täglichen Grenzwerte werden mit maximal 122 Minuten an SR-01 überschritten.

6.) Bewertung

Im Zuge der Bewertung weist die Zusatzbelastung eine Relevanz auf, sofern die geplanten WEA (Tabelle 8 und Tabelle 9) zu einer Überschreitung der jährlichen Grenzwerte von 30 Stunden/Jahr oder die täglichen Grenzwerte von 30 Minuten/Tag führt. Weiterhin besteht für die Zusatzbelastung eine Relevanz, sofern zusätzliche Schattenwurfzeiten an den schon seitens der Vorbelastung überschrittenen Immissionsorten zu erwarten sind.

6.1. Maximal mögliche jährliche Schattendauer

Im Folgenden wird die maximal mögliche jährliche Schattenwurfdauer in Bezug auf durch die Zusatzbelastung verursachte Überschreitungen bewertet:

IO	Maximal mögliche Schatten-dauer jährlich VB [h/a]	Maximal mögliche Schatten-dauer jährlich GB [h/a]	Grenzwertüber-schreitung 30 h/a GB [h/a]	Erhöhung durch ZB [h/a]	Relevanz
SR-01	68:12:00	192:52:00	162:52:00	124:40:00	ja
SR-02	63:04:00	141:27:00	111:27:00	78:23:00	ja
SR-03	27:56:00	75:25:00	45:25:00	47:29:00	ja
SR-04	13:34:00	175:19:00	145:19:00	161:45:00	ja
SR-05	40:11:00	71:39:00	41:39:00	31:28:00	ja
SR-06	30:10:00	62:40:00	32:40:00	32:30:00	ja
SR-07	26:09:00	53:39:00	23:39:00	27:30:00	ja
SR-08	29:33:00	55:10:00	25:10:00	25:37:00	ja
SR-09	19:30:00	41:07:00	11:07:00	21:37:00	ja
SR-10	11:46:00	20:01:00	--	8:15:00	nein
SR-11	13:04:00	33:01:00	3:01:00	19:57:00	ja
SR-12	51:08:00	65:39:00	35:39:00	14:31:00	ja
SR-13	45:18:00	59:55:00	29:55:00	14:37:00	ja
SR-14	46:37:00	61:48:00	31:48:00	15:11:00	ja
SR-15	50:44:00	67:11:00	37:11:00	16:27:00	ja
SR-16	50:42:00	67:18:00	37:18:00	16:36:00	ja
SR-17	34:58:00	60:44:00	30:44:00	25:46:00	ja

Tabelle 8: Bewertung der maximal möglichen jährlichen Schattendauer der Vor- und Gesamtbelastung, Grenzwertüberschreitung der Gesamtbelastung, Darstellung der Erhöhung durch die Zusatzbelastung

An insgesamt 16 Immissionsorten kommt es zu einer Überschreitung des Grenzwertes der Gesamtbelastung. An den Immissionsorten SR-01, SR-02, SR-05, SR-06 sowie SR-12 bis SR-17 tritt diese bereits durch die Vorbelastung auf und wird durch die Zusatzbelastung weiter erhöht. Die maximale Erhöhung der Zusatzbelastung tritt auf an SR-04 mit zusätzlichen 161:45:00 Stunden im Jahr.

6.2. Maximal mögliche tägliche Schattendauer

Im Folgenden wird die maximal mögliche tägliche Schattenwurfdauer in Bezug auf durch die Zusatzbelastung verursachte Überschreitungen bewertet:

IO	Maximal mögliche Schatten- dauer täglich VB [min/d]	Maximal mögliche Schatten- dauer täglich GB [min/d]	Grenzwertüber- schreitung 30 min/d GB [min/d]	Erhöhung durch ZB [min/d]	Relevanz
SR-01	00:53	02:32	02:02	01:39	ja
SR-02	00:47	01:14	00:44	00:27	ja
SR-03	00:23	00:47	00:17	00:24	ja
SR-04	00:22	01:56	01:26	01:34	ja
SR-05	00:31	00:53	00:23	00:22	ja
SR-06	00:43	00:45	00:15	00:02	ja
SR-07	00:39	00:46	00:16	00:07	ja
SR-08	00:28	00:48	00:18	00:20	ja
SR-09	00:32	00:43	00:13	00:11	ja
SR-10	00:29	00:29	--	--	nein
SR-11	00:27	00:42	00:12	00:15	ja
SR-12	00:32	00:32	00:02	--	nein
SR-13	00:24	00:31	00:01	00:07	ja
SR-14	00:25	00:29	--	00:04	nein
SR-15	00:35	00:35	00:05	--	nein
SR-16	00:33	00:33	00:03	--	nein
SR-17	00:31	00:49	00:19	00:18	ja

Tabelle 9: Bewertung der maximal möglichen täglichen Schattendauer der Vor- und Gesamtbelastung, Grenzwertüberschreitung der Gesamtbelastung, Darstellung der Erhöhung durch die Zusatzbelastung

An insgesamt 15 Immissionsorten führt die Gesamtbelastung zu einer Überschreitung des Grenzwertes der Schattenwurfdauer. An den Immissionsorten SR-01, SR-02, SR-05 bis SR-07, SR-09 und SR-17 tritt diese bereits durch die Vorbelastung auf und wird durch die Zusatzbelastung weiter erhöht. Die maximale Erhöhung der Zusatzbelastung tritt auf an SR-01 mit zusätzlichen 99:00 Minuten im Jahr.

7.) Anlagen

- Anlage A: Schattenausbreitung der Gesamtbelastung
- Anlage A1: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Gesamtbelastung unterteilt in Minuten / Tag und Stunden / Jahr (Grenzwerte)
- Anlage A2: SHADOW-Hauptergebnis mit Darstellung der Gesamtbelastung, Immissionsorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag
- Anlage A3: SHADOW-Kalender mit Darstellung der Schattenzeiten je Immissionsort SR-01 bis SR-17 über das ganze Jahr
- Anlage A4: SHADOW-Grafischer Kalender mit Darstellung der Schattenzeiten je Immissionsort durch die einzelnen WEA über das ganze Jahr
- Anlage A5: SHADOW-Kalender pro WEA mit Darstellung der Beschattungszeiten je WEA über das ganze Jahr
- Anlage A6: SHADOW-Grafischer Kalender pro WEA mit Darstellung der Beschattungszeiten je WEA an den Immissionsorten über das ganze Jahr
- Anlage B: Schattenausbreitung der Vor- und Zusatzbelastung
- Anlage B1: SHADOW-Hauptergebnis mit Darstellung der Vorbelastung, Immissionsorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

- Anlage B2: SHADOW-Hauptergebnis mit Darstellung der Zusatzbelastung, Immissionsorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag
- Anlage B3: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Zusatzbelastung unterteilt in Minuten / Tag und Stunden / Jahr
- Anlage C: Bilder der untersuchten Immissionsorte

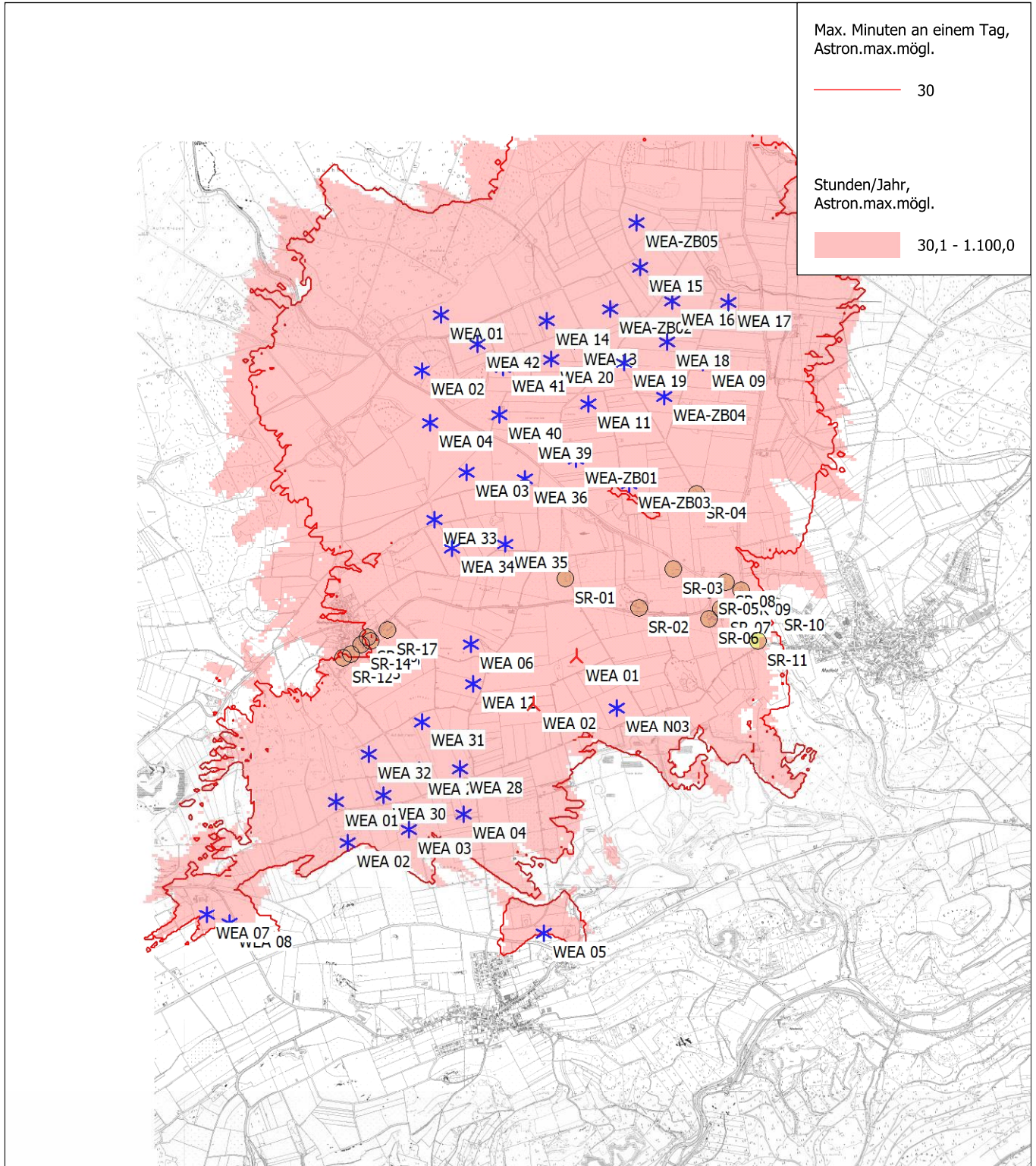
Anlage A: Schattenausbreitung der Gesamtbelastung

Anlage A1: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Gesamtbelastung unterteilt in Minuten / Tag und Stunden / Jahr

SHADOW - Karte

Berechnung: Gesamtbelastung

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0 500 1000 1500 2000 m

Karte: Bitmap-Karte: karte 1.tiff , Maßstab 1:40.000, Mitte: UTM (north)-WGS84 Zone: 32 Ost: 478.260 Nord: 5.698.260

 Neue WEA
 Existierende WEA
 Schattenrezeptor

Höhe der Schattenkarte: Höhenraster-Objekt: 216094-01 WP Brilon-Madfeld_EMDGrid_0.wpg (1)

Anlage A2: SHADOW-Hauptergebnis mit Darstellung der Gesamtbelastung, Immissionsorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Hauptergebnis

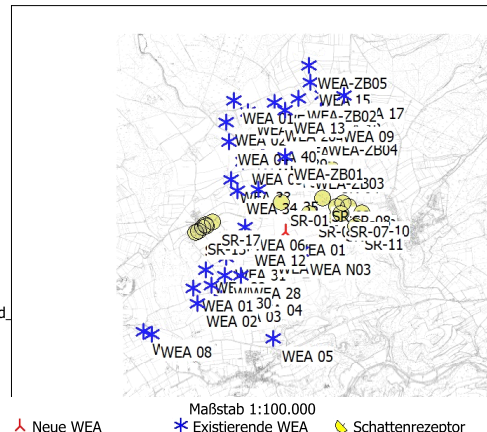
Berechnung: Gesamtbelastung Voraussetzungen für Berechnung des Schattenwurfs

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: Höhenrastr-Objekt: 216094-01 WP Brilon-Madfeld
Hindernisse in Berechnung verwendet
Berechnungshöhe ü.Gr. für Karte: 1,5 m
Rasterauflösung: 5,0 m

Alle Koordinatenangaben in:
UTM (north)-WGS84 Zone: 32



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Berechnet:
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SHADOW - Hauptergebnis

Berechnung: Gesamtbelastung

...(Fortsetzung von vorheriger Seite)

	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]
WEA 42	477.977	5.699.956	453,0	WEA L-04 ENE...Ja		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA N03	478.944	5.697.414	488,3	NORDEX N131...Ja		NORDEX	N131/3300 DE-3.300	3.300	131,0	164,0	1.719	10,9
WEA-ZB01	478.661	5.699.147	437,9	ENERCON E-1... Ja		ENERCON	E-138 EP3 E2-4.200	4.200	138,3	160,0	1.679	13,0
WEA-ZB02	478.899	5.700.197	462,1	ENERCON E-1... Ja		ENERCON	E-138 EP3 E2-4.200	4.200	138,3	160,0	1.679	13,0
WEA-ZB03	479.034	5.698.974	462,4	ENERCON E-1... Ja		ENERCON	E-138 EP3 E2-4.200	4.200	138,3	160,0	1.679	13,0
WEA-ZB04	479.277	5.699.581	460,0	ENERCON E-1... Ja		ENERCON	E-138 EP3 E2-4.200	4.200	138,3	160,0	1.679	13,0
WEA-ZB05	479.084	5.700.798	440,4	ENERCON E-1... Ja		ENERCON	E-138 EP3 E2-4.200	4.200	138,3	160,0	1.679	13,0

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
					[m]	[m]	[m]	[°]		[m]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	478.592	5.698.307	458,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	479.104	5.698.105	481,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Almer Str. 41, 59929 Brilon	479.342	5.698.373	471,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Lohweg 1, 59929 Brilon	479.507	5.698.903	469,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Almer Str. 39, 59929 Brilon	479.591	5.698.231	476,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	479.591	5.698.027	482,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	479.673	5.698.098	474,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Almer Str. 26, 59929 Brilon	479.708	5.698.284	472,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Almer Str. 24, 59929 Brilon	479.817	5.698.224	467,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Almer Str. 29, 59929 Brilon	480.048	5.698.117	467,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Stempelstraße 22, 59929 Brilon	479.934	5.697.873	473,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	477.039	5.697.758	487,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	477.098	5.697.781	486,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	477.169	5.697.849	481,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	477.234	5.697.877	482,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	477.215	5.697.900	480,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	477.350	5.697.950	485,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

Berechnungsergebnisse

Schattenrezeptor

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	192:52	202	2:32
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	141:27	223	1:14
SR-03	SR-03, Almer Str. 41, 59929 Brilon	75:25	223	0:47
SR-04	SR-04, Lohweg 1, 59929 Brilon	175:19	222	1:56
SR-05	SR-05, Almer Str. 39, 59929 Brilon	71:39	177	0:53
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	62:40	133	0:45
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	53:39	142	0:46
SR-08	SR-08, Almer Str. 26, 59929 Brilon	55:10	158	0:48
SR-09	SR-09, Almer Str. 24, 59929 Brilon	41:07	120	0:43
SR-10	SR-10, Almer Str. 29, 59929 Brilon	20:01	70	0:29
SR-11	SR-11, Stempelstraße 22, 59929 Brilon	33:01	89	0:42
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	65:39	229	0:32
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	59:55	219	0:31
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	61:48	213	0:29
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	67:11	192	0:35
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	67:18	206	0:33
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	60:44	150	0:49

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal [h/a]
	WEA 01 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (1)	0:00
	WEA 01 ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (66)	0:00

(Fortsetzung nächste Seite)...

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Hauptergebnis

Berechnung: Gesamtbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA 01	NORDEX N149/5.X 5700 149.0 !O! NH: 125,0 m (Ges:199,5 m) (8)	261:10
WEA 02	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (67)	0:00
WEA 02	NORDEX N163/5.X 5700 163.0 !O! NH: 164,0 m (Ges:245,5 m) (9)	165:06
WEA 02	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (2)	0:00
WEA 03	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (68)	14:58
WEA 03	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (3)	0:00
WEA 04	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (4)	15:08
WEA 04	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (69)	0:00
WEA 05	(28143) ENERCON E-40/5.40 500 40.3 !O! NH: 48,0 m (Ges:68,2 m) (5)	0:00
WEA 06	(0260972) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (6)	63:00
WEA 07	(8251110) NORDEX N29-250 250-45 29.7 !-! NH: 50,0 m (Ges:64,8 m) (7)	0:00
WEA 08	(8251176) NORDEX N29-250 250-45 29.7 !-! NH: 50,0 m (Ges:64,8 m) (8)	0:00
WEA 09	(9111291) DEWIND D6/64-1,25MW 1250 64.0 !O! NH: 91,5 m (Ges:123,5 m) (9)	0:00
WEA 11	(9138727) FUHLÄNDER FL-MD77 1500 77.0 !-! NH: 100,0 m (Ges:138,5 m) (11)	0:00
WEA 12	(9139150) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (12)	53:51
WEA 13	(9140523) FUHLÄNDER FL-MD77 1500 77.0 !-! NH: 100,0 m (Ges:138,5 m) (13)	0:00
WEA 14	(9140539) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (14)	0:00
WEA 15	(9140540) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (15)	0:00
WEA 16	(9140541) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (16)	0:00
WEA 17	(9140543) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (17)	0:00
WEA 18	(9140544) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (18)	0:00
WEA 19	(9140545) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (19)	0:00
WEA 20	(9140546) ENERCON E-48 800 48.0 !O! NH: 75,6 m (Ges:99,6 m) (20)	0:00
WEA 28	(9974503) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (28)	39:21
WEA 29	(9974504) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (29)	15:38
WEA 30	(9974505) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (30)	0:52
WEA 31	(9974506) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (31)	81:22
WEA 32	(9974507) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (32)	4:08
WEA 33	(9974508) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (33)	7:25
WEA 34	(9974509) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (34)	10:23
WEA 35	(9974510) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (35)	21:47
WEA 36	(9974511) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (36)	6:48
WEA 39	(9974513) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (39)	4:58
WEA 40	WEA L-02 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (40)	3:52
WEA 41	WEA L-03 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (41)	0:00
WEA 42	WEA L-04 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (42)	0:00
WEA N03	NORDEX N131/3300 DE 3300 131.0 !-! NH: 164,0 m (Ges:229,5 m) (58)	174:55
WEA-ZB01	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (61)	31:15
WEA-ZB02	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (62)	0:00
WEA-ZB03	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (63)	119:37
WEA-ZB04	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (64)	0:00
WEA-ZB05	ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (65)	0:00

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.

Anlage A3: SHADOW-Kalender mit Darstellung der Schattenzeiten je Immissionsort
SR-01 bis SR-17 über das ganze Jahr

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-01 - SR-01, Radlinghauser Str. 4, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	10:38 (WEA N03)	08:05		11:50 (WEA 01)	07:13	07:03		06:00	19:44 (WEA 34)	05:15	
2	16:27	140	10:39 (WEA 02)	17:14	27	12:17 (WEA 01)	18:05	19:58	20:40	18	20:02 (WEA 34)	21:32
3	08:31		10:39 (WEA N03)	11:06:04		11:53 (WEA 01)	07:11	07:01	05:58		19:44 (WEA 34)	21:15
4	16:28	139	13:51 (WEA 02)	17:16	21	12:14 (WEA 01)	18:06	19:59	20:49	16	20:00 (WEA 34)	21:33
5	08:31		10:39 (WEA N03)	10:08:02		12:00 (WEA 01)	07:09	06:59	05:56		19:45 (WEA 34)	21:14
6	16:29	138	13:50 (WEA 02)	17:18	8	12:08 (WEA 01)	18:08	20:01	20:51	14	19:59 (WEA 34)	21:34
7	08:31		10:40 (WEA N03)	08:01			07:06	06:57	05:54		19:46 (WEA 34)	21:13
8	16:30	137	13:51 (WEA 02)	17:19			18:10	20:03	20:52	11	19:57 (WEA 34)	21:35
9	08:31		10:41 (WEA N03)	07:59			07:04	06:54	05:52		19:50 (WEA 34)	21:12
10	16:31	137	13:52 (WEA 02)	17:21			18:12	20:04	20:54	5	19:55 (WEA 34)	21:36
11	08:30		10:41 (WEA N03)	07:57			07:02	06:52	05:50			05:12
12	16:33	140	15:30 (WEA 12)	17:23			18:13	20:06	20:56			21:37
13	08:30		10:42 (WEA N03)	07:56			07:00	06:50	05:49		20:24 (WEA 33)	05:11
14	16:34	142	15:32 (WEA 12)	17:25			18:15	20:08	20:57	4	20:28 (WEA 33)	21:38
15	08:30		10:43 (WEA N03)	07:54			06:58	06:48	05:47		20:23 (WEA 33)	05:11
16	16:35	145	15:48 (WEA 31)	17:27			18:17	20:09	20:59	7	20:30 (WEA 33)	21:39
17	08:29		10:44 (WEA N03)	07:52			06:55	06:45	05:45		20:21 (WEA 33)	05:10
18	16:37	148	15:50 (WEA 31)	17:29			18:19	20:11	21:00	10	20:31 (WEA 33)	21:40
19	08:29		10:45 (WEA N03)	07:50			06:53	06:43	05:43		20:22 (WEA 33)	05:10
20	16:38	147	15:51 (WEA 31)	17:30			18:20	20:13	21:02	12	20:33 (WEA 33)	21:41
21	08:28		10:46 (WEA N03)	07:49			06:51	06:41	05:42		20:20 (WEA 33)	05:09
22	16:39	147	15:52 (WEA 31)	17:32			18:22	20:14	21:03	14	20:34 (WEA 33)	21:42
23	08:27		10:47 (WEA N03)	07:47			06:49	06:39	05:39		20:21 (WEA 33)	05:09
24	16:41	151	16:03 (WEA 32)	17:34			18:24	20:16	21:05	16	20:36 (WEA 33)	21:42
25	08:27		10:49 (WEA N03)	07:45		16:15 (WEA 06)	06:46	06:37	05:39		20:19 (WEA 33)	05:09
26	16:42	152	16:06 (WEA 32)	17:36	8	16:23 (WEA 06)	18:26	20:18	21:07	16	20:35 (WEA 33)	21:43
27	08:26		10:50 (WEA N03)	07:43		16:13 (WEA 06)	06:44	06:35	05:37		20:28 (WEA 33)	05:09
28	16:44	151	16:07 (WEA 32)	17:38	13	16:26 (WEA 06)	18:27	20:19	21:08	17	20:36 (WEA 33)	21:43
29	08:25		10:52 (WEA N03)	07:41		16:11 (WEA 06)	06:42	06:32	05:36		20:19 (WEA 33)	05:08
30	16:45	146	16:07 (WEA 32)	17:40	16	16:27 (WEA 06)	18:29	20:21	21:10	16	20:35 (WEA 33)	21:44
31	08:24		10:55 (WEA N03)	07:40		16:10 (WEA 06)	06:40	06:30	05:34		20:19 (WEA 33)	05:08
32	16:47	142	16:08 (WEA 32)	17:41	19	16:29 (WEA 06)	18:31	20:23	21:11	17	20:36 (WEA 33)	21:44
33	08:24		11:30 (WEA 01)	07:37		16:09 (WEA 06)	06:37	06:28	05:33		20:20 (WEA 33)	05:08
34	16:48	130	16:09 (WEA 32)	17:43	20	16:29 (WEA 06)	18:32	20:24	21:13	16	20:36 (WEA 33)	21:45
35	08:23		11:31 (WEA 01)	07:35		16:08 (WEA 06)	06:35	06:25	05:31		20:21 (WEA 33)	05:08
36	16:50	127	16:09 (WEA 32)	17:45	22	16:30 (WEA 06)	18:34	20:26	21:14	16	20:35 (WEA 33)	21:45
37	08:22		11:31 (WEA 01)	07:33		16:08 (WEA 06)	06:33	06:24	05:30		20:20 (WEA 33)	05:08
38	16:52	125	16:09 (WEA 32)	17:47	22	16:30 (WEA 06)	18:36	20:28	21:15	14	20:34 (WEA 33)	21:46
39	08:21		11:32 (WEA 01)	07:32		16:08 (WEA 06)	06:31	06:22	05:28		20:21 (WEA 33)	05:08
40	16:53	119	16:09 (WEA 32)	17:49	23	16:31 (WEA 06)	18:37	20:29	2	19:56 (WEA 34)	21:17	
41	08:20		11:33 (WEA 01)	07:30		16:08 (WEA 06)	06:28	06:20	05:27		20:22 (WEA 33)	05:08
42	16:55	111	16:09 (WEA 32)	17:50	23	16:31 (WEA 06)	18:39	20:31	11	20:00 (WEA 34)	21:18	
43	08:19		11:34 (WEA 01)	07:27		16:08 (WEA 06)	06:26	06:17	05:26		20:23 (WEA 33)	05:09
44	16:56	101	16:08 (WEA 32)	17:52	23	16:31 (WEA 06)	18:41	20:33	14	20:01 (WEA 34)	21:20	
45	08:17		11:34 (WEA 01)	07:25		16:08 (WEA 06)	06:24	06:15	05:25		20:26 (WEA 33)	05:09
46	16:58	80	15:41 (WEA 12)	17:54	22	16:30 (WEA 06)	18:42	20:34	16	20:02 (WEA 34)	21:21	
47	08:16		11:36 (WEA 01)	07:23		16:09 (WEA 06)	06:22	06:13	05:23		20:24 (WEA 33)	05:09
48	17:00	65	15:40 (WEA 12)	17:56	21	16:30 (WEA 06)	18:44	20:36	18	20:03 (WEA 34)	21:22	
49	08:15		11:37 (WEA 01)	07:21		16:10 (WEA 06)	06:19	06:11	05:22		19:44 (WEA 34)	21:22
50	17:02	62	15:40 (WEA 12)	17:58	19	16:29 (WEA 06)	18:46	20:38	19	20:03 (WEA 34)	21:24	
51	08:14		11:38 (WEA 01)	07:19		16:11 (WEA 06)	06:17	06:09	05:21		19:43 (WEA 34)	21:23
52	17:03	56	15:38 (WEA 12)	17:59	17	16:28 (WEA 06)	18:47	20:39	20	20:03 (WEA 34)	21:25	
53	08:12		11:40 (WEA 01)	07:17		16:12 (WEA 06)	06:15	06:07	05:20		19:43 (WEA 34)	21:20
54	17:05	46	12:26 (WEA 01)	18:01	13	16:25 (WEA 06)	18:49	20:41	20	20:03 (WEA 34)	21:26	
55	08:11		11:41 (WEA 01)	07:15		16:15 (WEA 06)	06:12	06:04	05:23		19:43 (WEA 34)	21:23
56	17:07	44	12:25 (WEA 01)	18:03	7	16:22 (WEA 06)	18:51	20:42	20	20:03 (WEA 34)	21:28	
57	08:10		11:43 (WEA 01)			07:10	06:03	05:53	19	19:43 (WEA 34)	05:18	
58	17:09	41	12:24 (WEA 01)			07:03	20:44	19	20:02 (WEA 34)	21:29		05:11
59	08:08		11:45 (WEA 01)			07:08	06:02	05:54	18	19:43 (WEA 34)	05:17	05:12
60	17:10	37	12:22 (WEA 01)			19:54	20:46	18	20:01 (WEA 34)	21:30		21:46
61	08:07		11:47 (WEA 01)			07:06			05:16			
62	17:12	33	12:20 (WEA 01)			19:56			21:31			
Sonnenscheinstunden 261 3479 279 344 367 415 177 483 496 165												
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)		Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	
	Sonnenuntergang (SS:MM)			Zeitpunkt (SS:MM) Schattende (WEA mit letztem Schatten)	

Projekt:
216094-04 WP Brilon-MadfeldLizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender****Berechnung: Gesamtbelastung Schattenrezeptor: SR-01 - SR-01, Radlinghauser Str. 4, 59929 Brilon**
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	20:30 (WEA 33)	06:37	07:25	07:18
2	21:46	21:15	20:46 (WEA 33)	20:14	19:06	18:21
3	05:13	05:50	20:30 (WEA 33)	06:38	07:26	08:09
4	21:46	21:13	20:44 (WEA 33)	20:12	19:03	16:20
5	05:14	05:51	20:30 (WEA 33)	06:40	07:28	08:10
6	21:45	21:12	20:42 (WEA 33)	20:10	19:01	16:20
7	05:15	05:53	20:32 (WEA 33)	06:42	07:30	08:12
8	21:45	21:10	20:41 (WEA 33)	20:07	18:59	16:19
9	05:15	05:54	20:33 (WEA 33)	06:43	07:31	08:13
10	21:44	21:08	20:39 (WEA 33)	20:05	18:57	16:19
11	05:16	05:56	20:36 (WEA 33)	06:45	07:33	08:14
12	21:44	21:07	20:38 (WEA 33)	20:03	18:54	16:18
13	05:17	05:57	20:38 (WEA 33)	06:46	07:35	08:15
14	21:43	21:05	20:01	18:52	16:50	16:18
15	05:18	05:59	19:58 (WEA 34)	06:48	07:36	08:17
16	21:43	21:03	20:06 (WEA 34)	19:58	18:50	16:48
17	05:19	06:00	19:55 (WEA 34)	06:50	07:38	10:11
18	21:42	21:01	20:07 (WEA 34)	19:56	18:48	16:47
19	05:20	06:02	19:54 (WEA 34)	06:51	07:40	10:11
20	21:41	20:59	20:09 (WEA 34)	19:54	18:45	16:45
21	05:21	06:04	19:53 (WEA 34)	06:53	07:41	10:11
22	21:41	20:57	20:09 (WEA 34)	19:51	18:43	16:44
23	05:22	06:05	19:52 (WEA 34)	06:54	07:43	10:11
24	21:40	20:56	20:10 (WEA 34)	19:49	18:41	16:42
25	05:23	06:07	19:51 (WEA 34)	06:56	07:45	10:11
26	21:39	20:54	20:10 (WEA 34)	19:47	18:39	16:41
27	05:24	06:08	19:51 (WEA 34)	06:58	07:46	10:11
28	21:38	20:52	20:11 (WEA 34)	19:45	18:37	16:39
29	05:25	06:10	19:50 (WEA 34)	06:59	07:48	10:11
30	21:37	20:50	20:10 (WEA 34)	19:42	18:35	16:38
31	05:27	06:11	19:50 (WEA 34)	07:01	07:50	10:11
32	21:36	20:48	20:10 (WEA 34)	19:40	18:32	16:37
33	05:28	06:13	19:50 (WEA 34)	07:02	07:51	10:11
34	21:35	20:46	20:10 (WEA 34)	19:38	18:30	16:35
35	05:29	06:15	19:50 (WEA 34)	07:04	07:53	10:11
36	21:34	20:44	20:09 (WEA 34)	19:35	18:28	16:34
37	05:30	06:16	19:51 (WEA 34)	07:05	07:55	10:11
38	21:33	20:42	20:08 (WEA 34)	19:33	18:26	16:33
39	05:31	06:18	19:51 (WEA 34)	07:07	07:57	10:11
40	21:32	20:40	20:07 (WEA 34)	19:31	18:24	16:31
41	05:33	06:19	19:52 (WEA 34)	07:09	07:58	10:11
42	21:31	20:41	20:06 (WEA 34)	19:29	18:22	16:30
43	05:34	20:33 (WEA 33)	06:21	19:54 (WEA 34)	07:10	08:00
44	21:29	20:42 (WEA 33)	06:23	19:26	18:20	16:28
45	05:35	20:32 (WEA 33)	06:23	19:24	18:18	16:26
46	21:28	20:44 (WEA 33)	06:23	19:24	18:18	16:26
47	05:37	20:31 (WEA 33)	06:24	19:13	18:03	16:25
48	21:27	20:45 (WEA 33)	06:24	19:12	18:16	16:27
49	05:38	20:30 (WEA 33)	06:26	19:15	18:19	16:27
50	21:25	20:45 (WEA 33)	06:29	19:19	18:24	16:30
51	05:40	20:30 (WEA 33)	06:27	19:17	18:17	16:28
52	21:24	20:45 (WEA 33)	06:27	19:17	18:17	16:28
53	05:41	20:30 (WEA 33)	06:29	19:18	18:19	16:30
54	21:23	20:46 (WEA 33)	06:29	19:15	18:10	16:24
55	05:42	20:29 (WEA 33)	06:31	19:20	18:24	16:34
56	21:21	20:46 (WEA 33)	06:32	19:12	18:16	16:26
57	05:44	20:29 (WEA 33)	06:33	19:22	18:28	16:40
58	21:20	20:46 (WEA 33)	06:34	19:10	18:14	16:24
59	05:45	20:30 (WEA 33)	06:34	19:23	18:37	16:51
60	21:18	20:46 (WEA 33)	06:35	19:08	18:14	16:22
61	05:47	20:29 (WEA 33)	06:35	19:16	18:29	16:41
62	21:17	20:46 (WEA 33)	06:35	19:16	18:29	16:41
63	Sonnenscheinstunden	500	452	381	332	268
64	astr. max. mögl. Beschattung	155	303	294	1979	4400

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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Projekt:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

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Berechnet:

18.09.2020 10:28/3.4.388

SHADOW - Kalender**Berechnung: Gesamtbelastung Schattenrezeptor: SR-02 - SR-02, Radlinghauser Str. 7, 59929 Brilon****Voraussetzungen für Berechnung des Schattenwurfs**

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	08:31	13:01 (WEA N03) 08:05	55	15:35 (WEA 02) 07:13	48	15:44 (WEA 01) 07:03		06:00		05:15	
2	16:27	13:44 (WEA N03) 17:14		16:30 (WEA 01) 18:05		16:32 (WEA 01) 19:58		20:47		21:32	
3	08:31	13:01 (WEA N03) 08:04	55	15:35 (WEA 02) 07:11	48	15:45 (WEA 01) 07:01		05:58		05:15	
4	16:28	13:45 (WEA N03) 17:16	56	16:31 (WEA 01) 18:06	45	16:30 (WEA 01) 19:59		20:49		21:33	
5	08:31	13:01 (WEA N03) 08:02		15:35 (WEA 02) 07:09		15:47 (WEA 01) 06:59		05:56		05:14	
6	16:29	13:44 (WEA N03) 17:18	58	16:33 (WEA 01) 18:08	42	16:29 (WEA 01) 20:01		20:51		21:34	
7	08:31	13:02 (WEA N03) 08:01		15:35 (WEA 02) 07:06		15:48 (WEA 01) 06:57		05:54		05:13	
8	16:30	13:45 (WEA N03) 17:19	58	16:33 (WEA 01) 18:10	38	16:26 (WEA 01) 20:03		20:52		21:35	
9	08:31	13:03 (WEA N03) 07:59		15:35 (WEA 02) 07:04		15:50 (WEA 01) 06:54		05:52		05:12	
10	16:31	13:46 (WEA N03) 17:21	59	16:34 (WEA 01) 18:12	34	16:24 (WEA 01) 20:04		20:54	1	20:26 (WEA 33) 21:36	
11	08:30	13:03 (WEA N03) 07:57		15:34 (WEA 02) 07:02		15:53 (WEA 01) 06:52		05:50		05:12	
12	16:33	13:46 (WEA N03) 17:23	61	16:35 (WEA 01) 18:13	29	16:22 (WEA 01) 20:06		20:55	2	20:27 (WEA 33) 21:37	
13	08:30	13:05 (WEA N03) 07:56		15:35 (WEA 02) 07:00		15:56 (WEA 01) 06:50		05:49		05:11	
14	16:34	13:46 (WEA N03) 17:25	62	16:37 (WEA 02) 18:15	23	16:19 (WEA 01) 20:08		20:57	2	20:28 (WEA 33) 21:38	
15	08:30	13:05 (WEA N03) 07:54		15:35 (WEA 02) 06:58		16:01 (WEA 01) 06:48		05:47		05:11	
16	16:35	13:46 (WEA N03) 17:27	65	16:38 (WEA 02) 18:17	12	16:13 (WEA 01) 20:09		20:59	3	20:30 (WEA 33) 21:39	
17	08:29	13:06 (WEA N03) 07:52		15:36 (WEA 02) 06:55		06:45		05:45		05:10	
18	16:37	13:47 (WEA N03) 17:29	66	17:00 (WEA 02) 18:19		20:11		21:00	5	20:31 (WEA 35) 21:40	
19	08:29	13:07 (WEA N03) 07:50		15:36 (WEA 02) 06:53		06:43		05:44		05:10	
20	16:38	13:48 (WEA N03) 17:30	68	17:02 (WEA 02) 18:20		20:13		21:02	8	20:33 (WEA 35) 21:41	
21	08:28	13:07 (WEA N03) 07:49		15:36 (WEA 02) 06:51		17:36 (WEA 06) 06:41		05:42		05:09	
22	16:39	13:49 (WEA N03) 17:32	71	17:04 (WEA 02) 18:22	9	17:45 (WEA 06) 06:39		21:03	10	20:34 (WEA 35) 21:41	
23	08:27	13:08 (WEA N03) 07:47		15:37 (WEA 02) 06:49		17:33 (WEA 06) 06:39		05:40		05:09	
24	16:41	13:49 (WEA N03) 17:34	70	17:04 (WEA 02) 18:24	13	17:46 (WEA 06) 06:38		21:05	12	20:36 (WEA 35) 21:42	
25	08:27	13:08 (WEA N03) 07:45		15:37 (WEA 02) 06:46		17:32 (WEA 06) 06:37		05:39		05:09	
26	16:42	13:49 (WEA N03) 17:36	70	17:04 (WEA 02) 18:25	15	17:47 (WEA 06) 06:38		21:06	14	20:37 (WEA 35) 21:43	
27	08:26	13:10 (WEA N03) 07:43		15:37 (WEA 02) 06:44		17:32 (WEA 06) 06:34		05:37		05:09	
28	16:44	13:49 (WEA N03) 17:38	70	17:04 (WEA 02) 18:27	15	17:47 (WEA 06) 06:39		21:08	15	20:39 (WEA 35) 21:43	
29	08:25	13:11 (WEA N03) 07:41		15:37 (WEA 02) 06:42		17:31 (WEA 06) 06:32		05:36		05:08	
30	16:45	13:49 (WEA N03) 17:39	68	17:03 (WEA 02) 18:29	15	17:46 (WEA 06) 06:38		21:10	16	20:39 (WEA 35) 21:44	
31	08:24	13:12 (WEA N03) 07:39		15:37 (WEA 02) 06:40		17:31 (WEA 06) 06:30		05:34		05:08	
1	16:47	13:49 (WEA N03) 17:41	64	17:01 (WEA 02) 18:31	15	17:46 (WEA 06) 06:38		21:11	17	20:40 (WEA 35) 21:44	
2	08:23	13:14 (WEA N03) 07:37		15:37 (WEA 02) 06:37		17:32 (WEA 06) 06:28		05:33		05:08	
3	16:48	13:15 (WEA N03) 07:35	69	17:11 (WEA 02) 18:32	14	17:46 (WEA 06) 06:38		21:13	16	20:40 (WEA 35) 21:45	
4	08:23	13:15 (WEA N03) 07:35		15:37 (WEA 02) 06:35		17:32 (WEA 06) 06:26		05:31		05:08	
5	16:50	13:16 (WEA N03) 07:33	72	17:13 (WEA 02) 18:34	13	17:45 (WEA 06) 06:26		21:14	15	20:39 (WEA 35) 21:45	
6	08:22	13:16 (WEA N03) 07:33		15:37 (WEA 02) 06:33		17:33 (WEA 06) 06:24		05:30		05:08	
7	16:51	13:18 (WEA N03) 07:31	73	17:13 (WEA 02) 18:36	9	17:42 (WEA 06) 06:28		21:15	15	20:39 (WEA 35) 21:46	
8	08:21	13:18 (WEA N03) 07:31		15:38 (WEA 02) 06:31		06:22		05:28		05:08	
9	16:53	13:20 (WEA N03) 07:29	73	17:14 (WEA 02) 18:37		20:29		21:17	13	20:38 (WEA 35) 21:46	
10	08:20	13:20 (WEA N03) 07:29		15:38 (WEA 02) 06:28		06:20		05:27		05:08	
11	16:55	13:21 (WEA N03) 07:27	73	17:14 (WEA 02) 18:39		20:31		21:18	12	20:38 (WEA 35) 21:46	
12	08:18	13:23 (WEA N03) 07:27		15:38 (WEA 02) 06:26		06:17		05:26		05:09	
13	16:56	13:24 (WEA N03) 07:25	71	17:13 (WEA 02) 18:41		20:32		21:20	9	20:37 (WEA 35) 21:46	
14	08:17	13:26 (WEA N03) 07:25		15:39 (WEA 02) 06:24		06:15		05:25		05:09	
15	16:58	13:26 (WEA N03) 07:25	69	17:13 (WEA 02) 18:42		20:34		21:21	6	20:34 (WEA 35) 21:47	
16	08:16	13:27 (WEA N03) 07:23		15:40 (WEA 02) 06:22		06:13		05:23		05:09	
17	16:59	13:29 (WEA N03) 07:21	64	17:11 (WEA 02) 18:44		20:36		21:22	4	20:39 (WEA 35) 21:47	
18	08:15	13:30 (WEA N03) 07:21		15:40 (WEA 02) 06:19		06:11		05:22		05:10	
19	17:02	13:31 (WEA N03) 07:19	56	16:36 (WEA 01) 18:46		20:37		21:24	5	20:40 (WEA 35) 21:47	
20	08:14	13:32 (WEA N03) 07:19		15:41 (WEA 02) 06:17		06:09		05:21		05:10	
21	17:03	13:33 (WEA N03) 07:17	54	16:35 (WEA 01) 18:47		20:39		21:25	7	20:41 (WEA 35) 21:47	
22	08:12	13:34 (WEA N03) 07:17		15:41 (WEA 02) 06:15		06:07		05:20		05:10	
23	17:05	13:35 (WEA N03) 07:15	53	16:34 (WEA 01) 18:49		20:41		21:26	7	20:42 (WEA 35) 21:47	
24	08:11	13:36 (WEA N03) 07:15		15:42 (WEA 02) 06:12		06:05		05:19		05:11	
25	17:07	13:37 (WEA N03) 07:13	51	16:33 (WEA 01) 18:51		20:42		21:27	6	20:43 (WEA 35) 21:47	
26	08:10	13:38 (WEA N03) 07:13		15:43 (WEA 02) 06:10		06:03		05:18		05:11	
27	17:09	13:39 (WEA N03) 07:11	56	16:36 (WEA 01) 18:52		20:44		21:29		21:46	
28	08:08	13:40 (WEA N03) 07:11		15:44 (WEA 02) 06:08		06:01		05:17		05:12	
29	17:10	13:41 (WEA N03) 07:09	55	16:38 (WEA 01) 18:54		20:46		21:30		21:46	
30	08:07	13:42 (WEA N03) 07:09		15:45 (WEA 02) 06:06		06:00		05:16		05:12	
31	17:12	13:43 (WEA N03) 07:07	53	16:39 (WEA 01) 18:56		20:47		21:31		21:46	
Sonnenscheinstunden		261		279		367		415		463	
astr. max. mögl. Beschattung		1374		1799		389		30		191	

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

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-02 - SR-02, Radlinghauser Str. 7, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13		05:48	20:35 (WEA 35)	06:37	07:25	18:13 (WEA 06)	07:17	15:06 (WEA 02)	08:08	12:49 (WEA N03)					
2	21:46	21:15	11	20:46 (WEA 35)	20:14	19:06	13	18:26 (WEA 06)	17:01	68	16:31 (WEA 32)	16:21	46	15:47 (WEA 28)		
3	05:13	05:50		20:35 (WEA 35)	06:38	07:26		18:13 (WEA 06)	07:19		15:05 (WEA 02)	08:09		12:50 (WEA N03)		
4	21:46	21:13	9	20:44 (WEA 35)	20:12	19:03	11	18:24 (WEA 06)	16:59	68	16:30 (WEA 32)	16:20	45	15:47 (WEA 28)		
5	05:14	05:51		20:35 (WEA 35)	06:40	07:28		18:16 (WEA 06)	07:21		15:05 (WEA 02)	08:10		12:49 (WEA N03)		
6	21:45	21:12	7	20:42 (WEA 35)	20:10	19:01	5	18:21 (WEA 06)	16:57	64	16:28 (WEA 32)	16:20	42	15:45 (WEA 28)		
7	05:15	05:53		20:37 (WEA 35)	06:42	07:30			07:23		15:05 (WEA 02)	08:12		12:49 (WEA N03)		
8	21:45	21:10	4	20:41 (WEA 35)	20:07	18:59			16:55	61	16:06 (WEA 01)	16:19	41	13:30 (WEA N03)		
9	05:15	05:54		20:36 (WEA 35)	06:43	07:31			07:25		15:05 (WEA 02)	08:13		12:50 (WEA N03)		
10	21:44	21:08	3	20:39 (WEA 35)	20:05	18:57			16:53	60	16:05 (WEA 01)	16:19	41	13:31 (WEA N03)		
11	05:16	05:56		20:36 (WEA 35)	06:45	07:33		16:34 (WEA 01)	16:53	60	16:04 (WEA 01)	16:18	43	12:49 (WEA N03)		
12	21:44	21:07	2	20:38 (WEA 35)	20:03	18:54	19	16:53 (WEA 01)	16:52	60	16:04 (WEA 01)	16:18	43	13:32 (WEA N03)		
13	05:17	05:57		20:35 (WEA 35)	06:46	07:35		16:30 (WEA 01)	07:28		15:05 (WEA 02)	08:15		12:49 (WEA N03)		
14	21:43	21:05	1	20:36 (WEA 35)	20:01	18:52	27	16:57 (WEA 01)	16:50	58	16:03 (WEA 01)	16:18	43	13:32 (WEA N03)		
15	05:18	05:59			06:48	07:36		16:26 (WEA 01)	07:30		15:05 (WEA 02)	08:17		12:50 (WEA N03)		
16	21:43	21:03			19:58	18:50	32	16:58 (WEA 01)	16:48	57	16:02 (WEA 01)	16:18	43	13:33 (WEA N03)		
17	05:19	06:00			19:59	18:45	40	17:02 (WEA 01)	16:45	55	16:06 (WEA 02)	08:18		12:50 (WEA N03)		
18	21:42	21:01			19:56	18:48	36	17:00 (WEA 01)	16:47	56	16:02 (WEA 01)	16:17	44	13:34 (WEA N03)		
19	05:20	06:02			19:51	18:50	40	17:04 (WEA 01)	16:44	53	16:00 (WEA 01)	16:17	43	13:34 (WEA N03)		
20	21:41	20:59			19:54	18:45	40	17:02 (WEA 01)	16:45	55	16:01 (WEA 01)	16:17	43	13:34 (WEA N03)		
21	05:21	06:04			19:51	18:41	46	17:04 (WEA 01)	16:42	55	16:03 (WEA 01)	16:17	44	13:35 (WEA N03)		
22	21:41	20:57			19:51	18:43	44	17:04 (WEA 01)	16:44	53	16:00 (WEA 01)	16:17	43	13:34 (WEA N03)		
23	05:22	06:05			19:54	18:43	40	17:02 (WEA 01)	16:45	55	16:01 (WEA 01)	16:17	43	13:34 (WEA N03)		
24	21:40	20:56			19:49	18:41	46	17:04 (WEA 01)	16:42	55	16:03 (WEA 01)	16:17	44	13:35 (WEA N03)		
25	05:23	06:07			19:45	18:43	44	17:04 (WEA 01)	16:44	53	16:00 (WEA 01)	16:17	43	13:34 (WEA N03)		
26	21:39	20:54			19:47	18:39	49	17:05 (WEA 01)	16:41	56	16:04 (WEA 29)	16:17	44	13:35 (WEA N03)		
27	05:24	06:08			19:45	18:35	53	17:07 (WEA 01)	16:38	55	16:07 (WEA 01)	16:17	45	13:37 (WEA N03)		
28	21:38	20:52			19:45	18:37	51	17:06 (WEA 01)	16:39	56	16:05 (WEA 01)	16:17	44	13:36 (WEA N03)		
29	05:25	06:10		20:14 (WEA 34)	19:59	18:39	49	17:05 (WEA 01)	16:41	56	16:04 (WEA 01)	16:17	44	13:35 (WEA N03)		
30	21:37	20:50	7	20:21 (WEA 34)	19:42	18:35	53	17:07 (WEA 01)	16:38	55	16:07 (WEA 01)	16:17	45	13:37 (WEA N03)		
31	05:26	06:11		20:12 (WEA 34)	19:40	18:32	55	17:07 (WEA 01)	16:36	51	16:05 (WEA 01)	16:17	44	13:37 (WEA N03)		
1	21:36	20:48	7	20:19 (WEA 34)	19:40	18:32	55	17:07 (WEA 01)	16:36	51	16:05 (WEA 01)	16:17	44	13:37 (WEA N03)		
2	05:28	06:13		20:12 (WEA 34)	19:40	18:32	55	17:07 (WEA 01)	16:36	51	16:05 (WEA 01)	16:17	44	13:37 (WEA N03)		
3	21:35	20:46	6	20:18 (WEA 34)	19:38	18:30	59	17:40 (WEA 12)	16:35	47	16:04 (WEA 30)	16:17	44	13:38 (WEA N03)		
4	05:29	06:15		20:11 (WEA 34)	19:40	18:30	59	17:40 (WEA 12)	16:35	47	16:04 (WEA 30)	16:17	44	13:38 (WEA N03)		
5	21:34	20:44	5	20:16 (WEA 34)	19:35	18:28	66	17:45 (WEA 12)	16:34	40	16:03 (WEA 30)	16:18	45	13:38 (WEA N03)		
6	05:30	06:16		20:11 (WEA 34)	19:35	18:28	66	17:45 (WEA 12)	16:34	40	16:03 (WEA 30)	16:18	45	13:38 (WEA N03)		
7	21:33	20:42	3	20:14 (WEA 34)	19:33	18:26	70	17:44 (WEA 12)	16:33	41	16:01 (WEA 29)	16:18	45	13:39 (WEA N03)		
8	05:31	06:18		20:10 (WEA 34)	19:33	18:26	70	17:44 (WEA 12)	16:33	41	16:01 (WEA 29)	16:18	45	13:39 (WEA N03)		
9	21:32	2	20:43 (WEA 35)	20:40	2	20:12 (WEA 34)	19:31	18:24	71	17:45 (WEA 12)	16:31	33	15:35 (WEA 02)	16:18	44	13:39 (WEA N03)
10	05:33	20:38 (WEA 35)	06:19		07:09		07:58	18:22	73	17:44 (WEA 12)	16:30	38	15:43 (WEA 28)	16:19	44	13:39 (WEA N03)
11	21:31	8	20:46 (WEA 35)	20:38	19:28		18:22	73	17:44 (WEA 12)	16:30	38	15:43 (WEA 28)	16:19	44	13:39 (WEA N03)	
12	05:34	20:37 (WEA 35)	06:21		07:10		18:20	74	17:44 (WEA 12)	16:29	34	15:45 (WEA 28)	16:19	44	13:40 (WEA N03)	
13	21:29	10	20:47 (WEA 35)	20:36	19:26		18:20	74	17:44 (WEA 12)	16:29	34	15:45 (WEA 28)	16:19	44	13:40 (WEA N03)	
14	05:35	20:36 (WEA 35)	06:23		07:12		18:20	74	17:44 (WEA 12)	16:29	34	15:45 (WEA 28)	16:19	44	13:40 (WEA N03)	
15	21:28	12	20:48 (WEA 35)	20:33	19:24		18:18	73	17:44 (WEA 12)	16:28	36	15:46 (WEA 28)	16:20	44	13:40 (WEA N03)	
16	05:37	20:35 (WEA 35)	06:24		07:13		18:18 (WEA 06)	08:03								
17	21:27	14	20:49 (WEA 35)	20:31	19:22	7	18:25 (WEA 06)	18:16	72	17:47 (WEA 12)	16:27	40	15:47 (WEA 28)	16:20	44	13:40 (WEA N03)
18	05:38	20:35 (WEA 35)	06:26		07:15		18:16 (WEA 06)	07:05								
19	21:25	14	20:49 (WEA 35)	20:29	19:19	11	18:27 (WEA 06)	17:14	68	16:41 (WEA 12)	16:26	42	15:47 (WEA 28)	16:21	45	13:42 (WEA N03)
20	05:40	20:34 (WEA 35)	06:27		07:17		18:13 (WEA 06)	07:07								
21	21:24	15	20:49 (WEA 35)	20:27	19:17	14	18:27 (WEA 06)	17:12	67	16:32 (WEA 31)	16:25	44	15:47 (WEA 28)	16:22	45	13:42 (WEA N03)
22	05:41	20:34 (WEA 35)	06:29		07:18		18:13 (WEA 06)	07:09								
23	21:23	16	20:50 (WEA 35)	20:25	19:15	15	18:28 (WEA 06)	17:10	70	16:33 (WEA 31)	16:24	45	15:48 (WEA 28)	16:22	44	13:42 (WEA N03)
24	05:42	20:34 (WEA 35)	06:30		07:20		18:13 (WEA 06)	07:10								
25	21:21	16	20:50 (WEA 35)	20:23	19:12	15	18:28 (WEA 06)	17:08	71	16:34 (WEA 31)	16:23	45	15:47 (WEA 28)	16:23	44	13:42 (WEA N03)
26	05:44	20:33 (WEA 35)	06:32		07:22		18:12 (WEA 06)	07:12								
27	21:20	16	20:49 (WEA 35)	20:21	19:10	15	18:27 (WEA 06)	17:06	71	16:34 (WEA 31)	16:23	46	15:48 (WEA 28)	16:24	44	13:43 (WEA N03)
28	05:45	20:34 (WEA 35)	06:34		07:23		18:12 (WEA 06)	07:14								
29	21:18	14	20:48 (WEA 35)	20:18	19:08	15	18:27 (WEA 06)	17:04	71	16:34 (WEA 31)	16:22	46	15:48 (WEA 28)	16:25	44	13:43 (WEA N03)
30	05:47	20:34 (WEA 35)	06:35													
31	21:17	13	20:47 (WEA 35)	20:16												
Sonnenscheinstunden		500		452		381		332		268		246		1359		
astr.max.mögl.Beschattung		150		67		92		1526		1510						

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-03 - SR-03, Almer Str. 41, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	13:57 (WEA N03) 08:05		15:39 (WEA 02) 07:13		17:13 (WEA 06) 07:03		06:00			05:15	
2	08:27	14:15 (WEA N03) 08:04	40	15:39 (WEA 01) 18:05	12	17:25 (WEA 06) 19:57		20:47			21:32	11
3	08:31	13:59 (WEA N03) 08:02	41	15:41 (WEA 02) 07:09	10	17:14 (WEA 06) 06:51		05:58			21:33	11
4	08:31	14:00 (WEA N03) 08:01	43	15:42 (WEA 02) 07:06	12	17:25 (WEA 06) 19:59		20:49			21:33	11
5	08:31	15:55 (WEA 28) 17:18	43	16:49 (WEA 32) 18:08	10	17:24 (WEA 06) 20:01		19:32 (WEA 34) 05:56			21:34	11
6	08:31	14:00 (WEA N03) 08:01	43	15:42 (WEA 02) 07:06	17:15 (WEA 06) 06:57		19:32 (WEA 34) 05:54				21:35	10
7	08:31	15:56 (WEA 28) 17:19	43	16:50 (WEA 32) 18:10	6	17:21 (WEA 06) 20:03	5	19:32 (WEA 34) 05:52			21:36	10
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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-03 - SR-03, Almer Str. 41, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12	05:48	20:31 (WEA 03) 06:37	19:35 (WEA 35) 07:25	17:17	15:17 (WEA 01) 08:08	15:27 (WEA 02)				
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26	21:25	20 20:51 (WEA 03) 20:29	19:19	17:14	16:26	33 15:48 (WEA 01) 16:21	22 14:14 (WEA 03)				
26	05:39	20:51 (WEA 03) 06:27	07:17	17:07	16:25	32 15:16 (WEA 02) 08:30	23 13:52 (WEA 03)				
27	21:24	20 20:51 (WEA 03) 20:27	19:17	17:12	16:25	32 15:16 (WEA 02) 08:31	22 14:14 (WEA 03)				
27	05:41	20:51 (WEA 03) 06:29	07:19	17:09	16:24	30 15:18 (WEA 02) 08:31	22 14:13 (WEA 03)				
28	21:23	21 20:52 (WEA 03) 20:25	5 19:58 (WEA 33) 19:15	17:10	16:24	30 15:48 (WEA 01) 16:22	21 14:14 (WEA 03)				
28	05:42	20:51 (WEA 03) 06:30	5 19:59 (WEA 33) 19:20	17:10	16:23	28 15:49 (WEA 02) 08:31	21 13:53 (WEA 03)				
29	21:21	20 20:51 (WEA 03) 20:23	10 19:56 (WEA 33) 19:12	17:08	6 16:27 (WEA 12) 16:22	22 15:47 (WEA 01) 16:23	21 14:15 (WEA 03)				
29	05:44	20:50 (WEA 03) 06:32	19:56 (WEA 33) 19:22	17:12	16:23	28 15:21 (WEA 02) 08:31	21 13:54 (WEA 03)				
30	21:20	19 20:49 (WEA 03) 20:21	13 19:54 (WEA 33) 19:10	17:06	22 16:25 (WEA 12) 16:23	26 15:47 (WEA 01) 16:24	21 14:15 (WEA 03)				
30	05:45	20:51 (WEA 03) 06:34	19:56 (WEA 33) 19:23	17:14	16:23	28 15:24 (WEA 02) 08:31	21 13:55 (WEA 03)				
31	21:18	17 20:48 (WEA 03) 20:18	13 19:49 (WEA 33) 19:08	17:14	29 16:22	22 15:45 (WEA 01) 16:23	20 14:15 (WEA 03)				
31	05:47	20:51 (WEA 03) 06:35	19:35 (WEA 35) 17:16	15:19 (WEA 01)	16:22	22 15:45 (WEA 01) 16:23	20 14:15 (WEA 03)				
31	21:17	16 20:47 (WEA 03) 20:16	13 19:48 (WEA 35) 17:02	16:26 (WEA 12)	16:26	22 15:45 (WEA 01) 16:23	20 14:15 (WEA 03)				
Sonnenscheinstunden 500		452		381		332		268		246	
astr.max.mögl.Beschattung 361		110		60		170		1185		597	

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:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

KÖTTER Consulting Engineers GmbH & Co. KG

Bonifatiusstr. 400

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+49 5971 9710-31

Schaer / t.schaer@koetter-consulting.com

Berechnet:

18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-04 - SR-04, Lohweg 1, 59929 Brilon**Voraussetzungen für Berechnung des Schattenwurfs**

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	08:31	15:03 (WEA 01)	08:05	07:13	17:38 (WEA 35)	07:03		19:29 (WEA 03)	06:00	18:34 (WEA-ZB03)	05:15
	16:27	15:19 (WEA 01)	17:14	18:05	1	17:39 (WEA 35)	19:57	19:32 (WEA 03)	20:47	20:19 (WEA 39)	21:32
2	08:31	15:04 (WEA 01)	08:04	07:11	1	17:37 (WEA 35)	19:01	19:32 (WEA 03)	20:58	18:33 (WEA-ZB03)	05:14
	16:28	15:19 (WEA 01)	17:16	18:06	4	17:41 (WEA 35)	19:59	19:33 (WEA 03)	20:49	20:21 (WEA 40)	21:33
3	08:31	15:04 (WEA 01)	08:02	07:09	1	17:36 (WEA 35)	06:59	19:25 (WEA 03)	05:56	18:32 (WEA-ZB03)	05:14
	16:29	15:18 (WEA 01)	17:18	18:08	7	17:43 (WEA 35)	20:01	19:35 (WEA 03)	20:51	20:22 (WEA 40)	21:34
4	08:31	15:06 (WEA 01)	08:01	07:06	1	17:35 (WEA 35)	06:57	19:24 (WEA 03)	05:54	18:31 (WEA-ZB03)	05:13
	16:30	15:18 (WEA 01)	17:19	18:10	9	17:44 (WEA 35)	20:02	19:37 (WEA 03)	20:52	20:23 (WEA 40)	21:35
5	08:31	15:07 (WEA 01)	07:59	07:04	1	17:35 (WEA 35)	06:54	19:24 (WEA 03)	05:52	18:31 (WEA-ZB03)	05:12
	16:31	15:18 (WEA 01)	17:21	18:12	11	17:46 (WEA 34)	20:04	19:39 (WEA 03)	20:54	20:26 (WEA 40)	21:36
6	08:30	15:09 (WEA 01)	07:57	07:02	1	17:36 (WEA 35)	06:52	19:23 (WEA 03)	05:50	18:31 (WEA-ZB03)	05:12
	16:33	15:17 (WEA 01)	17:23	18:13	12	17:48 (WEA 34)	20:06	19:40 (WEA 03)	20:55	20:26 (WEA 40)	21:37
7	08:30	15:12 (WEA 01)	07:56	07:00	1	17:37 (WEA 35)	06:50	19:23 (WEA 03)	05:49	18:30 (WEA-ZB03)	05:11
	16:34	15:16 (WEA 01)	17:25	18:15	11	17:50 (WEA 34)	20:08	19:42 (WEA 03)	20:57	20:25 (WEA 40)	21:38
8	08:30		07:54	06:58	1	17:48 (WEA 34)	06:48	19:23 (WEA 03)	05:47	18:30 (WEA-ZB03)	05:11
	16:35		17:27	18:17	2	17:50 (WEA 34)	20:09	19:42 (WEA 03)	20:59	20:26 (WEA 40)	21:39
9	08:29		07:52	06:55			06:45	19:23 (WEA 03)	05:45	18:30 (WEA-ZB03)	05:10
	16:36		17:28	18:19			20:11	19:41 (WEA 03)	21:00	20:25 (WEA 40)	21:40
10	08:29		07:50	06:53			06:43	19:24 (WEA 03)	05:43	18:30 (WEA-ZB03)	05:10
	16:38		17:30	18:20			20:13	19:40 (WEA 03)	21:02	20:25 (WEA 40)	21:41
11	08:28		07:49	06:51			06:41	19:24 (WEA 03)	05:42	18:29 (WEA-ZB03)	05:09
	16:39		17:32	18:22			20:14	19:38 (WEA 03)	21:03	20:24 (WEA 40)	21:41
12	08:27		07:47	06:49			06:39	19:26 (WEA 03)	05:40	18:30 (WEA-ZB03)	05:09
	16:41		17:34	18:24			20:16	19:36 (WEA 03)	21:05	20:23 (WEA 40)	21:42
13	08:27		07:45	06:46			06:37		05:39	18:29 (WEA-ZB03)	05:09
	16:42	3	16:09 (WEA 12)	17:36	18:25		20:18		21:06	20:20 (WEA 40)	21:43
14	08:26		16:07 (WEA 12)	07:43	06:44		06:34		05:37	18:30 (WEA-ZB03)	05:09
	16:44	4	16:11 (WEA 12)	17:38	18:27		20:19		21:08	20:06 (WEA-ZB01)	21:43
15	08:25		16:07 (WEA 12)	07:41	06:42		06:32		05:36	18:29 (WEA-ZB03)	05:08
	16:45	6	16:13 (WEA 12)	17:39	18:29		20:21		21:10	20:05 (WEA-ZB01)	21:44
16	08:24		16:07 (WEA 12)	07:39	06:40		06:30		05:34	18:30 (WEA-ZB03)	05:08
	16:47	8	16:15 (WEA 12)	17:41	18:31		20:23		21:11	20:05 (WEA-ZB01)	21:44
17	08:23		16:07 (WEA 12)	07:37	06:37		06:28		05:33	18:30 (WEA-ZB03)	05:08
	16:48	9	16:16 (WEA 12)	17:43	18:32		20:24		21:13	20:04 (WEA-ZB01)	21:45
18	08:23		16:08 (WEA 12)	07:35	06:35		06:26		05:31	18:30 (WEA-ZB03)	05:08
	16:50	10	16:18 (WEA 31)	17:45	18:34	1	18:09 (WEA 33)		21:14	20:03 (WEA-ZB01)	21:45
19	08:22		16:08 (WEA 12)	07:33	06:33		06:24		05:30	18:30 (WEA-ZB03)	05:08
	16:51	10	16:18 (WEA 31)	17:47	18:36		20:28	17	19:14 (WEA-ZB03)	21:15	87
20	08:21		16:09 (WEA 12)	07:31	06:31		06:22		05:28	18:31 (WEA-ZB03)	05:08
	16:53	8	16:17 (WEA 31)	17:49	18:37		20:29	26	19:18 (WEA-ZB03)	21:17	84
21	08:20		16:11 (WEA 12)	07:29	06:28		06:19		05:27	18:31 (WEA-ZB03)	05:08
	16:55	4	16:15 (WEA 12)	17:50	18:39		20:31	38	19:57 (WEA-ZB01)	21:18	80
22	08:18		07:27	06:26			06:17		05:26	18:32 (WEA-ZB03)	05:09
	16:56		17:52	18:41			20:32	51	20:01 (WEA-ZB01)	21:20	76
23	08:17		07:25	06:24			06:15		05:25	18:31 (WEA-ZB03)	05:09
	16:58		17:54	18:42			20:34	60	20:03 (WEA-ZB01)	21:21	69
24	08:16		07:23	06:21			06:13		05:23	18:32 (WEA-ZB03)	05:09
	17:00		17:56	18:44			20:36	68	20:05 (WEA-ZB01)	21:22	63
25	08:15		07:21	06:19			06:11		05:22	18:32 (WEA-ZB03)	05:09
	17:02		17:57	18:46			20:37	74	20:06 (WEA-ZB01)	21:24	62
26	08:14		07:19	06:17			06:09		05:21	18:33 (WEA-ZB03)	05:10
	17:03		17:59	18:47			20:39	78	20:07 (WEA-ZB01)	21:25	62
27	08:12		07:17	06:15			06:07		05:20	18:37 (WEA-ZB03)	05:10
	17:05		18:01	18:49			20:41	88	20:13 (WEA 39)	21:26	61
28	08:11		07:15	06:12			06:05		05:19	18:36 (WEA-ZB03)	05:11
	17:07		18:03	18:51			20:42	94	20:15 (WEA 39)	21:28	61
29	08:10			07:10			06:03		05:18	18:35 (WEA-ZB03)	05:11
	17:09			19:52			20:44	97	20:16 (WEA 39)	21:29	60
30	08:08			07:08			06:01		05:17	18:34 (WEA-ZB03)	05:12
	17:10			19:54			20:46	100	20:17 (WEA 39)	21:30	60
31	08:07			07:06					05:16	18:35 (WEA-ZB03)	
	17:12			19:56					21:31	19:34 (WEA-ZB03)	
Sonnenscheinstunden		261		279			415		483		496
astr.max.mögl.Beschattung		142		58			952		2781		1593

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor: SR-04 - SR-04, Lohweg 1, 59929 Brilon**
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12	18:45 (WEA-ZB03) 05:48	18:40 (WEA-ZB03) 06:37	19:24 (WEA 03) 07:25	17:17	16:08
2	21:46	19:38 (WEA-ZB03) 21:15	20:34 (WEA 40) 20:14	19:38 (WEA 03) 19:06	17:00	16:06
3	05:13	18:44 (WEA-ZB03) 05:50	18:40 (WEA-ZB03) 06:38	19:22 (WEA 03) 07:26	18:09	16:09
4	21:46	19:38 (WEA-ZB03) 21:13	20:35 (WEA 40) 20:12	19:38 (WEA 03) 19:03	16:59	16:20
5	05:14	18:44 (WEA-ZB03) 05:51	18:39 (WEA-ZB03) 06:40	19:21 (WEA 03) 07:28	18:10	16:20
6	21:45	19:38 (WEA-ZB03) 21:12	20:35 (WEA 40) 20:10	18:39 (WEA 03) 19:01	16:57	16:20
7	05:15	18:45 (WEA-ZB03) 05:53	18:40 (WEA-ZB03) 06:42	19:20 (WEA 03) 07:30	17:23	16:19
8	21:45	19:39 (WEA-ZB03) 21:10	20:36 (WEA 40) 20:07	19:39 (WEA 03) 18:59	16:55	16:19
9	05:15	18:44 (WEA-ZB03) 05:54	18:40 (WEA-ZB03) 06:43	19:20 (WEA 03) 07:31	17:25	16:19
10	21:44	19:39 (WEA-ZB03) 21:08	20:36 (WEA 40) 20:05	19:39 (WEA 03) 18:56	16:53	16:19
11	05:16	18:44 (WEA-ZB03) 05:56	18:40 (WEA-ZB03) 06:45	19:19 (WEA 03) 07:33	18:14 (WEA 35) 07:26	16:18
12	21:44	19:39 (WEA-ZB03) 21:07	20:36 (WEA 40) 20:03	17:36 (WEA 03) 18:54	9 18:27 (WEA 34) 16:52	16:18
13	05:17	18:44 (WEA-ZB03) 05:57	18:40 (WEA-ZB03) 06:46	19:19 (WEA 03) 07:35	18:12 (WEA 35) 07:28	16:18
14	21:43	19:40 (WEA-ZB03) 21:05	20:35 (WEA 40) 20:01	19:34 (WEA 03) 18:52	12 18:25 (WEA 34) 16:50	16:18
15	05:18	18:44 (WEA-ZB03) 05:59	18:41 (WEA-ZB03) 06:48	19:19 (WEA 03) 07:36	18:10 (WEA 35) 07:30	16:17
16	21:43	19:40 (WEA-ZB03) 21:03	20:35 (WEA 40) 19:58	12 19:31 (WEA 03) 18:50	12 18:22 (WEA 34) 16:48	16:18
17	05:19	18:44 (WEA-ZB03) 06:00	18:41 (WEA-ZB03) 06:50	19:19 (WEA 03) 07:38	18:10 (WEA 35) 07:32	16:18
18	21:42	19:41 (WEA-ZB03) 21:01	20:32 (WEA 40) 19:56	11 19:30 (WEA 03) 18:48	10 18:20 (WEA 35) 16:47	16:17
19	05:20	18:44 (WEA-ZB03) 06:02	18:42 (WEA-ZB03) 06:51	19:20 (WEA 03) 07:40	18:10 (WEA 35) 07:33	16:17
20	21:41	19:41 (WEA-ZB03) 20:59	20:31 (WEA 40) 19:54	7 19:27 (WEA 03) 18:45	8 18:18 (WEA 35) 16:45	16:17
21	05:21	18:44 (WEA-ZB03) 06:04	18:42 (WEA-ZB03) 06:53	19:21 (WEA 03) 07:41	18:10 (WEA 35) 07:35	16:17
22	21:41	19:42 (WEA-ZB03) 20:57	20:29 (WEA 40) 19:51	4 19:25 (WEA 03) 18:43	6 18:16 (WEA 35) 16:44	16:17
23	05:22	18:43 (WEA-ZB03) 06:05	18:42 (WEA-ZB03) 06:54	18:43	3 18:13 (WEA 35) 16:42	16:17
24	21:40	19:42 (WEA-ZB03) 20:56	20:27 (WEA 39) 19:49	18:41	3 18:13 (WEA 35) 16:42	16:17
25	05:23	18:43 (WEA-ZB03) 06:07	18:43 (WEA-ZB03) 06:56	18:43	18:13 (WEA 35) 16:42	16:17
26	21:39	19:42 (WEA-ZB03) 20:54	20:25 (WEA 39) 19:47	18:39	18:13 (WEA 35) 16:42	16:17
27	05:24	18:43 (WEA-ZB03) 06:08	18:43 (WEA-ZB03) 06:57	18:39	18:13 (WEA 35) 16:42	16:17
28	21:38	19:43 (WEA-ZB03) 20:52	20:23 (WEA 39) 19:45	18:37	18:13 (WEA 35) 16:42	16:17
29	05:25	18:43 (WEA-ZB03) 06:10	18:44 (WEA-ZB03) 06:59	18:37	18:13 (WEA 35) 16:42	16:17
30	21:37	19:43 (WEA-ZB03) 20:50	20:22 (WEA 39) 19:42	18:34	18:13 (WEA 35) 16:42	16:17
31	05:26	18:42 (WEA-ZB03) 06:11	18:44 (WEA-ZB03) 07:01	18:32	18:13 (WEA 35) 16:42	16:17
1	21:36	19:43 (WEA-ZB03) 20:48	20:19 (WEA 39) 19:40	18:32	18:13 (WEA 35) 16:42	16:17
2	05:28	18:42 (WEA-ZB03) 06:13	18:46 (WEA-ZB03) 07:02	18:31	18:13 (WEA 35) 16:42	16:17
3	21:35	19:43 (WEA-ZB03) 20:46	20:13 (WEA-ZB01) 19:38	18:30	18:13 (WEA 35) 16:42	16:17
4	05:29	18:41 (WEA-ZB03) 06:15	18:46 (WEA-ZB03) 07:04	18:30	18:13 (WEA 35) 16:42	16:17
5	21:34	19:44 (WEA-ZB03) 20:44	20:11 (WEA-ZB01) 19:35	18:28	18:13 (WEA 35) 16:42	16:17
6	05:30	18:42 (WEA-ZB03) 06:16	18:48 (WEA-ZB03) 07:05	18:26	18:13 (WEA 35) 16:42	16:17
7	21:33	19:45 (WEA-ZB03) 20:42	20:10 (WEA-ZB01) 19:33	18:26	18:13 (WEA 35) 16:42	16:17
8	05:31	18:42 (WEA-ZB03) 06:18	18:49 (WEA-ZB03) 07:07	18:26	18:13 (WEA 35) 16:42	16:17
9	21:32	19:45 (WEA-ZB03) 20:40	20:07 (WEA-ZB01) 19:31	18:24	18:13 (WEA 35) 16:42	16:17
10	05:33	18:41 (WEA-ZB03) 06:19	18:51 (WEA-ZB03) 07:09	18:24	18:13 (WEA 35) 16:42	16:17
11	21:31	20:06 (WEA-ZB01) 20:38	20:05 (WEA-ZB01) 19:28	18:22	18:13 (WEA 35) 16:42	16:17
12	05:34	18:41 (WEA-ZB03) 06:21	18:53 (WEA-ZB03) 07:10	18:20	18:13 (WEA 35) 16:42	16:17
13	21:29	20:08 (WEA-ZB01) 20:36	19:59 (WEA-ZB01) 19:26	18:20	18:13 (WEA 35) 16:42	16:17
14	05:35	18:40 (WEA-ZB03) 06:22	18:56 (WEA-ZB03) 07:12	18:18	18:13 (WEA 35) 16:42	16:17
15	21:28	19:41 (WEA-ZB01) 20:33	19:21 (WEA-ZB03) 19:24	18:18	18:13 (WEA 35) 16:42	16:17
16	05:37	18:41 (WEA-ZB03) 06:24	19:00 (WEA-ZB03) 07:13	18:18	18:13 (WEA 35) 16:42	16:17
17	21:27	20:12 (WEA-ZB01) 20:31	19:16 (WEA-ZB03) 19:12	18:16	18:13 (WEA 35) 16:42	16:17
18	05:38	18:40 (WEA-ZB03) 06:26	19:15	18:16	18:13 (WEA 35) 16:42	16:17
19	21:25	18:40 (WEA-ZB03) 06:27	19:15	18:16	18:13 (WEA 35) 16:42	16:17
20	05:39	18:40 (WEA-ZB03) 06:27	19:17	18:16	18:13 (WEA 35) 16:42	16:17
21	21:24	20:13 (WEA-ZB01) 20:27	19:17	18:16	18:13 (WEA 35) 16:42	16:17
22	05:41	18:41 (WEA-ZB03) 06:29	19:17	18:16	18:13 (WEA 35) 16:42	16:17
23	21:23	20:15 (WEA-ZB01) 20:25	19:15	18:16	18:13 (WEA 35) 16:42	16:17
24	05:42	18:40 (WEA-ZB03) 06:30	19:12	18:16	18:13 (WEA 35) 16:42	16:17
25	21:21	20:16 (WEA-ZB01) 20:23	19:12	18:16	18:13 (WEA 35) 16:42	16:17
26	05:44	18:40 (WEA-ZB03) 06:32	19:12	18:16	18:13 (WEA 35) 16:42	16:17
27	21:20	20:16 (WEA-ZB01) 20:21	19:10	18:16	18:13 (WEA 35) 16:42	16:17
28	05:45	18:40 (WEA-ZB03) 06:34	19:12	18:16	18:13 (WEA 35) 16:42	16:17
29	21:18	20:17 (WEA-ZB01) 20:18	19:08	18:16	18:13 (WEA 35) 16:42	16:17
30	05:47	18:40 (WEA-ZB03) 06:35	19:06	18:16	18:13 (WEA 35) 16:42	16:17
31	21:17	20:17 (WEA-ZB01) 20:16	19:06	18:16	18:13 (WEA 35) 16:42	16:17
Sonnenscheinstunden	500	452	381	332	268	246
astr.max.mögl.Beschattung	2137	2113	154	60	60	469

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-05 - SR-05, Almer Str. 39, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	14:58 (WEA N03)	08:05		16:43 (WEA 29)	07:13		16:45 (WEA 01)	07:03		06:00		05:15	
2	16:27	15:22 (WEA N03)	17:14	1	16:44 (WEA 29)	18:05	21	17:06 (WEA 01)	19:57		20:47		21:32	
3	08:31	14:59 (WEA N03)	08:04		16:42 (WEA 29)	07:11		16:47 (WEA 01)	07:01		05:58		05:14	
4	16:28	15:23 (WEA N03)	17:16	4	16:46 (WEA 29)	18:06	17	17:04 (WEA 01)	19:59		20:49		21:33	
5	08:31	14:58 (WEA N03)	08:02		16:28 (WEA 02)	07:09		16:50 (WEA 01)	06:59		05:56		05:14	
6	16:29	15:23 (WEA N03)	17:18	16	16:49 (WEA 29)	18:10	11	17:01 (WEA 01)	20:01		20:51		21:34	
7	08:31	14:59 (WEA N03)	08:01		16:25 (WEA 02)	07:06					05:54		05:13	
8	16:30	15:24 (WEA N03)	17:19	22	16:50 (WEA 29)	18:08					20:02		21:35	
9	08:31	14:59 (WEA N03)	07:59		16:24 (WEA 02)	07:04					05:54		05:12	
10	16:31	15:25 (WEA N03)	17:21	22	16:48 (WEA 29)	18:12					20:04		21:36	
11	08:30	14:59 (WEA N03)	07:57	21	16:22 (WEA 02)	07:02					06:52		05:12	
12	16:33	15:25 (WEA N03)	17:23	21	16:43 (WEA 02)	18:13					20:06		21:37	
13	08:30	14:59 (WEA N03)	07:56		16:22 (WEA 02)	07:00					06:50		05:11	
14	16:34	15:27 (WEA N03)	17:25	22	16:44 (WEA 02)	18:15					20:07		21:38	
15	08:29	14:59 (WEA N03)	07:54	22	16:21 (WEA 02)	06:58					06:48		05:11	
16	16:35	15:27 (WEA N03)	17:27	24	16:45 (WEA 02)	18:17					20:09		21:39	
17	08:29	15:00 (WEA N03)	07:52		16:21 (WEA 02)	06:55					06:45		05:10	
18	16:36	15:28 (WEA N03)	17:29	31	17:00 (WEA 01)	18:19					20:11		21:40	
19	08:29	15:00 (WEA N03)	07:50		16:20 (WEA 02)	06:53			19:45 (WEA 34)		05:43		05:10	
20	16:38	15:29 (WEA N03)	17:30	39	17:02 (WEA 01)	18:20		20:13	2	19:47 (WEA 34)	21:02		21:41	
21	08:28	15:00 (WEA N03)	07:49		16:20 (WEA 02)	06:51		06:41		19:46 (WEA 34)	05:42		05:09	
22	16:39	15:29 (WEA N03)	17:32	43	17:04 (WEA 01)	18:22		20:14	2	19:48 (WEA 34)	21:03		21:41	
23	08:27	15:00 (WEA N03)	07:47		16:20 (WEA 02)	06:49		06:39			05:40		05:09	
24	16:41	15:29 (WEA N03)	17:34	46	17:06 (WEA 01)	18:24		20:16			21:05		21:42	
25	08:27	15:00 (WEA N03)	07:45		16:20 (WEA 02)	06:46		06:37			05:39		05:09	
26	16:42	15:30 (WEA N03)	17:36	48	17:08 (WEA 01)	18:25		20:18			21:06		21:43	
27	08:26	15:01 (WEA N03)	07:43		16:20 (WEA 02)	06:44		06:34		19:52 (WEA 35)	05:37		05:09	
28	16:44	15:31 (WEA N03)	17:38	50	17:10 (WEA 01)	18:27		20:19	1	19:53 (WEA 35)	21:08		21:43	
29	08:25	15:01 (WEA N03)	07:41		16:21 (WEA 02)	06:42		06:32		19:51 (WEA 35)	05:36		05:08	
30	16:45	15:31 (WEA N03)	17:39	51	17:12 (WEA 01)	18:29		20:21	3	19:54 (WEA 35)	21:10		21:44	
31	08:24	15:02 (WEA N03)	07:39		16:21 (WEA 02)	06:40		06:30		19:50 (WEA 35)	05:34		05:08	
32	16:47	15:32 (WEA N03)	17:41	53	17:14 (WEA 01)	18:31		20:22	6	19:56 (WEA 35)	21:11		21:44	
33	08:23	15:02 (WEA N03)	07:37		16:22 (WEA 02)	06:37		06:28		19:50 (WEA 35)	05:33		05:08	
34	16:48	15:32 (WEA N03)	17:43	52	17:14 (WEA 01)	18:32		20:24	8	19:58 (WEA 35)	21:12		21:45	
35	08:23	15:01 (WEA N03)	07:35		16:23 (WEA 02)	06:35		06:26		19:51 (WEA 35)	05:31		05:08	
36	16:50	15:32 (WEA N03)	17:45	50	17:13 (WEA 01)	18:34		20:26	8	19:59 (WEA 35)	21:14		21:45	
37	08:22	15:02 (WEA N03)	07:33		16:24 (WEA 02)	06:33		06:24		19:51 (WEA 35)	05:30		05:08	
38	16:51	15:32 (WEA N03)	17:47	49	17:13 (WEA 01)	18:36		20:27	9	20:00 (WEA 35)	21:15		21:46	
39	08:21	15:03 (WEA N03)	07:31		16:26 (WEA 02)	06:31		06:22		19:53 (WEA 35)	05:28		05:08	
40	16:53	15:32 (WEA N03)	17:49	52	17:21 (WEA 12)	18:37		20:29	4	19:57 (WEA 35)	21:17		21:46	
41	08:20	15:03 (WEA N03)	07:29		16:30 (WEA 02)	06:28		06:19			05:27		05:08	
42	16:55	15:33 (WEA N03)	17:50	47	17:23 (WEA 12)	18:39		20:31			21:18		21:46	
43	08:18	15:04 (WEA N03)	07:27		16:40 (WEA 01)	06:26		06:17			05:26		05:09	
44	16:56	15:33 (WEA N03)	17:52	42	17:24 (WEA 12)	18:41		20:32			21:20		21:46	
45	08:17	15:04 (WEA N03)	07:25		16:40 (WEA 01)	06:24		06:15			05:25		05:09	
46	16:58	15:32 (WEA N03)	17:54	41	17:24 (WEA 12)	18:42		20:34			21:21		21:47	
47	08:16	15:05 (WEA N03)	07:23		16:40 (WEA 01)	06:21		06:13			05:23	20:50 (WEA 36)	05:09	
48	17:00	16:29 (WEA 28)	17:56	39	17:23 (WEA 12)	18:44		20:36			21:22	1	20:51 (WEA 36)	21:47
49	08:15	15:07 (WEA N03)	07:21		16:41 (WEA 01)	06:19		06:11			05:22	2	20:50 (WEA 36)	05:09
50	17:02	16:31 (WEA 28)	17:57	34	17:21 (WEA 12)	18:46		20:37			21:24	2	20:52 (WEA 36)	21:47
51	08:14	15:07 (WEA N03)	07:19		16:42 (WEA 01)	06:17		06:09			05:21	2	20:51 (WEA 36)	05:10
52	17:03	16:32 (WEA 28)	17:59	29	17:11 (WEA 01)	18:47		20:39			21:25	2	20:53 (WEA 36)	21:47
53	08:12	15:09 (WEA N03)	07:17		16:42 (WEA 01)	06:15		06:07			05:20	2	20:51 (WEA 36)	05:10
54	17:05	16:35 (WEA 28)	18:01	27	17:09 (WEA 01)	18:49		20:41			21:26	3	20:54 (WEA 36)	21:47
55	08:11	15:09 (WEA N03)	07:15		16:43 (WEA 01)	06:12		06:05			05:19	3	20:53 (WEA 36)	05:11
56	17:07	16:35 (WEA 28)	18:03	25	17:08 (WEA 01)	18:51		20:42			21:27	3	20:56 (WEA 36)	21:47
57	08:10	15:12 (WEA N03)			07:10			06:03			05:18	3	20:53 (WEA 36)	05:11
58	17:09	16:35 (WEA 28)			19:52			20:44			21:29	4	20:57 (WEA 36)	21:46
59	08:08	15:13 (WEA N03)			07:08			06:01			05:17	4	20:54 (WEA 36)	05:12
60	17:10	16:34 (WEA 28)			19:54			20:46			21:30	4	20:58 (WEA 36)	21:46
61	08:07	15:17 (WEA N03)			07:06						05:16			
62	17:12	15:25 (WEA N03)			19:56						21:31			
Sonnenscheinstunden		261		279		367		415		483		496		
astr. max. mögl. Beschattung		843		980		49		43		19				

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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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-05 - SR-05, Almer Str. 39, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12 21:46	05:48 21:15	06:37 20:14	19:46 (WEA 34) 07:25 19:48 (WEA 34) 19:06	17:17 17:00	15:50 (WEA 02) 08:07 16:31 (WEA 01) 16:21	14:42 (WEA N03) 15:11 (WEA N03)
2	05:13 21:46	05:50 21:13	06:38 20:12	19:43 (WEA 34) 07:26 19:45 (WEA 34) 19:03	17:19 16:59	15:51 (WEA 02) 08:09 16:29 (WEA 01) 16:20	14:43 (WEA N03) 15:12 (WEA N03)
3	05:14 21:45	05:51 21:12	06:40 20:10	19:43 (WEA 34) 19:03 19:01	17:21 16:57	15:51 (WEA 02) 08:10 16:15 (WEA 02) 16:20	14:43 (WEA N03) 15:11 (WEA N03)
4	05:15 21:45	05:53 21:10	06:42 20:07	19:43 (WEA 34) 19:03 19:01	17:23 16:55	15:52 (WEA 02) 08:12 16:14 (WEA 02) 16:19	14:43 (WEA N03) 15:11 (WEA N03)
5	05:15 21:44	05:54 21:08	06:43 20:05	19:43 (WEA 34) 19:03 19:01	17:25 16:53	15:53 (WEA 02) 08:13 16:13 (WEA 02) 16:19	14:45 (WEA N03) 15:12 (WEA N03)
6	05:16 21:44	05:56 21:07	06:45 20:03	19:43 (WEA 34) 19:03 19:01	17:26 16:52	15:54 (WEA 02) 08:14 16:18 (WEA 29) 16:18	14:45 (WEA N03) 15:12 (WEA N03)
7	05:17 21:43	05:57 21:05	06:46 20:01	19:43 (WEA 34) 19:03 19:01	17:28 16:50	15:55 (WEA 02) 08:15 16:19 (WEA 29) 16:18	14:45 (WEA N03) 15:11 (WEA N03)
8	05:18 21:43	05:59 21:03	06:48 19:58	19:43 (WEA 34) 19:03 19:01	17:30 16:48	15:58 (WEA 02) 08:17 16:18 (WEA 29) 16:18	14:47 (WEA N03) 15:12 (WEA N03)
9	05:19 21:42	06:00 21:01	06:50 19:56	19:43 (WEA 34) 19:03 19:01	17:32 16:47	16:13 (WEA 29) 16:17 16:14 (WEA 29) 16:19	14:47 (WEA N03) 15:12 (WEA N03)
10	05:20 21:41	06:02 20:59	06:51 19:54	19:43 (WEA 34) 19:03 19:01	17:33 16:45	16:14 (WEA 29) 16:19 16:15 (WEA 29) 16:17	14:48 (WEA N03) 15:12 (WEA N03)
11	05:21 21:41	06:04 20:57	06:53 19:51	19:43 (WEA 34) 19:03 19:01	17:35 16:44	16:15 (WEA 29) 16:17 16:14 (WEA 29) 16:19	14:48 (WEA N03) 15:12 (WEA N03)
12	05:22 21:40	06:05 20:56	06:54 19:49	19:43 (WEA 34) 19:03 19:01	17:37 16:42	16:16 (WEA 29) 16:17 16:06 (WEA 28) 16:17	14:49 (WEA N03) 15:12 (WEA N03)
13	05:23 21:39	06:07 21:04 (WEA 36) 21:07 (WEA 36)	06:56 19:47 19:47	19:43 (WEA 34) 19:03 19:01	17:39 17:16 (WEA 01) 16:42 17:17 (WEA 01) 16:39	16:17 16:08 (WEA 28) 16:17 16:07 (WEA 28) 16:17	14:50 (WEA N03) 15:13 (WEA N03)
14	05:24 21:38	06:08 21:06 (WEA 36) 21:01 (WEA 36)	06:57 19:45 19:45	19:43 (WEA 34) 19:03 19:01	17:41 17:15 (WEA 01) 16:44 17:15 (WEA 01) 16:41	16:18 16:09 (WEA 28) 16:17 16:07 (WEA 28) 16:17	14:51 (WEA N03) 15:13 (WEA N03)
15	05:25 21:37	06:10 21:05 (WEA 36) 21:01 (WEA 36)	06:59 19:42 19:42	19:43 (WEA 34) 19:03 19:01	17:43 17:16 (WEA 01) 16:46 17:16 (WEA 01) 16:42	16:19 16:08 (WEA 28) 16:17 16:07 (WEA 28) 16:17	14:51 (WEA N03) 15:13 (WEA N03)
16	05:26 21:36	06:11 21:04 (WEA 36) 21:01 (WEA 36)	07:01 19:40 19:40	19:43 (WEA 34) 19:03 19:01	17:45 17:17 (WEA 01) 16:48 17:17 (WEA 01) 16:42	16:20 16:09 (WEA 28) 16:17 16:07 (WEA 28) 16:17	14:52 (WEA N03) 15:13 (WEA N03)
17	05:28 21:35	06:13 21:03 (WEA 36) 21:01 (WEA 36)	07:02 19:38 19:38	19:43 (WEA 34) 19:03 19:01	17:47 17:18 (WEA 01) 16:50 17:18 (WEA 01) 16:44	16:21 16:10 (WEA 28) 16:17 16:08 (WEA 28) 16:17	14:53 (WEA N03) 15:14 (WEA N03)
18	05:29 21:34	06:15 21:02 (WEA 36) 21:01 (WEA 36)	07:04 19:35 19:35	19:43 (WEA 34) 19:03 19:01	17:50 17:19 (WEA 01) 16:52 17:19 (WEA 01) 16:46	16:22 16:11 (WEA 28) 16:17 16:09 (WEA 28) 16:17	14:54 (WEA N03) 15:14 (WEA N03)
19	05:30 21:33	06:16 21:02 (WEA 36) 21:01 (WEA 36)	07:05 19:33 19:33	19:43 (WEA 34) 19:03 19:01	17:52 17:19 (WEA 01) 16:54 17:19 (WEA 01) 16:48	16:23 16:12 (WEA 28) 16:17 16:10 (WEA 28) 16:17	14:55 (WEA N03) 15:15 (WEA N03)
20	05:31 21:32	06:18 21:01 (WEA 36) 21:01 (WEA 36)	07:07 19:31 19:31	19:43 (WEA 34) 19:03 19:01	17:54 17:19 (WEA 01) 16:56 17:19 (WEA 01) 16:50	16:24 16:13 (WEA 28) 16:17 16:11 (WEA 28) 16:17	14:56 (WEA N03) 15:16 (WEA N03)
21	05:33 21:31	06:19 21:00 (WEA 36) 21:00 (WEA 36)	07:09 19:28 19:28	19:43 (WEA 34) 19:03 19:01	17:56 17:19 (WEA 01) 16:58 17:19 (WEA 01) 16:52	16:25 16:14 (WEA 28) 16:17 16:12 (WEA 28) 16:17	14:57 (WEA N03) 15:17 (WEA N03)
22	05:34 21:29	06:21 20:58 (WEA 36) 20:58 (WEA 36)	07:10 19:26 19:26	19:43 (WEA 34) 19:03 19:01	17:58 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:26 16:15 (WEA 28) 16:17 16:13 (WEA 28) 16:17	14:58 (WEA N03) 15:18 (WEA N03)
23	05:35 21:28	06:23 20:57 (WEA 36) 20:57 (WEA 36)	07:12 19:24 19:24	19:43 (WEA 34) 19:03 19:01	18:00 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:27 16:16 (WEA 28) 16:17 16:14 (WEA 28) 16:17	14:59 (WEA N03) 15:19 (WEA N03)
24	05:37 21:27	06:24 20:56 (WEA 36) 20:56 (WEA 36)	07:13 19:22 19:22	19:43 (WEA 34) 19:03 19:01	18:03 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:28 16:17 (WEA 28) 16:17 16:14 (WEA 28) 16:17	14:59 (WEA N03) 15:20 (WEA N03)
25	05:38 21:25	06:26 20:55 (WEA 36) 20:55 (WEA 36)	07:15 19:19 19:19	19:43 (WEA 34) 19:03 19:01	18:05 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:29 16:18 (WEA 28) 16:17 16:15 (WEA 28) 16:17	14:59 (WEA N03) 15:21 (WEA N03)
26	05:39 21:24	06:27 20:54 (WEA 36) 20:54 (WEA 36)	07:17 19:17 19:17	19:43 (WEA 34) 19:03 19:01	18:07 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:30 16:19 (WEA 28) 16:17 16:16 (WEA 28) 16:17	14:59 (WEA N03) 15:22 (WEA N03)
27	05:41 21:23	06:29 20:53 (WEA 36) 20:53 (WEA 36)	07:18 19:15 19:15	19:43 (WEA 34) 19:03 19:01	18:09 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:31 16:20 (WEA 28) 16:17 16:17 (WEA 28) 16:17	14:59 (WEA N03) 15:23 (WEA N03)
28	05:42 21:21	06:30 20:52 (WEA 36) 20:52 (WEA 36)	07:20 19:13 19:13	19:43 (WEA 34) 19:03 19:01	18:10 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:32 16:21 (WEA 28) 16:17 16:18 (WEA 28) 16:17	14:59 (WEA N03) 15:24 (WEA N03)
29	05:44 21:20	06:32 20:51 (WEA 36) 20:51 (WEA 36)	07:22 19:10 19:10	19:43 (WEA 34) 19:03 19:01	18:12 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:33 16:22 (WEA 28) 16:17 16:19 (WEA 28) 16:17	14:59 (WEA N03) 15:25 (WEA N03)
30	05:45 21:18	06:34 20:50 (WEA 36) 20:50 (WEA 36)	07:23 19:08 19:08	19:43 (WEA 34) 19:03 19:01	18:14 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:34 16:23 (WEA 28) 16:17 16:20 (WEA 28) 16:17	14:59 (WEA N03) 15:26 (WEA N03)
31	05:47 21:17	06:35 20:49 (WEA 36) 20:49 (WEA 36)	07:25 19:06 19:06	19:43 (WEA 34) 19:03 19:01	18:16 17:19 (WEA 01) 16:59 17:19 (WEA 01) 16:54	16:35 16:24 (WEA 28) 16:17 16:21 (WEA 28) 16:17	14:59 (WEA N03) 15:27 (WEA N03)
Sonneneinstrahlung	500	452	381	332	268	246	716
astr.max.mögl.Beschattung	21	39	4	838	747	716	

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-06 - SR-06, Radlinghauser Str. 3, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	08:05	15:32 (WEA N03)	07:13	16:44 (WEA 02)	07:03
2	16:27	17:14	16:06 (WEA N03)	18:05	17:39 (WEA 01)	19:57
3	08:31	08:04	15:32 (WEA N03)	07:11	16:46 (WEA 02)	07:01
4	16:28	17:16	16:06 (WEA N03)	18:06	17:41 (WEA 12)	19:59
5	08:31	08:02	15:32 (WEA N03)	07:09	16:47 (WEA 02)	06:59
6	16:29	17:18	16:49 (WEA 28)	18:08	17:43 (WEA 12)	20:01
7	08:31	08:01	15:32 (WEA N03)	07:06	16:49 (WEA 02)	06:57
8	16:30	17:19	16:50 (WEA 28)	18:10	17:44 (WEA 01)	20:02
9	08:31	07:59	15:32 (WEA N03)	07:04	16:55 (WEA 02)	06:54
10	16:31	17:21	16:52 (WEA 28)	18:12	17:46 (WEA 01)	20:04
11	08:30	07:57	15:32 (WEA N03)	07:02	17:13 (WEA 01)	06:52
12	16:33	17:23	16:53 (WEA 28)	18:13	17:46 (WEA 01)	20:06
13	08:30	07:56	15:33 (WEA N03)	07:00	17:13 (WEA 01)	06:50
14	16:34	17:25	16:53 (WEA 28)	18:15	17:47 (WEA 01)	20:07
15	08:29	07:54	15:34 (WEA N03)	06:58	17:11 (WEA 01)	06:48
16	16:35	17:27	16:52 (WEA 28)	18:17	17:46 (WEA 01)	20:09
17	08:29	07:52	15:34 (WEA N03)	06:55	17:11 (WEA 01)	06:45
18	16:37	17:29	17:00 (WEA 29)	18:19	17:46 (WEA 01)	20:11
19	08:29	07:50	15:35 (WEA N03)	06:53	17:11 (WEA 01)	06:43
20	16:38	17:30	17:02 (WEA 29)	18:20	17:46 (WEA 01)	20:12
21	08:28	07:49	15:35 (WEA N03)	06:51	17:11 (WEA 01)	06:41
22	16:39	17:32	17:04 (WEA 29)	18:22	17:46 (WEA 01)	20:14
23	08:27	07:47	15:36 (WEA N03)	06:49	17:11 (WEA 01)	06:39
24	16:41	17:34	17:05 (WEA 29)	18:24	17:45 (WEA 01)	20:16
25	08:27	07:45	15:38 (WEA N03)	06:46	17:11 (WEA 01)	06:37
26	16:42	17:36	17:03 (WEA 29)	18:25	17:45 (WEA 01)	20:17
27	08:26	07:43	15:39 (WEA N03)	06:44	17:12 (WEA 01)	06:34
28	16:44	17:38	16:01 (WEA N03)	18:27	17:44 (WEA 01)	20:19
29	08:25	07:41	15:41 (WEA N03)	06:42	17:12 (WEA 01)	06:32
30	16:45	17:39	17:01 (WEA 02)	18:29	17:42 (WEA 01)	20:21
31	08:24	07:39	15:45 (WEA N03)	06:40	17:13 (WEA 01)	06:30
32	16:47	17:41	17:04 (WEA 02)	18:31	17:41 (WEA 01)	20:22
33	08:23	07:37	16:47 (WEA 02)	06:37	17:14 (WEA 01)	06:28
34	16:48	17:43	17:06 (WEA 02)	18:32	17:40 (WEA 01)	20:24
35	08:23	07:35	16:46 (WEA 02)	06:35	17:15 (WEA 01)	06:26
36	16:50	17:45	17:07 (WEA 02)	18:34	17:39 (WEA 01)	20:26
37	08:22	07:33	16:45 (WEA 02)	06:33	17:17 (WEA 01)	06:24
38	16:51	17:47	17:08 (WEA 02)	18:36	17:36 (WEA 01)	20:27
39	08:21	15:41 (WEA N03)	07:31	16:44 (WEA 02)	06:31	17:20 (WEA 01)
40	16:53	15:41 (WEA N03)	17:49	17:09 (WEA 02)	18:37	17:33 (WEA 01)
41	08:20	15:39 (WEA N03)	07:29	16:44 (WEA 02)	06:28	16:19
42	16:55	15:54 (WEA N03)	17:50	17:10 (WEA 02)	18:39	20:31
43	08:18	15:38 (WEA N03)	07:27	16:43 (WEA 02)	06:26	16:17
44	16:56	15:56 (WEA N03)	17:52	17:26 (WEA 31)	18:41	20:32
45	08:17	15:36 (WEA N03)	07:25	16:43 (WEA 02)	06:24	16:15
46	16:58	15:57 (WEA N03)	17:54	17:28 (WEA 31)	18:42	20:34
47	08:16	15:34 (WEA N03)	07:23	16:43 (WEA 02)	06:21	16:13
48	17:00	15:59 (WEA N03)	17:56	17:30 (WEA 31)	18:44	20:36
49	08:15	15:35 (WEA N03)	07:21	16:43 (WEA 02)	06:19	16:11
50	17:02	16:00 (WEA N03)	17:57	17:31 (WEA 31)	18:46	20:37
51	08:14	15:34 (WEA N03)	07:19	16:43 (WEA 02)	06:17	16:09
52	17:03	16:01 (WEA N03)	17:59	17:30 (WEA 31)	18:47	20:39
53	08:12	15:34 (WEA N03)	07:17	16:43 (WEA 02)	06:15	16:07
54	17:05	16:02 (WEA N03)	18:01	17:35 (WEA 01)	18:49	20:41
55	08:11	15:33 (WEA N03)	07:15	16:43 (WEA 02)	06:12	16:05
56	17:07	16:03 (WEA N03)	18:03	17:37 (WEA 01)	18:51	20:42
57	08:10	15:33 (WEA N03)	07:10	16:43 (WEA 02)	06:03	16:03
58	17:09	16:04 (WEA N03)	18:04	17:38 (WEA 01)	18:52	20:44
59	08:08	15:32 (WEA N03)	07:08	16:43 (WEA 02)	06:01	16:01
60	17:10	16:04 (WEA N03)	18:05	17:39 (WEA 01)	18:53	20:46
61	08:07	15:32 (WEA N03)	07:06	16:43 (WEA 02)	06:00	16:00
62	17:12	16:06 (WEA N03)	18:07	17:40 (WEA 01)	18:54	20:48
63	08:06	15:31 (WEA N03)	07:04	16:43 (WEA 02)	05:58	15:58
64	17:14	16:08 (WEA N03)	18:09	17:41 (WEA 01)	18:56	20:50
65	08:05	15:30 (WEA N03)	07:02	16:43 (WEA 02)	05:56	15:56
66	17:16	16:10 (WEA N03)	18:11	17:42 (WEA 01)	18:58	20:52
67	08:04	15:29 (WEA N03)	07:00	16:43 (WEA 02)	05:54	15:54
68	17:18	16:12 (WEA N03)	18:13	17:43 (WEA 01)	18:59	20:54
69	08:03	15:28 (WEA N03)	06:58	16:43 (WEA 02)	05:52	15:52
70	17:20	16:14 (WEA N03)	18:15	17:44 (WEA 01)	19:00	20:56
71	08:02	15:27 (WEA N03)	06:56	16:43 (WEA 02)	05:50	15:50
72	17:22	16:16 (WEA N03)	18:17	17:45 (WEA 01)	19:01	20:58
73	08:01	15:26 (WEA N03)	06:54	16:43 (WEA 02)	05:48	15:48
74	17:24	16:18 (WEA N03)	18:19	17:46 (WEA 01)	19:02	21:00
75	08:00	15:25 (WEA N03)	06:52	16:43 (WEA 02)	05:46	15:46
76	17:26	16:20 (WEA N03)	18:21	17:47 (WEA 01)	19:03	21:02
77	07:59	15:24 (WEA N03)	06:50	16:43 (WEA 02)	05:44	15:44
78	17:28	16:22 (WEA N03)	18:23	17:48 (WEA 01)	19:04	21:04
79	07:58	15:23 (WEA N03)	06:48	16:43 (WEA 02)	05:42	15:42
80	17:30	16:24 (WEA N03)	18:25	17:49 (WEA 01)	19:05	21:06
81	07:57	15:22 (WEA N03)	06:46	16:43 (WEA 02)	05:40	15:40
82	17:32	16:26 (WEA N03)	18:27	17:50 (WEA 01)	19:06	21:08
83	07:56	15:21 (WEA N03)	06:44	16:43 (WEA 02)	05:38	15:38
84	17:34	16:28 (WEA N03)	18:29	17:51 (WEA 01)	19:07	21:10
85	07:55	15:20 (WEA N03)	06:42	16:43 (WEA 02)	05:36	15:36
86	17:36	16:30 (WEA N03)	18:31	17:52 (WEA 01)	19:08	21:12
87	07:54	15:19 (WEA N03)	06:40	16:43 (WEA 02)	05:34	15:34
88	17:38	16:32 (WEA N03)	18:33	17:53 (WEA 01)	19:09	21:14
89	07:53	15:18 (WEA N03)	06:38	16:43 (WEA 02)	05:32	15:32
90	17:40	16:34 (WEA N03)	18:35	17:54 (WEA 01)	19:10	21:16
91	07:52	15:17 (WEA N03)	06:36	16:43 (WEA 02)	05:30	15:30
92	17:42	16:36 (WEA N03)	18:37	17:55 (WEA 01)	19:11	21:18
93	07:51	15:16 (WEA N03)	06:34	16:43 (WEA 02)	05:28	15:28
94	17:44	16:38 (WEA N03)	18:39	17:56 (WEA 01)	19:12	21:20
95	07:50	15:15 (WEA N03)	06:32	16:43 (WEA 02)	05:26	15:26
96	17:46	16:40 (WEA N03)	18:41	17:57 (WEA 01)	19:13	21:22
97	07:49	15:14 (WEA N03)	06:30	16:43 (WEA 02)	05:24	15:24
98	17:48	16:42 (WEA N03)	18:43	17:58 (WEA 01)	19:14	21:24
99	07:48	15:13 (WEA N03)	06:28	16:43 (WEA 02)	05:22	15:22
100	17:50	16:44 (WEA N03)	18:45	17:59 (WEA 01)	19:15	21:26
101	07:47	15:12 (WEA N03)	06:26	16:43 (WEA 02)	05:20	15:20
102	17:52	16:46 (WEA N03)	18:47	18:00 (WEA 01)	19:16	21:28
103	07:46	15:11 (WEA N03)	06:24	16:43 (WEA 02)	05:18	15:18
104	17:54	16:48 (WEA N03)	18:49	18:01 (WEA 01)	19:17	21:30
105	07:45	15:10 (WEA N03)	06:22	16:43 (WEA 02)	05:16	15:16
106	17:56	16:50 (WEA N03)	18:51	18:02 (WEA 01)	19:18	21:32
107	07:44	15:09 (WEA N03)	06:20	16:43 (WEA 02)	05:14	15:14
108	17:58	16:52 (WEA N03)	18:53	18:03 (WEA 01)	19:19	21:34
109	07:43	15:08 (WEA N03)	06:18	16:43 (WEA 02)	05:12	15:12
110	18:00	16:54 (WEA N03)	18:55	18:04 (WEA 01)	19:20	21:36
111	07:42	15:07 (WEA N03)	06:16	16:43 (WEA 02)	05:10	15:10
112	18:02	16:56 (WEA N03)	18:57	18:05 (WEA 01)	19:21	21:38
113	07:41	15:06 (WEA N03)	06:14	16:43 (WEA 02)	05:08	15:08
114	18:04	16:58 (WEA N03)	18:59	18:06 (WEA 01)	19:22	21:40
115	07:40	15:05 (WEA N03)	06:12	16:43 (WEA 02)	05:06	15:06
116	18:06	17:00 (WEA N03)	19:01	18:07 (WEA 01)	19:23	21:42
117	07:39	15:04 (WEA N03)	06:10	16:43 (WEA 02)	05:04	15:04
118	18:08	17:02 (WEA N03)	19:03	18:08 (WEA 01)	19:24	21:44
119	07:38	15:03 (WEA N03)	06:08	16:43 (WEA 02)	05:02	15:02
120	18:10	17:04 (WEA N03)	19:05	18:09 (WEA 01)	19:25	21:46
121	07:37	15:02 (WEA N03)	06:06	16:43 (WEA 02)	05:00	15:00
122	18:12	17:06 (WEA N03)	19:07	18:10 (WEA 01)	19:26	21:48
123	07:36	15:01 (WEA N03)	06:04	16:43 (WEA 02)	04:58	14:58
124	18:14	17:08 (WEA N03)	19:09	18:11 (WEA 01)	19:27	21:50
125	07:35	15:00 (WEA N03)	06:02	16:43 (WEA 02)	04:56	14:56
126	18:16	17:10 (WEA N03)	19:11	18:12 (WEA 01)	19:28	21:52
127	07:34	14:59 (WEA N03)	06:00	16:43 (WEA 02)	04:54	14:54
128	18:18	17:12 (WEA N03)	19:13	18:13 (WEA 01)	19:29	21:54
129	07:33	14:58 (WEA N03)	05:58	16:43 (WEA 02)	04:52	14:52
130	18:20	17:14 (WEA N03)	19:15	18:14 (WEA 01)	19:30	21:56
131	07:32	14:57 (WEA N03)	05:56	16:43 (WEA 02)	04:50	14:50
132	18:22	17:16 (WEA N03)	19:17	18:15 (WEA 01)	19:31	21:58
133	07:31	14:56 (WEA N03)	05:54	16:43 (WEA 02)	04:48	14:48
134	18:24	17:18 (WEA N03)	19:19	18:16 (WEA 01)	19:32	22:00
135	07:30	14:55 (WEA N03)	05:52	16:43 (WEA 02)	04:46	14:46
136	18:26	17:20 (WEA N03)	19:21	18:17 (WEA 01)	19:33	22:02
137	07:29	14:54 (WEA N03)	05:50	16:43 (WEA 02)	04:44	14:44
138	18:28	17:22 (WEA N03)	19:23	18:18 (WEA 01)	19:34	22:04
139	07:28	14:53 (WEA N03)	05:48	16:43 (WEA 02)	04:42	14:42
140	18:30	17:24 (WEA N03)	19:25	18:19 (WEA 01)	19:35	22:06
141	07:27	14:52 (WEA N03)	05:46	16:43 (WEA 02)	04:40	14:40
142	18:32	17:26 (WEA N03)	19:27	18:20 (WEA 01)	19:36	22:08
143	07:26					

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-06 - SR-06, Radlinghauser Str. 3, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12	05:48			06:37		07:25	17:51 (WEA 01)	07:17	15:04 (WEA N03)	08:07	
	21:46	21:15			20:14		19:06	18:25 (WEA 01)	17:01	16:31 (WEA 29)	16:21	
2	05:13	05:50			06:38		07:26	17:49 (WEA 01)	07:19	15:04 (WEA N03)	08:09	
	21:46	21:13			20:12		19:03	18:24 (WEA 01)	16:59	16:30 (WEA 29)	16:20	
3	05:14	05:51			06:40		07:28	17:49 (WEA 01)	07:21	15:03 (WEA N03)	08:10	
	21:45	21:12			20:10		19:01	18:24 (WEA 01)	16:57	16:22 (WEA 28)	16:20	
4	05:15	05:53			06:42		07:30	17:49 (WEA 01)	07:23	15:03 (WEA N03)	08:12	
	21:45	21:10			20:07		18:59	18:24 (WEA 01)	16:55	16:23 (WEA 28)	16:19	
5	05:15	05:54			06:43		07:31	17:48 (WEA 01)	07:24	15:03 (WEA N03)	08:13	
	21:44	21:08			20:05		18:57	18:23 (WEA 01)	16:53	16:24 (WEA 28)	16:19	
6	05:16	05:56			06:45		07:33	17:48 (WEA 01)	07:26	15:02 (WEA N03)	08:14	
	21:44	21:06			20:03		18:54	18:23 (WEA 01)	16:52	16:21 (WEA 28)	16:18	
7	05:17	05:57			06:46		07:35	17:49 (WEA 01)	07:28	15:02 (WEA N03)	08:15	
	21:43	21:05			20:01		18:52	18:23 (WEA 01)	16:50	16:20 (WEA 28)	16:18	
8	05:18	05:59			06:48		07:36	17:48 (WEA 01)	07:30	15:02 (WEA N03)	08:17	
	21:43	21:03			19:58		18:50	18:21 (WEA 01)	16:48	16:18 (WEA 28)	16:18	
9	05:19	06:00			06:50		07:38	17:26 (WEA 02)	07:32	15:02 (WEA N03)	08:18	
	21:42	21:01			19:56		18:48	18:20 (WEA 01)	16:47	15:36 (WEA N03)	16:17	
10	05:20	06:02		20:24 (WEA 35)	06:51		07:40	17:22 (WEA 02)	07:33	15:03 (WEA N03)	08:19	
	21:41	20:59	7	20:31 (WEA 35)	19:54		18:45	18:18 (WEA 12)	16:45	15:36 (WEA N03)	16:17	
11	05:21	06:04		20:22 (WEA 35)	06:53		07:41	17:21 (WEA 02)	07:35	15:03 (WEA N03)	08:20	
	21:41	20:57	7	20:29 (WEA 35)	19:51		18:43	18:16 (WEA 12)	16:44	15:36 (WEA N03)	16:17	
12	05:22	06:05		20:21 (WEA 35)	06:54		07:43	17:18 (WEA 02)	07:37	15:04 (WEA N03)	08:21	
	21:40	20:56	6	20:27 (WEA 35)	19:49		18:41	18:13 (WEA 12)	16:42	15:36 (WEA N03)	16:17	
13	05:23	06:07		20:21 (WEA 35)	06:56		07:45	17:17 (WEA 02)	07:39	15:05 (WEA N03)	08:22	
	21:39	20:54	4	20:25 (WEA 35)	19:47		18:39	18:11 (WEA 01)	16:41	15:36 (WEA N03)	16:17	
14	05:24	06:08		20:20 (WEA 35)	06:57		07:46	17:16 (WEA 02)	07:40	15:06 (WEA N03)	08:23	
	21:38	20:52	3	20:23 (WEA 35)	19:45		18:37	18:09 (WEA 01)	16:39	15:36 (WEA N03)	16:17	
15	05:25	06:10		20:21 (WEA 35)	06:59		07:48	17:16 (WEA 02)	07:42	15:05 (WEA N03)	08:24	
	21:37	20:50	1	20:22 (WEA 35)	19:42		18:34	18:07 (WEA 01)	16:38	15:34 (WEA N03)	16:17	
16	05:26	06:11			07:01		07:50	17:14 (WEA 02)	07:44	15:07 (WEA N03)	08:25	
	21:36	20:48			19:40		18:32	18:02 (WEA 31)	16:36	15:34 (WEA N03)	16:17	
17	05:28	06:13			07:02		07:51	17:14 (WEA 02)	07:45	15:08 (WEA N03)	08:25	
	21:35	20:46			19:38		18:30	18:02 (WEA 31)	16:35	15:33 (WEA N03)	16:17	
18	05:29	06:15			07:04		07:53	17:14 (WEA 02)	07:47	15:09 (WEA N03)	08:26	
	21:34	20:44			19:35		18:28	18:00 (WEA 31)	16:34	15:33 (WEA N03)	16:18	
19	05:30	06:16			07:05		07:55	17:14 (WEA 02)	07:49	15:11 (WEA N03)	08:27	
	21:33	20:42			19:33		18:26	17:58 (WEA 31)	16:33	15:32 (WEA N03)	16:18	
20	05:31	06:18			07:07		07:57	17:14 (WEA 02)	07:50	15:13 (WEA N03)	08:28	
	21:32	20:40			19:31		18:24	17:40 (WEA 02)	16:31	15:31 (WEA N03)	16:18	
21	05:33	06:19			07:09		07:58	17:14 (WEA 02)	07:52	15:14 (WEA N03)	08:28	
	21:31	20:38			19:28		18:22	17:40 (WEA 02)	16:30	15:29 (WEA N03)	16:19	
22	05:34	06:21			07:10		08:00	17:15 (WEA 02)	07:54	15:17 (WEA N03)	08:29	
	21:29	20:36			19:26		18:20	17:39 (WEA 02)	16:29	15:27 (WEA N03)	16:19	
23	05:35	06:23			07:12		08:02	17:16 (WEA 02)	07:55		08:29	
	21:28	20:33			19:24	10	18:16 (WEA 01)	17:38 (WEA 02)	16:28		16:20	
24	05:37	06:24			07:13		18:01 (WEA 01)	17:17 (WEA 02)	07:57		08:30	
	21:27	20:31			19:22	17	18:18 (WEA 01)	17:37 (WEA 02)	16:27		16:20	
25	05:38	06:26			07:15		17:59 (WEA 01)	16:18 (WEA 02)	07:58		08:30	
	21:25	20:29			19:19	22	18:21 (WEA 01)	16:36 (WEA 02)	16:26		16:21	
26	05:39	06:27			07:17		17:56 (WEA 01)	15:14 (WEA N03)	08:00		08:30	
	21:24	20:27			19:17	25	18:21 (WEA 01)	16:34 (WEA 02)	16:25		16:22	
27	05:41	06:29			07:18		17:55 (WEA 01)	15:10 (WEA N03)	08:02		08:31	
	21:23	20:25			19:15	28	18:23 (WEA 01)	16:29 (WEA 02)	16:24		16:22	
28	05:42	06:30			07:20		17:54 (WEA 01)	15:08 (WEA N03)	08:03		08:31	
	21:21	20:23			19:12	30	18:24 (WEA 01)	15:31 (WEA N03)	16:23		16:23	
29	05:44	06:32			07:22		17:52 (WEA 01)	15:07 (WEA N03)	08:05		08:31	
	21:20	20:21			19:10	32	18:24 (WEA 01)	16:33 (WEA 29)	16:23		16:24	
30	05:45	06:34			07:23		17:51 (WEA 01)	15:06 (WEA N03)	08:06		08:31	
	21:18	20:18			19:08	33	18:24 (WEA 01)	16:35 (WEA 29)	16:22		16:25	
31	05:47	06:35					07:16	15:05 (WEA N03)			08:31	
	21:16	20:16					17:02	16:33 (WEA 29)			16:26	
Sonnenscheinstunden	500	452			381		332		268		246	
astr.max.mögl.Beschattung			28		197		1001		666			

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:
216094-04 WP Brilon-MadfeldLizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender****Berechnung: Gesamtbelastung Schattenrezeptor: SR-07 - SR-07, Radlinghauser Str. 1, 59929 Brilon**
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	08:05	15:36 (WEA N03) 07:13	16:46 (WEA 02) 07:03	06:00	05:15
	16:27	17:14	16:06 (WEA N03) 18:05	17:39 (WEA 12) 19:57	20:47	21:32
2	08:31	08:04	15:35 (WEA N03) 07:11	16:50 (WEA 02) 07:01	05:58	05:14
	16:28	17:16	16:46 (WEA 28) 18:06	17:39 (WEA 12) 19:59	20:49	21:33
3	08:31	08:02	15:36 (WEA N03) 07:08	17:07 (WEA 01) 06:59	05:56	05:14
	16:29	17:18	16:49 (WEA 28) 18:08	17:39 (WEA 12) 20:01	20:51	21:34
4	08:31	08:01	15:36 (WEA N03) 07:06	17:06 (WEA 01) 06:57	05:54	05:13
	16:30	17:19	16:50 (WEA 28) 18:10	17:38 (WEA 01) 20:02	20:52	21:35
5	08:31	07:59	15:36 (WEA N03) 07:04	17:06 (WEA 01) 06:54	05:52	05:12
	16:31	17:21	16:51 (WEA 28) 18:12	17:38 (WEA 01) 20:04	20:54	21:36
6	08:30	07:57	15:37 (WEA N03) 07:02	17:06 (WEA 01) 06:52	05:50	05:12
	16:33	17:23	16:50 (WEA 28) 18:13	17:38 (WEA 01) 20:06	20:55	21:37
7	08:30	07:56	15:38 (WEA N03) 07:00	17:06 (WEA 01) 06:50	05:49	05:11
	16:34	17:25	16:50 (WEA 28) 18:15	17:38 (WEA 01) 20:07	20:57	21:38
8	08:29	07:54	15:39 (WEA N03) 06:58	17:06 (WEA 01) 06:48	05:47	05:11
	16:35	17:27	16:58 (WEA 29) 18:17	17:37 (WEA 01) 20:09	20:59	21:39
9	08:29	07:52	15:39 (WEA N03) 06:55	17:06 (WEA 01) 06:45	05:45	05:10
	16:36	17:29	17:00 (WEA 29) 18:19	17:36 (WEA 01) 20:11	21:00	21:40
10	08:29	07:50	15:40 (WEA N03) 06:53	17:07 (WEA 01) 06:43	05:43	05:10
	16:38	17:30	17:02 (WEA 29) 18:20	17:36 (WEA 01) 20:12	21:02	21:41
11	08:28	07:49	15:42 (WEA N03) 06:51	17:08 (WEA 01) 06:41	05:42	05:09
	16:39	17:32	17:02 (WEA 29) 18:22	17:35 (WEA 01) 20:14	21:03	21:41
12	08:27	07:47	15:43 (WEA N03) 06:49	17:08 (WEA 01) 06:39	05:40	05:09
	16:41	17:34	17:01 (WEA 29) 18:24	17:32 (WEA 01) 20:15	21:05	21:42
13	08:27	07:45	15:46 (WEA N03) 06:46	17:10 (WEA 01) 06:37	05:39	05:09
	16:42	17:36	17:02 (WEA 29) 18:25	17:31 (WEA 01) 20:17	21:06	21:43
14	08:26	07:43	15:51 (WEA N03) 06:44	17:12 (WEA 01) 06:34	05:37	05:09
	16:44	17:38	17:00 (WEA 29) 18:27	17:29 (WEA 01) 20:19	21:08	21:43
15	08:25	07:41	16:45 (WEA 02) 06:42	17:14 (WEA 01) 06:32	05:36	05:08
	16:45	17:39	17:02 (WEA 29) 18:29	17:25 (WEA 01) 20:21	21:09	21:44
16	08:24	07:39	16:44 (WEA 02) 06:40	17:06	19:55 (WEA 34) 05:34	05:08
	16:47	17:41	17:03 (WEA 29) 18:31	20:22	19:56 (WEA 34) 21:11	21:44
17	08:23	07:37	16:43 (WEA 02) 06:37	17:06	19:56 (WEA 34) 05:33	05:08
	16:48	17:43	17:04 (WEA 29) 18:32	20:24	21:12	21:45
18	08:23	07:35	16:42 (WEA 02) 06:35	17:06	19:56 (WEA 34) 05:31	05:08
	16:50	17:45	17:05 (WEA 29) 18:34	20:26	21:14	21:45
19	08:22	07:33	16:41 (WEA 02) 06:33	17:06	19:56 (WEA 34) 05:30	05:08
	16:51	17:47	17:05 (WEA 29) 18:36	20:27	21:15	21:46
20	08:21	15:43 (WEA N03) 07:31	16:41 (WEA 02) 06:31	17:06	19:56 (WEA 34) 05:28	05:08
	16:53	17:49	17:06 (WEA 29) 18:37	20:29	21:17	21:46
21	08:20	15:41 (WEA N03) 07:29	16:41 (WEA 02) 06:28	17:06	19:56 (WEA 34) 05:27	05:08
	16:55	17:50	17:23 (WEA 31) 18:39	20:31	21:18	21:46
22	08:18	15:40 (WEA N03) 07:27	16:41 (WEA 02) 06:26	17:06	19:56 (WEA 34) 05:26	05:09
	16:56	17:52	17:26 (WEA 31) 18:41	20:32	21:19	21:46
23	08:17	15:38 (WEA N03) 07:25	16:41 (WEA 02) 06:24	17:06	19:56 (WEA 34) 05:25	05:09
	16:58	17:54	17:28 (WEA 31) 18:42	20:34	21:21	21:46
24	08:16	15:38 (WEA N03) 07:23	16:41 (WEA 02) 06:21	17:06	19:56 (WEA 34) 05:23	05:09
	17:00	17:56	17:30 (WEA 01) 18:44	20:36	21:22	21:47
25	08:15	15:38 (WEA N03) 07:21	16:42 (WEA 02) 06:19	17:06	19:56 (WEA 34) 05:22	05:09
	17:02	17:57	17:32 (WEA 01) 18:46	20:37	21:24	21:47
26	08:14	15:37 (WEA N03) 07:19	16:42 (WEA 02) 06:17	17:06	19:56 (WEA 34) 05:21	05:10
	17:03	17:59	17:34 (WEA 01) 18:47	20:39	21:25	21:47
27	08:12	15:37 (WEA N03) 07:17	16:42 (WEA 02) 06:15	17:06	19:56 (WEA 34) 05:20	05:10
	17:05	18:01	17:35 (WEA 12) 18:49	20:41	21:26	21:47
28	08:11	15:36 (WEA N03) 07:15	16:44 (WEA 02) 06:12	17:06	19:56 (WEA 34) 05:19	05:11
	17:07	18:03	17:37 (WEA 12) 18:51	20:42	21:27	21:47
29	08:10	15:36 (WEA N03) 07:13	16:44 (WEA 02) 06:10	17:06	19:56 (WEA 34) 05:18	05:11
	17:09	18:05	17:39 (WEA 12) 18:53	20:44	21:29	21:46
30	08:08	15:36 (WEA N03) 07:11	16:44 (WEA 02) 06:08	17:06	19:56 (WEA 34) 05:17	05:12
	17:10	18:05	17:41 (WEA 12) 18:55	20:46	21:30	21:46
31	08:07	15:36 (WEA N03) 07:09	16:44 (WEA 02) 06:06	17:06	19:56 (WEA 34) 05:16	05:12
	17:12	18:06	17:43 (WEA 12) 18:57	20:48	21:31	21:46
Sonnenscheinstunden	261	279	367	415	483	496
astr. max. mögl. Beschattung	278	846	431	30	17	

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-07 - SR-07, Radlinghauser Str. 1, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12 21:46	05:48 21:15	06:37 20:14	07:25 19:06	17:49 (WEA 01) 07:17 18:12 (WEA 01) 17:00	15:10 (WEA N03) 08:07 16:31 (WEA 29) 16:21
2	05:13 21:46	05:50 21:11 (WEA 36) 21:13	06:38 20:12	07:26 19:03	17:46 (WEA 01) 07:19 18:12 (WEA 01) 16:59	15:09 (WEA N03) 08:09 16:30 (WEA 29) 16:20
3	05:14 21:45	05:51 21:10 (WEA 36) 21:12	06:40 20:10	07:28 19:01	17:45 (WEA 01) 07:21 18:13 (WEA 01) 16:57	15:08 (WEA N03) 08:10 16:28 (WEA 29) 16:20
4	05:15 21:45	05:53 21:10 (WEA 36) 21:10	06:42 20:07	07:30 18:59	17:44 (WEA 01) 07:23 18:14 (WEA 01) 16:55	15:08 (WEA N03) 08:12 16:20 (WEA 28) 16:19
5	05:15 21:44	05:54 21:10 (WEA 36) 21:08	06:43 20:05	07:31 18:56	17:43 (WEA 01) 07:24 18:13 (WEA 01) 16:53	15:06 (WEA N03) 08:13 16:20 (WEA 28) 16:19
6	05:16 21:44	05:56 21:09 (WEA 36) 21:06	06:45 20:03	07:33 18:54	17:42 (WEA 01) 07:26 18:14 (WEA 01) 16:52	15:06 (WEA N03) 08:14 16:21 (WEA 28) 16:18
7	05:17 21:43	05:57 21:09 (WEA 36) 21:05	06:46 20:01	07:35 18:52	17:42 (WEA 01) 07:28 18:14 (WEA 01) 16:50	15:06 (WEA N03) 08:15 16:20 (WEA 28) 16:18
8	05:18 21:43	05:59 21:09 (WEA 36) 21:03	06:48 19:58	07:36 18:50	17:41 (WEA 01) 07:30 18:13 (WEA 01) 16:48	15:06 (WEA N03) 08:17 16:18 (WEA 28) 16:18
9	05:19 21:42	06:00 21:09 (WEA 36) 21:01	06:50 19:56	07:38 18:48	17:41 (WEA 01) 07:32 18:13 (WEA 01) 16:47	15:06 (WEA N03) 08:18 16:17 (WEA 28) 16:17
10	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:45	17:41 (WEA 01) 07:33 18:13 (WEA 01) 16:45	15:07 (WEA N03) 08:19 16:17 (WEA 28) 16:17
11	05:21 21:41	06:04 20:57	06:53 19:51	07:41 18:43	17:41 (WEA 01) 07:35 18:12 (WEA 12) 16:44	15:07 (WEA N03) 08:20 16:17 (WEA 28) 16:17
12	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	17:21 (WEA 02) 07:37 18:12 (WEA 12) 16:42	15:07 (WEA N03) 08:21 16:17 (WEA 28) 16:17
13	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	17:18 (WEA 02) 07:39 18:11 (WEA 12) 16:41	15:08 (WEA N03) 08:22 16:17 (WEA 28) 16:17
14	05:24 21:38	06:08 20:52	06:57 19:45	07:46 18:37	17:16 (WEA 02) 07:40 18:09 (WEA 12) 16:39	15:09 (WEA N03) 08:23 16:17 (WEA 28) 16:17
15	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:34	17:15 (WEA 02) 07:42 18:07 (WEA 01) 16:38	15:09 (WEA N03) 08:24 16:17 (WEA 28) 16:17
16	05:26 21:36	06:11 20:48	07:01 19:40	07:50 18:32	17:13 (WEA 02) 07:44 18:04 (WEA 01) 16:36	15:10 (WEA N03) 08:25 16:17 (WEA 28) 16:17
17	05:28 21:35	06:13 20:46	07:02 19:38	07:51 18:30	17:13 (WEA 02) 07:45 18:02 (WEA 01) 16:35	15:11 (WEA N03) 08:25 16:17 (WEA 28) 16:17
18	05:29 21:34	06:15 20:44	07:04 19:35	07:53 18:28	17:12 (WEA 02) 07:47 18:00 (WEA 01) 16:34	15:12 (WEA N03) 08:26 16:18 (WEA 28) 16:18
19	05:30 21:33	06:16 20:42	07:05 19:33	07:55 18:26	17:12 (WEA 02) 07:49 17:58 (WEA 31) 16:33	15:13 (WEA N03) 08:27 16:18 (WEA 28) 16:18
20	05:31 21:32	06:18 20:40	07:07 19:31	07:57 18:24	17:11 (WEA 02) 07:50 17:55 (WEA 31) 16:31	15:15 (WEA N03) 08:28 16:18 (WEA 28) 16:18
21	05:33 21:31	06:19 20:38	07:09 19:28	07:58 18:22	17:11 (WEA 02) 07:52 17:53 (WEA 31) 16:30	15:16 (WEA N03) 08:28 16:19 (WEA 28) 16:19
22	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	17:11 (WEA 02) 07:54 17:36 (WEA 02) 16:29	15:19 (WEA N03) 08:29 16:19 (WEA 28) 16:19
23	05:35 21:28	06:22 20:33	07:12 19:24	08:02 18:18	17:12 (WEA 02) 07:55 17:36 (WEA 02) 16:28	15:20 (WEA N03) 08:29 16:20 (WEA 28) 16:20
24	05:37 21:27	06:24 20:31	07:13 19:22	08:03 18:16	17:12 (WEA 02) 07:57 17:35 (WEA 02) 16:27	15:21 (WEA N03) 08:30 16:20 (WEA 28) 16:20
25	05:38 21:25	06:26 20:29	07:15 19:19	08:05 18:14	16:13 (WEA 02) 07:58 16:34 (WEA 02) 16:26	15:22 (WEA N03) 08:30 16:21 (WEA 28) 16:21
26	05:39 21:24	06:27 20:27	07:17 19:17	08:07 18:12	16:15 (WEA 02) 08:00 16:33 (WEA 02) 16:25	15:23 (WEA N03) 08:30 16:22 (WEA 28) 16:22
27	05:41 21:23	06:29 20:25	07:18 19:15	08:09 18:10	16:15 (WEA 02) 08:02 16:31 (WEA 02) 16:24	15:24 (WEA N03) 08:31 16:23 (WEA 28) 16:23
28	05:42 21:21	06:30 20:23	07:20 19:12	08:10 18:04	16:15 (WEA 02) 08:03 16:28 (WEA 02) 16:23	15:25 (WEA N03) 08:31 16:24 (WEA 28) 16:24
29	05:44 21:20	06:32 20:21	07:22 19:10	08:12 18:06	16:15 (WEA 02) 08:05 15:29 (WEA N03) 16:23	15:26 (WEA N03) 08:31 16:25 (WEA 28) 16:25
30	05:45 21:18	06:34 20:18	07:23 19:08	08:14 18:10	16:16 (WEA 02) 08:06 16:31 (WEA 29) 16:22	15:27 (WEA N03) 08:31 16:26 (WEA 28) 16:26
31	05:47 21:16	06:35 20:16	07:25 19:06	08:16 18:08	16:17 (WEA 02) 08:07 16:32 (WEA 29) 16:21	15:28 (WEA N03) 08:31 16:27 (WEA 28) 16:27
Sonnenscheinstunden	500	452	381	332	268	246
astr. max. mögl. Beschattung	13	33	41	919	611	246

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-08 - SR-08, Almer Str. 26, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12	05:48	06:37	19:43 (WEA 35) 07:25	17:17	15:55 (WEA 02) 08:07	14:57 (WEA N03)
2	21:46	21:15	20:14	5 19:48 (WEA 35) 19:06	17:00	16:31 (WEA 01) 16:21	24 15:21 (WEA N03)
3	05:13	05:50	06:38	19:42 (WEA 35) 07:26	17:19	15:55 (WEA 02) 08:09	14:58 (WEA N03)
4	21:46	21:13	20:12	3 19:45 (WEA 35) 19:03	16:59	16:17 (WEA 02) 16:20	23 15:21 (WEA N03)
5	05:14	05:51	06:40	19:40	17:21	15:56 (WEA 02) 08:10	14:59 (WEA N03)
6	21:45	21:12	20:10	19:01	16:57	16:17 (WEA 02) 16:20	22 15:21 (WEA N03)
7	05:15	05:53	06:42	19:37 (WEA 34) 07:30	17:23	15:57 (WEA 02) 08:12	14:59 (WEA N03)
8	21:45	21:10	20:07	18:59	16:55	16:16 (WEA 02) 16:19	21 15:20 (WEA N03)
9	05:15	05:54	06:43	19:37 (WEA 34) 07:31	17:24	15:58 (WEA 02) 08:13	15:00 (WEA N03)
10	21:44	21:08	20:05	2 19:39 (WEA 34) 18:56	16:53	16:15 (WEA 02) 16:19	21 15:21 (WEA N03)
11	05:16	05:56	06:45	19:35 (WEA 34) 07:33	17:26	15:58 (WEA 02) 08:14	15:01 (WEA N03)
12	21:44	21:06	20:03	1 19:36 (WEA 34) 18:54	16:52	16:13 (WEA 02) 16:18	19 15:20 (WEA N03)
13	05:17	05:57	06:46	19:35	17:28	16:01 (WEA 02) 08:15	15:02 (WEA N03)
14	21:43	21:05	20:01	18:52	16:50	16:11 (WEA 02) 16:18	18 15:20 (WEA N03)
15	05:18	05:59	06:48	19:36	17:30	16:05 (WEA 02) 08:17	15:03 (WEA N03)
16	21:43	21:03	19:58	18:50	16:48	2 16:07 (WEA 02) 16:18	18 15:21 (WEA N03)
17	05:19	06:00	06:50	19:38	17:32	16:17	15:04 (WEA N03)
18	21:42	21:01	19:56	18:48	16:47	16:17	16 15:20 (WEA N03)
19	05:20	06:02	06:51	19:40	17:33	15:02 (WEA N03) 08:19	15:05 (WEA N03)
20	21:41	20:59	19:54	18:45	16:45	5 15:07 (WEA N03) 16:17	15 15:20 (WEA N03)
21	05:21	06:04	06:53	19:41	17:35	14:58 (WEA N03) 08:20	15:06 (WEA N03)
22	21:41	20:57	19:51	18:43	16:44	16:08 (WEA 28) 16:17	14 15:20 (WEA N03)
23	05:22	06:05	06:54	19:43	17:37	14:57 (WEA N03) 08:21	15:07 (WEA N03)
24	21:40	20:56	19:49	18:41	16:42	21 16:09 (WEA 28) 16:17	13 15:20 (WEA N03)
25	05:23	06:07	06:56	19:45	17:39	14:55 (WEA N03) 08:22	15:08 (WEA N03)
26	21:39	20:54	19:47	18:39	16:42	27 16:10 (WEA 28) 16:17	11 15:19 (WEA N03)
27	05:24	06:08	06:57	19:46	17:40	14:55 (WEA N03) 08:23	15:09 (WEA N03)
28	21:38	20:52	19:45	18:37	18 17:37 (WEA 01) 16:31	26 16:09 (WEA 28) 16:17	10 15:19 (WEA N03)
29	05:25	06:10	06:59	19:48	17:42	14:53 (WEA N03) 08:24	15:10 (WEA N03)
30	21:37	20:50	19:42	18:34	21 17:41 (WEA 01) 16:38	27 16:07 (WEA 28) 16:17	9 15:19 (WEA N03)
31	05:26	06:11	07:01	19:50	17:43	14:53 (WEA N03) 08:25	15:12 (WEA N03)
1	21:36	20:48	19:40	18:32	24 17:42 (WEA 01) 16:36	25 16:05 (WEA 28) 16:17	7 15:19 (WEA N03)
2	05:28	06:13	07:02	19:51	17:47	14:52 (WEA N03) 08:25	15:13 (WEA N03)
3	21:35	20:46	19:38	18:30	25 17:42 (WEA 01) 16:35	25 15:17 (WEA N03) 16:17	6 15:19 (WEA N03)
4	05:29	06:15	07:04	19:53	17:48	14:52 (WEA N03) 08:26	15:14 (WEA N03)
5	21:34	20:44	19:35	18:28	32 17:53 (WEA 12) 16:34	26 15:18 (WEA N03) 16:18	5 15:18 (WEA N03)
6	05:30	06:16	07:05	19:55	17:49	14:52 (WEA N03) 08:27	15:15 (WEA N03)
7	21:33	20:42	19:33	18:26	35 17:54 (WEA 12) 16:33	27 15:19 (WEA N03) 16:18	3 15:18 (WEA N03)
8	05:31	06:18	07:07	19:57	17:51	14:53 (WEA N03) 08:28	15:17 (WEA N03)
9	21:32	20:40	19:31	18:24	38 17:54 (WEA 12) 16:31	26 15:19 (WEA N03) 16:18	1 15:18 (WEA N03)
10	05:33	06:19	07:09	19:58	17:54	14:52 (WEA N03) 08:28	15:18 (WEA N03)
11	21:31	20:38	19:28	18:22	37 17:53 (WEA 12) 16:30	27 15:19 (WEA N03) 16:19	15:19 (WEA N03)
12	05:34	06:21	07:10	19:59	17:55	14:52 (WEA N03) 08:29	15:20 (WEA N03)
13	21:29	20:36	19:26	18:20	45 17:51 (WEA 12) 16:29	28 15:20 (WEA N03) 16:19	15:20 (WEA N03)
14	05:35	06:22	07:12	19:59	17:56	14:53 (WEA N03) 08:29	15:21 (WEA N03)
15	21:28	20:33	19:24	18:18	45 17:49 (WEA 12) 16:28	27 15:20 (WEA N03) 16:20	15:21 (WEA N03)
16	05:37	06:24	07:13	19:59	17:57	14:53 (WEA N03) 08:30	15:22 (WEA N03)
17	21:27	20:31	19:22	18:16	45 17:43 (WEA 31) 16:27	28 15:21 (WEA N03) 16:20	3 15:20 (WEA N03)
18	05:38	06:26	07:15	19:59	17:58	14:53 (WEA N03) 08:30	15:23 (WEA N03)
19	21:25	20:29	19:19	17:14	48 16:45 (WEA 31) 16:26	27 15:20 (WEA N03) 16:21	4 15:22 (WEA N03)
20	05:39	20:50 (WEA 36) 20:27	19:17	17:07	47 16:44 (WEA 31) 16:25	27 15:21 (WEA N03) 16:21	6 15:23 (WEA N03)
21	21:24	3 20:53 (WEA 36) 20:25	19:15	17:12	48 16:44 (WEA 31) 16:25	27 15:21 (WEA N03) 16:21	6 15:23 (WEA N03)
22	05:41	20:49 (WEA 36) 20:29	19:18	17:09	47 16:41 (WEA 31) 16:24	26 15:21 (WEA N03) 16:21	7 15:24 (WEA N03)
23	21:23	4 20:53 (WEA 36) 20:25	19:15	17:10	47 16:41 (WEA 31) 16:24	26 15:21 (WEA N03) 16:21	7 15:24 (WEA N03)
24	05:42	20:48 (WEA 36) 20:30	19:16	17:08	45 16:39 (WEA 31) 16:23	25 15:20 (WEA N03) 16:20	9 15:25 (WEA N03)
25	21:21	3 20:51 (WEA 36) 20:23	19:12	17:08	45 16:39 (WEA 31) 16:23	25 15:20 (WEA N03) 16:20	9 15:25 (WEA N03)
26	05:44	20:47 (WEA 36) 20:32	19:12	17:08	45 16:39 (WEA 31) 16:23	25 15:20 (WEA N03) 16:20	9 15:25 (WEA N03)
27	21:20	2 20:49 (WEA 36) 20:21	7 19:45 (WEA 35) 19:10	17:06	43 16:37 (WEA 01) 16:23	25 15:21 (WEA N03) 16:24	10 15:26 (WEA N03)
28	05:45	20:48 (WEA 36) 20:33	19:13	17:06	43 16:37 (WEA 01) 16:23	25 15:21 (WEA N03) 16:24	10 15:26 (WEA N03)
29	21:18	20:18	8 19:52 (WEA 35) 19:08	17:04	41 16:35 (WEA 01) 16:22	24 15:21 (WEA N03) 16:25	11 15:27 (WEA N03)
30	05:47	06:35	19:43 (WEA 35) 19:11	17:02	37 16:33 (WEA 01) 16:21	23 15:20 (WEA N03) 16:24	12 15:28 (WEA N03)
31	21:16	20:16	6 19:49 (WEA 35) 19:06	17:02	37 16:33 (WEA 01) 16:21	23 15:20 (WEA N03) 16:24	12 15:28 (WEA N03)
Sonnenscheinstunden	500	452	381	332	268	246	238
astr.-max.mögl.Beschattung	12	21	11	686	652	338	

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:
216094-04 WP Brilon-MadfeldLizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender****Berechnung: Gesamtbelastung Schattenrezeptor: SR-09 - SR-09, Almer Str. 24, 59929 Brilon**
Voraussetzungen für Berechnung des SchattenwurfsDie 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	08:31	08:05	15:42 (WEA N03)	07:13	17:00 (WEA 01)	07:03	06:00	05:15
2	16:27	17:14	16:44 (WEA 28)	18:05	17:27 (WEA 01)	19:57	20:47	21:32
3	08:31	08:04	15:42 (WEA N03)	07:11	17:01 (WEA 01)	19:57	20:47	21:32
4	16:28	17:16	16:46 (WEA 28)	18:06	17:26 (WEA 01)	19:59	20:49	21:33
5	08:31	08:02	15:43 (WEA N03)	07:08	17:01 (WEA 01)	19:59	20:49	21:33
6	16:29	17:18	16:48 (WEA 28)	18:08	17:26 (WEA 01)	20:01	20:51	21:34
7	08:31	08:01	15:44 (WEA N03)	07:06	17:01 (WEA 01)	19:59	20:49	21:33
8	16:30	17:19	16:48 (WEA 28)	18:10	17:24 (WEA 01)	20:02	20:52	21:35
9	08:31	07:59	15:44 (WEA N03)	07:04	17:03 (WEA 01)	19:59	20:49	21:33
10	16:31	17:21	16:47 (WEA 28)	18:12	17:22 (WEA 01)	20:04	20:54	21:36
11	08:30	07:57	15:45 (WEA N03)	07:02	17:05 (WEA 01)	19:59	20:49	21:33
12	16:33	17:23	16:05 (WEA N03)	18:13	17:21 (WEA 01)	20:06	20:55	21:37
13	08:30	07:56	15:48 (WEA N03)	07:00	17:08 (WEA 01)	19:59	20:49	21:33
14	16:34	17:25	16:05 (WEA N03)	18:15	17:18 (WEA 01)	20:07	20:57	21:38
15	08:29	07:54	15:49 (WEA N03)	06:58	17:08 (WEA 01)	19:59	20:49	21:33
16	16:35	17:27	16:03 (WEA N03)	18:17	17:18 (WEA 01)	20:09	20:59	21:39
17	08:29	07:52	15:52 (WEA N03)	06:55	17:08 (WEA 01)	19:59	20:49	21:33
18	16:36	17:28	16:00 (WEA N03)	18:19	17:18 (WEA 01)	20:11	21:00	21:40
19	08:29	07:50	16:46 (WEA 02)	06:53	17:08 (WEA 01)	19:59	20:49	21:33
20	16:38	17:30	16:53 (WEA 02)	18:20	17:18 (WEA 01)	20:12	21:02	21:41
21	08:28	07:49	16:43 (WEA 02)	06:51	17:08 (WEA 01)	19:59	20:49	21:33
22	16:39	17:32	16:56 (WEA 02)	18:22	17:18 (WEA 01)	20:14	21:03	21:41
23	08:27	07:47	16:42 (WEA 02)	06:49	17:08 (WEA 01)	19:59	20:49	21:33
24	16:41	17:34	16:57 (WEA 02)	18:24	17:18 (WEA 01)	20:15	21:05	21:42
25	08:27	07:45	16:40 (WEA 02)	06:46	17:08 (WEA 01)	19:59	20:49	21:33
26	16:42	17:36	16:59 (WEA 02)	18:25	17:18 (WEA 01)	20:17	21:06	21:43
27	08:26	07:43	16:39 (WEA 02)	06:44	17:08 (WEA 01)	19:59	20:49	21:33
28	16:44	17:38	17:00 (WEA 02)	18:27	17:18 (WEA 01)	20:19	21:08	21:43
29	08:25	07:41	16:39 (WEA 02)	06:42	17:08 (WEA 01)	19:59	20:49	21:33
30	16:45	17:39	17:00 (WEA 02)	18:29	17:18 (WEA 01)	20:21	21:09	21:44
31	08:24	07:39	16:38 (WEA 02)	06:40	17:08 (WEA 01)	19:59	20:49	21:33
32	16:47	17:41	17:01 (WEA 02)	18:31	17:18 (WEA 01)	20:22	21:11	21:44
33	08:23	07:37	16:38 (WEA 02)	06:37	17:08 (WEA 01)	19:59	20:49	21:33
34	16:48	17:43	17:01 (WEA 02)	18:32	17:18 (WEA 01)	20:24	21:12	21:45
35	08:23	07:35	16:38 (WEA 02)	06:35	17:08 (WEA 01)	19:59	20:49	21:33
36	16:50	17:45	17:17 (WEA 01)	18:34	17:18 (WEA 01)	20:26	21:14	21:45
37	08:22	07:33	16:38 (WEA 02)	06:33	17:08 (WEA 01)	19:59	20:49	21:33
38	16:51	17:47	17:19 (WEA 01)	18:36	17:18 (WEA 01)	20:27	21:15	21:46
39	08:21	07:31	16:38 (WEA 02)	06:31	17:08 (WEA 01)	19:59	20:49	21:33
40	16:53	17:49	17:21 (WEA 01)	18:37	17:18 (WEA 01)	20:29	21:17	21:46
41	08:20	07:29	16:39 (WEA 02)	06:28	17:08 (WEA 01)	19:59	20:49	21:33
42	16:55	17:50	17:23 (WEA 01)	18:39	17:18 (WEA 01)	20:31	21:18	21:46
43	08:18	07:27	16:40 (WEA 02)	06:26	17:08 (WEA 01)	19:59	20:49	21:33
44	16:56	17:52	17:25 (WEA 01)	18:41	17:18 (WEA 01)	20:32	21:20	21:46
45	08:17	07:25	16:41 (WEA 02)	06:24	17:08 (WEA 01)	19:59	20:49	21:33
46	16:58	17:54	17:27 (WEA 01)	18:42	17:18 (WEA 01)	20:34	21:21	21:46
47	08:16	07:23	16:43 (WEA 02)	06:21	17:08 (WEA 01)	19:59	20:49	21:33
48	17:00	18:04	17:04 (WEA N03)	17:56	43	17:30 (WEA 12)	18:44	21:27
49	20:15	15:42 (WEA N03)	07:21	16:45 (WEA 02)	06:19	20:31	21:22	20:59
50	17:02	23	16:05 (WEA N03)	17:57	40	17:32 (WEA 12)	18:46	21:27
51	20:14	15:41 (WEA N03)	07:19	16:46 (WEA 02)	06:17	20:32	21:23	20:59
52	17:03	25	16:06 (WEA N03)	17:59	32	17:32 (WEA 12)	18:47	21:27
53	20:12	15:41 (WEA N03)	07:17	16:47 (WEA 02)	06:15	20:37	21:20	20:59
54	17:05	26	16:07 (WEA N03)	18:01	31	17:31 (WEA 12)	18:49	21:27
55	20:11	15:40 (WEA N03)	07:15	16:45 (WEA 02)	06:12	20:35	21:19	20:59
56	17:07	26	16:07 (WEA N03)	18:03	30	17:30 (WEA 12)	18:51	21:27
57	20:10	15:41 (WEA N03)	07:10	16:46 (WEA 02)	06:10	20:38	21:18	20:59
58	17:09	27	16:08 (WEA N03)	18:02	29	17:29 (WEA 12)	18:52	21:27
59	20:08	15:41 (WEA N03)	07:08	16:45 (WEA 02)	06:08	20:40	21:17	20:59
60	17:10	26	16:07 (WEA N03)	18:04	28	17:28 (WEA 12)	18:53	21:26
61	20:07	15:42 (WEA N03)	07:06	16:46 (WEA 02)	06:06	20:41	21:16	20:59
62	17:12	26	16:08 (WEA N03)	18:05	27	17:27 (WEA 12)	18:54	21:26
63	20:06	15:43 (WEA N03)	07:04	16:47 (WEA 02)	06:04	20:42	21:15	20:59
64	17:13	26	16:09 (WEA N03)	18:06	26	17:28 (WEA 12)	18:55	21:26
65	20:05	15:44 (WEA N03)	07:03	16:48 (WEA 02)	06:03	20:43	21:14	20:59
66	17:14	26	16:10 (WEA N03)	18:07	25	17:29 (WEA 12)	18:56	21:26
67	20:04	15:45 (WEA N03)	07:02	16:49 (WEA 02)	06:02	20:44	21:13	20:59
68	17:15	26	16:11 (WEA N03)	18:08	24	17:30 (WEA 12)	18:57	21:26
69	20:03	15:46 (WEA N03)	07:01	16:50 (WEA 02)	06:01	20:45	21:12	20:59
70	17:16	26	16:12 (WEA N03)	18:09	23	17:31 (WEA 12)	18:58	21:26
71	20:02	15:47 (WEA N03)	07:00	16:51 (WEA 02)	06:00	20:46	21:11	20:59
72	17:17	26	16:13 (WEA N03)	18:10	22	17:32 (WEA 12)	18:59	21:26
73	20:01	15:48 (WEA N03)	06:59	16:52 (WEA 02)	05:59	20:47	21:10	20:59
74	17:18	26	16:14 (WEA N03)	18:11	21	17:33 (WEA 12)	19:00	21:26
75	20:00	15:49 (WEA N03)	06:58	16:53 (WEA 02)	05:58	20:48	21:09	20:59
76	17:19	26	16:15 (WEA N03)	18:12	20	17:34 (WEA 12)	19:01	21:26
77	20:00	15:50 (WEA N03)	06:57	16:54 (WEA 02)	05:57	20:49	21:08	20:59
78	17:20	26	16:16 (WEA N03)	18:13	19	17:35 (WEA 12)	19:02	21:26
79	20:00	15:51 (WEA N03)	06:56	16:55 (WEA 02)	05:56	20:50	21:07	20:59
80	17:21	26	16:17 (WEA N03)	18:14	18	17:36 (WEA 12)	19:03	21:26
81	20:00	15:52 (WEA N03)	06:55	16:56 (WEA 02)	05:55	20:51	21:06	20:59
82	17:22	26	16:18 (WEA N03)	18:15	17	17:37 (WEA 12)	19:04	21:26
83	20:00	15:53 (WEA N03)	06:54	16:57 (WEA 02)	05:54	20:52	21:05	20:59
84	17:23	26	16:19 (WEA N03)	18:16	16	17:38 (WEA 12)	19:05	21:26
85	20:00	15:54 (WEA N03)	06:53	16:58 (WEA 02)	05:53	20:53	21:04	20:59
86	17:24	26	16:20 (WEA N03)	18:17	15	17:39 (WEA 12)	19:06	21:26
87	20:00	15:55 (WEA N03)	06:52	16:59 (WEA 02)	05:52	20:54	21:03	20:59
88	17:25	26	16:21 (WEA N03)	18:18	14	17:40 (WEA 12)	19:07	21:26
89	20:00	15:56 (WEA N03)	06:51	17:00 (WEA 02)	05:51	20:55	21:02	20:59
90	17:26	26	16:22 (WEA N03)	18:19	13	17:41 (WEA 12)	19:08	21:26
91	20:00	15:57 (WEA N03)	06:50	17:01 (WEA 02)	05:50	20:56	21:01	20:59
92	17:27	26	16:23 (WEA N03)	18:20	12	17:42 (WEA 12)	19:09	21:26
93	20:00	15:58 (WEA N03)	06:49	17:02 (WEA 02)	05:49	20:57	21:00	20:59
94	17:28	26	16:24 (WEA N03)	18:21	11	17:43 (WEA 12)	19:10	21:26
95	20:00	15:59 (WEA N03)	06:48	17:03 (WEA 02)	05:48	20:58	20:59	20:59
96	17:29	26	16:25 (WEA N03)	18:22	10	17:44 (WEA 12)	19:11	21:26
97	20:00	16:00 (WEA N03)	06:47	17:04 (WEA 02)	05:47	20:59	20:58	20:59
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99	20:00	16:01 (WEA N03)	06:46	17:05 (WEA 02)	05:46	21:00	20:57	20:59
100	17:31	26	16:27 (WEA N03)	18:24	8	17:46 (WEA 12)	19:13	21:26
101	20:00	16:02 (WEA N03)	06:45	17:06 (WEA 02)	05:45	21:01	20:56	20:59
102	17:32	26	16:28 (WEA N03)	18:25	7	17:47 (WEA 12)	19:14	21:26
103	20:00	16:03 (WEA N03)	06:44	17:07 (WEA 02)	05:44	21:02	20:55	20:59
104	17:33	26	16:29 (WEA N03)	18:26	6	17:48 (WEA 12)	19:15	21:26
105	20:00	16:04 (WEA N03)	06:43	17:08 (WEA 02)	05:43	21:03	20:54	20:59
106	17:34	26	16:30 (WEA N03)	18:27	5	17:49 (WEA 12)	19:16	21:26
107	20:00	16:05 (WEA N03)	06:42	17:09 (WEA 02)	05:42	21:04	20:53	20:59
108	17:35	26	16:31 (WEA N03)	18:28	4	17:50 (WEA 12)	19:17	21:26
109	20:00	16:06 (WEA N03)	06:41	17:10 (WEA 02)	05:41	21:05	20:52	20:59
110	17:36	26	16:32 (WEA N03)	18:29	3	17:51 (WEA 12)	19:18	21:26
111	20:00	16:07 (WEA N03)	06:40	17:11 (WEA 02)	05:40	21:06	20:51	20:59
112	17:37	26	16:33 (WEA N03)	18:30	2	17:52 (WEA 12)	19:19	21:26
113	20:00	16:08 (WEA N03)	06:39	17:12 (WEA 02)	05:39	21:07	20:50	20:59
114	17:38	26	16:34 (WEA N03)	18:31	1	17:53 (WEA 12)	19:20	21:26
115	20:00	16:09 (WEA N03)	06:38	17:13 (WEA 02)	05:38	21:08	20:49	20:59
116	17:39	26	16:35 (WEA N03)	18:32	0	17:54 (WEA 12)	19:21	21:26
117	20:00	16:10 (WEA N03)	06:37	17:14 (WEA 02)	05:37	21:09		

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-09 - SR-09, Almer Str. 24, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12 21:46	05:48 21:15	06:37 20:14	07:25 19:06	07:17 17:00	16:17 (WEA 02) 08:07 16:22 (WEA 02) 16:21
2	05:13 21:46	05:50 21:13	06:38 20:12	07:26 19:03	07:19 16:59	15:21 (WEA N03) 08:09 15:30 (WEA N03) 16:20
3	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	07:21 16:57	15:19 (WEA N03) 08:10 15:33 (WEA N03) 16:20
4	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	07:23 16:55	15:17 (WEA N03) 08:12 15:35 (WEA N03) 16:19
5	05:15 21:44	05:54 21:08	06:43 20:05	07:31 18:56	07:24 16:53	15:15 (WEA N03) 08:13 15:35 (WEA N03) 16:19
6	05:16 21:44	05:56 21:06	06:45 20:03	07:33 18:54	07:26 16:52	15:14 (WEA N03) 08:14 15:14 (WEA N03) 16:18
7	05:17 21:43	05:57 21:05	06:46 20:01	07:35 18:52	07:28 16:50	15:14 (WEA N03) 08:15 15:13 (WEA N03) 16:18
8	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	07:30 16:48	15:13 (WEA N03) 08:17 15:13 (WEA N03) 16:18
9	05:19 21:42	06:00 21:01	06:50 19:56	07:38 18:48	07:32 16:47	15:13 (WEA N03) 08:18 15:13 (WEA N03) 16:17
10	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:45	07:33 16:45	15:13 (WEA N03) 08:19 15:13 (WEA N03) 16:17
11	05:21 21:41	06:04 20:57	06:53 19:51	07:41 18:43	07:35 16:44	15:13 (WEA N03) 08:20 15:39 (WEA N03) 16:17
12	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:42	15:13 (WEA N03) 08:21 15:39 (WEA N03) 16:17
13	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:38 16:41	15:13 (WEA N03) 08:22 15:39 (WEA N03) 16:17
14	05:24 21:38	06:08 20:52	06:57 19:45	07:46 18:37	07:40 16:39	15:14 (WEA N03) 08:23 15:40 (WEA N03) 16:17
15	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:34	07:42 16:38	15:13 (WEA N03) 08:24 15:39 (WEA N03) 16:17
16	05:26 21:36	06:11 20:48	07:01 19:40	07:50 18:32	07:44 16:36	15:14 (WEA N03) 08:25 15:39 (WEA N03) 16:17
17	05:28 21:35	06:13 20:46	07:02 19:38	07:51 18:30	07:45 16:35	15:15 (WEA N03) 08:25 15:38 (WEA N03) 16:17
18	05:29 21:34	06:15 20:44	07:04 19:35	07:53 18:28	07:47 16:34	15:16 (WEA N03) 08:26 15:38 (WEA N03) 16:18
19	05:30 21:33	06:16 20:42	07:05 19:33	07:55 18:26	07:49 16:33	15:17 (WEA N03) 08:27 15:38 (WEA N03) 16:18
20	05:31 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:50 16:31	15:18 (WEA N03) 08:28 15:38 (WEA N03) 16:18
21	05:33 21:31	06:19 20:38	07:09 19:28	07:58 18:22	07:52 16:30	15:19 (WEA N03) 08:28 15:36 (WEA N03) 16:19
22	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 16:29	15:20 (WEA N03) 08:29 15:35 (WEA N03) 16:19
23	05:35 21:28	06:22 20:33	07:12 19:24	08:02 18:18	07:55 16:28	15:22 (WEA N03) 08:29 15:35 (WEA N03) 16:20
24	05:37 21:27	06:24 20:31	07:13 19:22	08:03 18:16	07:57 16:27	15:24 (WEA N03) 08:30 15:33 (WEA N03) 16:20
25	05:38 21:25	06:26 20:29	07:15 19:19	08:05 18:14	07:58 16:26	08:30 16:21
26	05:39 21:24	20:51 (WEA 36) 06:27 20:53 (WEA 36) 20:27	07:17 19:17	08:07 18:12	08:00 16:25	08:30 16:21
27	05:41 21:23	20:50 (WEA 36) 06:29 20:53 (WEA 36) 20:25	07:18 19:15	08:09 18:10	08:02 16:24	08:31 16:22
28	05:42 21:21	20:49 (WEA 36) 06:30 20:51 (WEA 36) 20:23	07:20 19:12	08:10 18:08	08:03 16:23	08:31 16:23
29	05:44 21:20	20:48 (WEA 36) 06:32 20:49 (WEA 36) 20:21	07:21 19:10	08:12 18:06	08:05 16:23	08:31 16:24
30	05:45 21:18	06:34 20:18	07:23 19:08	08:14 18:04	08:06 16:22	08:31 16:25
31	05:47 21:16	06:35 20:16	07:24 19:07	08:16 18:02	08:07 16:21	08:31 16:26
Sonnenscheinstunden astr.max.mögl. Beschattung	500 8	452 25	381 1	332 693	268 511	246

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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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-10 - SR-10, Almer Str. 29, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	08:05	07:13	17:36 (WEA 01)	07:03	06:00
	16:27	17:14	18:05	3 17:39 (WEA 01)	19:57	20:47
2	08:31	08:04	07:11	17:33 (WEA 01)	07:01	05:58
	16:28	17:16	18:06	8 17:41 (WEA 01)	19:59	20:49
3	08:31	08:02	07:08	17:31 (WEA 01)	06:59	05:56
	16:29	17:18	18:08	12 17:43 (WEA 12)	20:01	20:51
4	08:31	08:01	07:06	17:29 (WEA 01)	06:56	05:54
	16:30	17:19	18:10	15 17:44 (WEA 12)	20:02	20:52
5	08:31	07:59	07:04	17:28 (WEA 01)	06:54	05:52
	16:31	17:21	18:12	18 17:46 (WEA 12)	20:04	20:54
6	08:30	07:57	07:02	17:27 (WEA 01)	06:52	05:50
	16:33	17:23	18:13	21 17:48 (WEA 01)	20:06	20:55
7	08:30	07:56	07:00	17:27 (WEA 01)	06:50	05:49
	16:34	17:25	18:15	23 17:50 (WEA 01)	20:07	20:57
8	08:29	07:54	06:58	17:25 (WEA 01)	06:48	05:47
	16:35	17:27	18:17	24 17:49 (WEA 01)	20:09	20:59
9	08:29	07:52	06:55	17:25 (WEA 01)	06:45	05:45
	16:36	17:28	18:19	24 17:49 (WEA 01)	20:11	21:00
10	08:28	07:50	06:53	17:26 (WEA 01)	06:43	05:43
	16:38	17:30	18:20	23 17:49 (WEA 01)	20:12	21:02
11	08:28	07:49	06:51	17:26 (WEA 01)	06:41	05:42
	16:39	17:32	18:22	23 17:49 (WEA 01)	20:14	21:03
12	08:27	07:47	06:49	17:26 (WEA 01)	06:39	05:40
	16:41	17:34	18:24	21 17:47 (WEA 01)	20:16	21:05
13	08:27	07:45	06:46	17:27 (WEA 01)	06:37	05:39
	16:42	17:36	18:25	19 17:46 (WEA 01)	20:17	21:06
14	08:26	07:43	06:44	17:28 (WEA 01)	06:34	05:37
	16:44	17:38	18:27	17 17:45 (WEA 01)	20:19	21:08
15	08:25	07:41	06:42	17:29 (WEA 01)	06:32	05:36
	16:45	17:39	18:29	13 17:42 (WEA 01)	20:21	21:09
16	08:24	07:39	06:40	17:34 (WEA 01)	06:30	05:34
	16:47	17:41	18:31	3 17:37 (WEA 01)	20:22	2 19:56 (WEA 35)
17	08:23	07:37	06:37	06:28	20:24	2 19:54 (WEA 35)
	16:48	17:43	18:32	20:24	4 19:58 (WEA 35)	21:12
18	08:23	07:35	06:35	06:26	20:26	4 19:55 (WEA 35)
	16:50	17:45	18:34	20:26	4 19:59 (WEA 35)	21:14
19	08:22	07:33	06:33	06:24	20:27	05:30
	16:51	17:47	18:36	20:27	21:15	21:46
20	08:21	07:31	06:31	06:22	20:28	05:28
	16:53	17:48	18:37	20:29	21:17	21:46
21	08:19	07:29	06:28	06:19	20:29	05:27
	16:55	17:50	18:39	20:31	21:18	21:46
22	08:18	07:27	06:26	06:17	20:32	05:26
	16:56	17:52	18:41	20:32	21:20	21:46
23	08:17	07:25	06:24	06:15	20:33	05:25
	16:58	17:54	18:42	20:34	21:21	21:46
24	08:16	07:23	06:21	06:13	20:34	05:23
	17:00	17:56	18:44	20:36	21:22	21:47
25	08:15	07:21	06:19	06:11	20:37	05:22
	17:02	17:57	18:46	20:37	21:24	21:47
26	08:14	07:19	06:17	06:09	20:38	05:21
	17:03	17:59	18:47	20:39	21:25	21:47
27	08:12	07:17	06:15	06:07	20:40	05:20
	17:05	18:01	18:49	20:41	21:26	21:47
28	08:11	07:15	06:12	06:05	20:42	05:19
	17:07	18:03	18:51	20:43	21:27	21:47
29	08:10		07:10	06:03	20:44	05:18
	17:09		19:52	20:44	21:29	21:46
30	08:08		07:08	06:01	20:46	05:17
	17:10		19:54	20:46	21:30	21:46
31	08:07		07:06		21:31	
	17:12		19:56		483	496
Sonneneinstrahlung	261	279	367	415		
astr.max.mögl.Beschattung		320	267	10		

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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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-10 - SR-10, Almer Str. 29, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:12	05:48			06:37		07:25		18:06 (WEA 01)	07:17	15:53 (WEA N03)	08:07
	21:46	21:15			20:14		19:06		18:26 (WEA 01)	17:00	16:31 (WEA 28)	16:21
2	05:13	05:50			06:38		07:26		18:04 (WEA 01)	07:19	15:54 (WEA N03)	08:09
	21:46	21:13			20:12		19:03		18:26 (WEA 01)	16:59	16:13 (WEA N03)	16:20
3	05:14	05:51			06:40		07:28		18:04 (WEA 01)	07:21	15:55 (WEA N03)	08:10
	21:45	21:12			20:09		19:01		18:27 (WEA 01)	16:57	16:12 (WEA N03)	16:20
4	05:15	05:53			06:42		07:30		18:03 (WEA 01)	07:23	15:57 (WEA N03)	08:12
	21:45	21:10			20:07		18:59		18:27 (WEA 01)	16:55	16:11 (WEA N03)	16:19
5	05:15	05:54			06:43		07:31		18:02 (WEA 01)	07:24	15:58 (WEA N03)	08:13
	21:44	21:08			20:05		18:56		18:26 (WEA 01)	16:53	16:08 (WEA N03)	16:19
6	05:16	05:56			06:45		07:33		18:02 (WEA 01)	07:26		
	21:44	21:06			20:03		18:54		18:26 (WEA 01)	16:52		
7	05:17	05:57			06:46		07:35		18:03 (WEA 01)	07:28		
	21:43	21:05			20:01		18:52		18:25 (WEA 01)	16:50		
8	05:18	05:59			06:48		07:36		18:02 (WEA 01)	07:30		
	21:43	21:03			19:58		18:50		18:22 (WEA 01)	16:48		
9	05:19	06:00			06:50		07:38		18:03 (WEA 01)	07:32		
	21:42	21:01			19:56		18:48		18:20 (WEA 12)	16:47		
10	05:20	06:02			06:51		07:40		18:04 (WEA 01)	07:33		
	21:41	20:59			19:54		18:45		18:18 (WEA 12)	16:45		
11	05:21	06:04			06:53		07:41		18:05 (WEA 01)	07:35		
	21:41	20:57			19:51		18:43		18:15 (WEA 12)	16:44		
12	05:22	06:05			06:54		07:43		18:07 (WEA 01)	07:37		
	21:40	20:55			19:49		18:41		18:13 (WEA 01)	16:42		
13	05:23	06:07			06:56		07:45					
	21:39	20:54			19:47		18:39			16:41		
14	05:24	06:08			06:57		07:46			07:40		
	21:38	20:52			19:45		18:37			16:39		
15	05:25	06:10			06:59		07:48			07:42		
	21:37	20:50			19:42		18:34			16:38		
16	05:26	06:11			07:01		07:50			07:44		
	21:36	20:48			19:40		18:32			16:36		
17	05:28	06:13			07:02		07:51			07:45		
	21:35	20:46			19:38		18:30			16:35		
18	05:29	06:15			07:04		07:53			07:47		
	21:34	20:44			19:35		18:28			16:34		
19	05:30	06:16			07:05		07:55			07:49		
	21:33	20:42			19:33		18:26			16:33		
20	05:31	06:18			07:07		07:56		17:02 (WEA N03)	07:50		
	21:32	20:40			19:31		18:24		5	17:07 (WEA N03)	16:31	
21	05:33	06:19			07:09		07:58		16:58 (WEA N03)	07:52		
	21:31	20:38			19:28		18:22		12	17:10 (WEA N03)	16:30	
22	05:34	06:21			07:10		08:00		16:56 (WEA N03)	07:54		
	21:29	20:35			19:26		18:20		16	17:12 (WEA N03)	16:29	
23	05:35	06:22			07:12		08:02		16:55 (WEA N03)	07:55		
	21:28	20:33			19:24		18:18		18	17:13 (WEA N03)	16:28	
24	05:37	06:24			07:13		08:03		16:54 (WEA N03)	07:57		
	21:27	20:31			19:22		18:16		20	17:14 (WEA N03)	16:27	
25	05:38	06:26		19:58 (WEA 35)	07:15		07:05		15:53 (WEA N03)	07:58		
	21:25	20:29	4	20:02 (WEA 35)	19:19		17:14		22	16:15 (WEA N03)	16:26	
26	05:39	06:27		19:56 (WEA 35)	07:17		07:07		15:53 (WEA N03)	08:00		
	21:24	20:27	3	19:59 (WEA 35)	19:17		17:12		23	16:16 (WEA N03)	16:25	
27	05:41	06:29		19:56 (WEA 35)	07:18		07:09		15:52 (WEA N03)	08:02		
	21:23	20:25	2	19:58 (WEA 35)	19:15		17:10		23	16:15 (WEA N03)	16:24	
28	05:42	06:30			07:20		18:12 (WEA 01)	07:10		15:52 (WEA N03)	08:03	
	21:21	20:23			19:12	10	18:22 (WEA 01)	17:08		16:15 (WEA N03)	16:23	
29	05:44	06:32			07:21		18:09 (WEA 01)	07:12		15:52 (WEA N03)	08:05	
	21:20	20:21			19:10	15	18:24 (WEA 01)	17:06		16:34 (WEA 28)	16:23	
30	05:45	06:34			07:23		18:07 (WEA 01)	07:14		15:52 (WEA N03)	08:06	
	21:18	20:19			19:08	18	18:25 (WEA 01)	17:04		16:35 (WEA 28)	16:22	
31	05:47	06:35					07:16			15:53 (WEA N03)		
	21:16	20:16					17:02	25	16:33 (WEA 28)			
Sonnenscheinstunden	500	452			381		332			268		246
astr.max.mögl.Beschattung			9		43		469			83		

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-11 - SR-11, Stemmestraße 22, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 08:05		07:13	16:42 (WEA N03) 07:03	18:56 (WEA 01) 06:00	20:18 (WEA 35) 05:15
	16:27 17:14		18:05	17:09 (WEA N03) 19:57	19:04 (WEA 01) 20:47	20:20 (WEA 35) 21:32
2	08:31 08:04		07:11	16:42 (WEA N03) 07:01	05:58	20:18 (WEA 35) 05:14
	16:28 17:16		18:06	17:09 (WEA N03) 19:59	20:49	20:21 (WEA 35) 21:33
3	08:31 08:02		07:08	16:43 (WEA N03) 06:59	05:56	20:19 (WEA 35) 05:14
	16:29 17:18		18:08	17:36 (WEA 02) 20:01	20:51	20:22 (WEA 35) 21:34
4	08:31 08:01		07:06	16:42 (WEA N03) 06:56	05:54	05:13
	16:30 17:19		18:10	17:38 (WEA 02) 20:02	20:52	21:35
5	08:31 07:59		07:04	16:43 (WEA N03) 06:54	05:52	05:12
	16:31 17:21		18:12	17:39 (WEA 02) 20:04	20:54	21:36
6	08:30 07:57		07:02	16:44 (WEA N03) 06:52	05:50	05:12
	16:33 17:23		18:13	17:40 (WEA 02) 20:06	20:55	21:37
7	08:30 07:56		07:00	16:46 (WEA N03) 06:50	05:49	05:11
	16:34 17:25		18:15	17:41 (WEA 02) 20:07	20:57	21:38
8	08:29 07:54		06:58	16:48 (WEA N03) 06:48	05:47	05:11
	16:35 17:27		18:17	17:40 (WEA 02) 20:09	20:59	21:39
9	08:29 07:52		06:55	16:53 (WEA N03) 06:45	05:45	05:10
	16:36 17:28		18:19	17:41 (WEA 02) 20:11	21:00	21:40
10	08:28 07:50		06:53	17:18 (WEA 02) 06:43	05:43	05:10
	16:38 17:30		18:20	17:41 (WEA 02) 20:12	21:02	21:41
11	08:28 07:49		06:51	17:18 (WEA 02) 06:41	05:42	05:09
	16:39 17:32		18:22	17:40 (WEA 02) 20:14	21:03	21:41
12	08:27 07:47		06:49	17:18 (WEA 02) 06:39	05:40	05:09
	16:41 17:34		18:24	17:39 (WEA 02) 20:16	21:05	21:42
13	08:27 07:45		06:46	17:18 (WEA 02) 06:37	05:39	05:09
	16:42 17:36		18:25	17:38 (WEA 02) 20:17	21:06	21:43
14	08:26 07:43		06:44	17:19 (WEA 02) 06:34	05:37	05:09
	16:44 17:38		18:27	17:37 (WEA 02) 20:19	21:08	21:43
15	08:25 07:41		06:42	17:20 (WEA 02) 06:32	05:36	05:08
	16:45 17:39		18:29	17:35 (WEA 02) 20:21	21:09	21:44
16	08:24 07:39		06:40	17:22 (WEA 02) 06:30	05:34	05:08
	16:47 17:41		18:31	18:05 (WEA 01) 20:22	21:11	21:44
17	08:23 07:37		06:37	17:56 (WEA 01) 06:28	05:33	05:08
	16:48 17:43		18:32	18:07 (WEA 01) 20:24	21:12	21:45
18	08:23 07:35		06:35	17:55 (WEA 01) 06:26	05:31	05:08
	16:50 17:45		18:34	18:09 (WEA 01) 20:26	21:14	21:45
19	08:22 07:33		06:33	17:52 (WEA 01) 06:24	05:30	05:08
	16:51 17:47		18:36	18:10 (WEA 01) 20:27	21:15	21:46
20	08:21 07:31	16:51 (WEA N03) 06:31	17:51 (WEA 01) 06:22	17:51 (WEA 01) 06:22	05:28	05:08
	16:53 17:49	17:02 (WEA N03) 18:37	18:12 (WEA 01) 20:29	18:12 (WEA 01) 20:29	21:17	21:46
21	08:19 07:29	16:48 (WEA N03) 06:28	17:51 (WEA 01) 06:19	17:51 (WEA 01) 06:19	05:27	05:08
	16:55 17:50	17:04 (WEA N03) 18:39	18:14 (WEA 01) 20:31	18:14 (WEA 01) 20:31	21:18	21:46
22	08:18 07:27	16:46 (WEA N03) 06:26	17:49 (WEA 01) 06:17	17:49 (WEA 01) 06:17	05:26	05:09
	16:56 17:52	17:06 (WEA N03) 18:41	18:15 (WEA 01) 20:32	18:15 (WEA 01) 20:32	21:20	21:46
23	08:17 07:25	16:45 (WEA N03) 06:24	17:49 (WEA 01) 06:15	17:49 (WEA 01) 06:15	05:25	05:09
	16:58 17:54	17:07 (WEA N03) 18:42	18:15 (WEA 01) 20:34	18:15 (WEA 01) 20:34	21:21	21:46
24	08:16 07:23	16:44 (WEA N03) 06:21	17:49 (WEA 01) 06:13	17:49 (WEA 01) 06:13	05:23	05:09
	17:00 17:56	17:08 (WEA N03) 18:44	18:15 (WEA 01) 20:36	18:15 (WEA 01) 20:36	21:22	21:47
25	08:15 07:21	16:44 (WEA N03) 06:19	17:49 (WEA 01) 06:11	17:49 (WEA 01) 06:11	05:22	05:09
	17:02 17:57	17:09 (WEA N03) 18:46	18:15 (WEA 01) 20:37	18:15 (WEA 01) 20:37	21:24	21:47
26	08:14 07:19	16:42 (WEA N03) 06:17	17:48 (WEA 01) 06:09	17:48 (WEA 01) 06:09	05:21	05:10
	17:03 17:59	17:09 (WEA N03) 18:47	18:14 (WEA 01) 20:39	18:14 (WEA 01) 20:39	21:25	21:47
27	08:12 07:17	16:42 (WEA N03) 06:15	17:49 (WEA 01) 06:07	17:49 (WEA 01) 06:07	05:20	05:10
	17:05 18:01	17:09 (WEA N03) 18:49	18:13 (WEA 01) 20:41	18:13 (WEA 01) 20:41	21:26	21:47
28	08:11 07:15	16:42 (WEA N03) 06:12	17:49 (WEA 01) 06:05	17:49 (WEA 01) 06:05	05:19	05:11
	17:07 18:03	17:09 (WEA N03) 18:51	18:13 (WEA 01) 20:42	18:13 (WEA 01) 20:42	21:27	21:46
29	08:10		07:10	18:49 (WEA 01) 06:03	05:18	05:11
	17:09		19:52	19:11 (WEA 01) 20:44	21:29	21:46
30	08:08		07:08	18:51 (WEA 01) 06:01	05:17	05:12
	17:10		19:54	19:09 (WEA 01) 20:46	21:30	21:46
31	08:07		07:06	18:53 (WEA 01)	05:16	
	17:12		19:56	19:07 (WEA 01)	21:31	
Sonnenscheinstunden	261	279	367	415	483	496
astr.max.mögl.Beschattung		199	766	8	8	

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	(WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende	(WEA mit letztem Schatten)
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Projekt:
216094-04 WP Brilon-MadfeldLizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender****Berechnung:** Gesamtbelastung **Schattenrezeptor:** SR-11 - SR-11, Stemmelstraße 22, 59929 Brilon
Voraussetzungen für Berechnung des SchattenwurfsDie 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

	July	August	September	Oktober	November	Dezember
1	05:12 21:46	05:48 21:15	06:37 20:14	07:25 19:06	17:58 (WEA 02) 18:18 (WEA 02)	07:17 17:00
2	05:13 21:46	05:50 21:13	06:38 20:12	07:26 19:03	17:56 (WEA 02) 18:18 (WEA 02)	07:19 16:59
3	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	17:56 (WEA 02) 18:18 (WEA 02)	07:21 16:57
4	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	17:56 (WEA 02) 18:18 (WEA 02)	07:23 16:55
5	05:15 21:44	05:54 21:08	06:43 20:05	07:31 18:56	17:26 (WEA N03) 18:17 (WEA 02)	07:24 16:53
6	05:16 21:44	05:56 21:06	06:45 20:03	07:33 18:54	17:23 (WEA N03) 18:17 (WEA 02)	07:26 16:52
7	05:17 21:43	05:57 21:05	06:46 20:01	07:35 18:52	17:21 (WEA N03) 18:16 (WEA 02)	07:28 16:50
8	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	17:19 (WEA N03) 18:15 (WEA 02)	07:30 16:48
9	05:19 21:42	06:00 21:01	06:50 19:56	07:38 18:48	17:18 (WEA N03) 18:13 (WEA 02)	07:32 16:47
10	05:20 21:41	06:02 20:59	20:28 (WEA 35) 06:51	07:40 18:45	17:17 (WEA N03) 18:12 (WEA 02)	07:33 16:45
11	05:21 21:41	06:04 20:57	20:26 (WEA 35) 06:53	18:49 (WEA 01) 07:41	17:16 (WEA N03) 18:08 (WEA 02)	07:35 16:44
12	05:22 21:40	06:05 20:55	20:29 (WEA 35) 06:54	18:55 (WEA 01) 18:44 (WEA 01)	18:43 07:43	16:44 07:37
13	05:23 21:39	06:07 20:54	20:25 (WEA 35) 06:56	18:58 (WEA 01) 18:42 (WEA 01)	18:41 07:45	16:42 07:38
14	05:24 21:38	06:08 20:52	19:49 06:57	19:00 (WEA 01) 18:41 (WEA 01)	18:39 07:46	16:41 07:40
15	05:25 21:37	06:10 20:50	21 06:59	19:02 (WEA 01) 18:39 (WEA 01)	18:37 07:48	16:39 07:42
16	05:26 21:36	06:11 20:48	23 07:01	19:02 (WEA 01) 18:38 (WEA 01)	18:34 07:50	16:38 07:44
17	05:28 21:35	06:13 20:46	25 07:02	19:03 (WEA 01) 18:37 (WEA 01)	18:32 07:51	16:36 07:45
18	05:29 21:34	06:15 20:44	25 07:04	19:02 (WEA 01) 18:36 (WEA 01)	18:30 07:53	16:35 07:47
19	05:30 21:33	06:16 20:42	27 07:05	19:03 (WEA 01) 18:35 (WEA 01)	18:28 07:55	16:34 07:49
20	05:31 21:32	06:18 20:40	27 07:07	19:02 (WEA 01) 18:35 (WEA 01)	18:26 07:56	16:33 07:50
21	05:33 21:31	06:19 20:38	27 07:09	19:02 (WEA 01) 18:35 (WEA 01)	18:24 07:58	16:31 07:52
22	05:34 21:29	06:21 20:35	26 07:10	19:01 (WEA 01) 18:35 (WEA 01)	18:22 08:00	16:30 07:54
23	05:35 21:28	06:22 20:33	24 07:12	18:59 (WEA 01) 18:36 (WEA 01)	18:20 08:02	16:29 07:55
24	05:37 21:27	06:24 20:31	21 07:13	18:57 (WEA 01) 18:36 (WEA 01)	18:18 08:03	16:28 07:57
25	05:38 21:25	06:26 20:29	18 07:15	18:54 (WEA 01) 18:37 (WEA 01)	18:16 07:05	16:27 07:58
26	05:39 21:24	06:27 20:27	16 07:17	18:53 (WEA 01) 18:37 (WEA 01)	17:14 07:07	16:26 08:00
27	05:41 21:23	06:29 20:25	13 07:18	18:50 (WEA 01) 18:06 (WEA 02)	17:12 07:09	16:25 08:02
28	05:42 21:21	06:30 20:23	15 07:20	18:48 (WEA 01) 18:02 (WEA 02)	17:10 07:10	16:24 08:03
29	05:44 21:20	06:32 20:21	14 07:21	18:16 (WEA 02) 18:00 (WEA 02)	17:08 07:12	16:23 08:05
30	05:45 21:18	06:34 20:18	16 07:23	18:16 (WEA 02) 17:58 (WEA 02)	17:06 07:14	16:23 08:06
31	05:47 21:16	06:35 20:16	20 07:25	18:18 (WEA 02) 17:04	17:04 07:16	16:25 08:31
Sonneneinstrahlung	499	452	381	332	268	246
astr.max.mögl.Beschattung		8	396	596		

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-12 - SR-12, Am Ruhberg 16, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	09:34 (WEA 04) 08:05 10:04 (WEA 29) 17:14	09:01 (WEA 31) 07:13 09:12 (WEA 31) 18:05	07:03 19:58	07:28 (WEA 01) 06:00 07:47 (WEA 01) 20:47	05:15 21:32
2	08:31 16:28	09:34 (WEA 04) 08:04 10:05 (WEA 29) 17:16	08:59 (WEA 31) 07:11 09:14 (WEA 31) 18:07	07:01 19:59	07:29 (WEA 01) 05:58 07:46 (WEA 01) 20:49	05:15 21:33
3	08:31 16:29	09:35 (WEA 04) 08:02 10:05 (WEA 29) 17:18	08:59 (WEA 31) 07:09 09:16 (WEA 31) 18:08	06:59 20:01	07:29 (WEA 01) 05:56 07:44 (WEA 01) 20:51	05:14 21:34
4	08:31 16:30	09:35 (WEA 04) 08:01 10:05 (WEA 29) 17:20	08:57 (WEA 31) 07:06 09:17 (WEA 31) 18:10	06:57 20:03	07:30 (WEA 01) 05:54 07:42 (WEA 01) 20:52	05:13 21:35
5	08:31 16:32	09:36 (WEA 04) 07:59 10:05 (WEA 29) 17:21	08:57 (WEA 31) 07:04 09:17 (WEA 31) 18:12	06:54 20:04	07:34 (WEA 01) 05:52 07:38 (WEA 01) 20:54	05:12 21:36
6	08:30 16:33	09:36 (WEA 04) 07:57 10:04 (WEA 29) 17:23	08:57 (WEA 31) 07:02 09:19 (WEA 31) 18:14	06:52 20:06	07:38 (WEA 01) 05:51 07:42 (WEA 01) 20:56	05:12 21:37
7	08:30 16:34	09:37 (WEA 04) 07:56 10:05 (WEA 29) 17:25	08:56 (WEA 31) 07:00 09:19 (WEA 31) 18:15	07:32 (WEA 02) 06:50 07:44 (WEA 02) 20:08	07:42 (WEA 01) 05:49 07:47 (WEA 01) 20:57	05:11 21:38
8	08:30 16:35	09:38 (WEA 04) 07:54 10:04 (WEA 29) 17:27	08:56 (WEA 31) 06:58 09:19 (WEA 31) 18:17	07:29 (WEA 02) 06:48 07:46 (WEA 02) 20:09	07:47 (WEA 01) 05:47 07:49 (WEA 01) 20:59	05:11 21:39
9	08:29 16:37	09:39 (WEA 04) 07:52 10:03 (WEA 29) 17:29	08:56 (WEA 31) 06:56 09:19 (WEA 31) 18:19	07:27 (WEA 02) 06:45 07:47 (WEA 02) 20:11	07:49 (WEA 01) 05:45 07:51 (WEA 01) 21:00	05:10 21:40
10	08:29 16:38	09:40 (WEA 04) 07:51 10:04 (WEA 29) 17:30	08:56 (WEA 31) 06:53 09:19 (WEA 31) 18:20	07:25 (WEA 02) 06:43 07:48 (WEA 02) 20:13	07:51 (WEA 01) 05:44 07:53 (WEA 01) 21:02	05:10 21:41
11	08:28 16:39	09:40 (WEA 04) 07:49 10:05 (WEA 29) 17:32	08:56 (WEA 31) 06:51 09:19 (WEA 31) 18:22	07:24 (WEA 02) 06:41 07:49 (WEA 02) 20:14	07:53 (WEA 01) 05:42 07:55 (WEA 01) 21:04	05:10 21:41
12	08:27 16:41	09:42 (WEA 04) 07:47 10:06 (WEA 29) 17:34	08:56 (WEA 31) 06:49 09:18 (WEA 31) 18:24	07:23 (WEA 12) 06:39 07:49 (WEA 02) 20:16	07:55 (WEA 06) 05:40 07:57 (WEA 06) 21:05	05:09 21:42
13	08:27 16:42	09:08 (WEA 28) 07:45 10:07 (WEA 28) 17:36	08:57 (WEA 31) 06:47 09:17 (WEA 31) 18:26	07:20 (WEA 12) 06:37 07:49 (WEA 02) 20:18	07:58 (WEA 06) 05:39 07:59 (WEA 06) 21:07	05:09 21:43
14	08:26 16:44	09:07 (WEA 28) 07:43 10:07 (WEA 28) 17:41	08:59 (WEA 31) 06:44 09:00 (WEA 31) 18:29	07:19 (WEA 12) 06:35 07:49 (WEA 02) 20:21	07:59 (WEA 06) 05:37 07:59 (WEA 06) 21:10	05:09 21:44
15	08:25 16:45	09:07 (WEA 28) 07:41 10:07 (WEA 28) 17:40	09:00 (WEA 31) 06:42 09:16 (WEA 31) 18:29	07:18 (WEA 12) 06:32 07:49 (WEA 02) 20:21	07:58 (WEA 06) 05:36 07:59 (WEA 06) 21:10	05:09 21:44
16	08:24 16:47	09:06 (WEA 28) 07:39 10:08 (WEA 28) 17:41	09:02 (WEA 31) 06:40 09:14 (WEA 31) 18:31	07:16 (WEA 12) 06:30 07:48 (WEA 02) 20:23	07:59 (WEA 06) 05:34 07:59 (WEA 06) 21:11	05:08 21:44
17	08:24 16:48	09:06 (WEA 28) 07:37 10:09 (WEA 28) 17:43	09:05 (WEA 31) 06:38 09:11 (WEA 31) 18:32	07:16 (WEA 12) 06:28 07:48 (WEA 02) 20:24	07:59 (WEA 06) 05:33 07:59 (WEA 06) 21:13	05:08 21:45
18	08:23 16:50	09:06 (WEA 28) 07:36 10:10 (WEA 28) 17:45	09:06 (WEA 31) 06:35 09:16 (WEA 31) 18:34	07:16 (WEA 12) 06:26 07:49 (WEA 02) 20:26	07:59 (WEA 06) 05:31 07:59 (WEA 06) 21:14	05:08 21:45
19	08:22 16:52	09:05 (WEA 28) 07:34 10:10 (WEA 28) 17:47	09:07 (WEA 31) 06:33 09:17 (WEA 31) 18:36	07:16 (WEA 12) 06:24 07:49 (WEA 02) 20:28	07:59 (WEA 06) 05:30 07:59 (WEA 06) 21:16	05:08 21:46
20	08:21 16:53	09:05 (WEA 28) 07:32 10:11 (WEA 28) 17:49	09:08 (WEA 31) 06:31 09:18 (WEA 31) 18:37	07:16 (WEA 12) 06:22 07:49 (WEA 02) 20:29	07:59 (WEA 06) 05:29 07:59 (WEA 06) 21:17	05:08 21:46
21	08:20 16:55	09:06 (WEA 28) 07:30 10:12 (WEA 28) 17:50	09:09 (WEA 31) 06:28 09:19 (WEA 31) 18:39	07:18 (WEA 12) 06:20 07:49 (WEA 02) 20:31	07:59 (WEA 06) 05:27 07:59 (WEA 06) 21:18	05:09 21:46
22	08:19 16:57	09:07 (WEA 28) 07:28 10:13 (WEA 28) 17:52	09:10 (WEA 31) 06:26 09:20 (WEA 31) 18:41	07:20 (WEA 12) 06:18 07:49 (WEA 02) 20:33	07:59 (WEA 06) 05:26 07:59 (WEA 06) 21:20	05:09 21:46
23	08:17 16:58	09:07 (WEA 28) 07:26 10:14 (WEA 28) 17:54	09:11 (WEA 31) 06:24 09:21 (WEA 31) 18:43	07:29 (WEA 02) 06:16 07:36 (WEA 02) 20:34	07:59 (WEA 06) 05:25 07:59 (WEA 06) 21:21	05:09 21:47
24	08:16 17:00	09:07 (WEA 28) 07:23 10:15 (WEA 28) 17:56	09:12 (WEA 31) 06:22 09:22 (WEA 31) 18:44	07:30 (WEA 02) 06:13 07:49 (WEA 02) 20:36	07:59 (WEA 06) 05:24 07:59 (WEA 06) 21:22	05:09 21:47
25	08:15 17:02	09:08 (WEA 28) 07:21 10:16 (WEA 28) 17:58	09:13 (WEA 31) 06:20 09:23 (WEA 31) 18:46	07:31 (WEA 02) 06:11 07:49 (WEA 02) 20:38	07:59 (WEA 06) 05:22 07:59 (WEA 06) 21:24	05:10 21:47
26	08:14 17:03	09:09 (WEA 28) 07:19 10:17 (WEA 28) 17:59	09:14 (WEA 31) 06:17 09:24 (WEA 31) 18:48	07:32 (WEA 02) 06:09 07:49 (WEA 02) 20:39	07:59 (WEA 06) 05:21 07:59 (WEA 06) 21:25	05:10 21:47
27	08:12 17:05	09:11 (WEA 28) 07:17 10:18 (WEA 28) 18:01	09:15 (WEA 31) 06:15 09:25 (WEA 31) 18:49	07:33 (WEA 02) 06:07 07:49 (WEA 02) 20:41	07:59 (WEA 06) 05:20 07:59 (WEA 06) 21:26	05:10 21:47
28	08:11 17:07	09:12 (WEA 28) 07:15 10:19 (WEA 28) 18:03	09:16 (WEA 31) 06:13 09:26 (WEA 31) 18:51	07:34 (WEA 02) 06:05 07:49 (WEA 02) 20:43	07:59 (WEA 06) 05:19 07:59 (WEA 06) 21:28	05:11 21:47
29	08:10 17:09	09:13 (WEA 28) 07:13 10:20 (WEA 28) 18:05	09:17 (WEA 31) 06:11 09:27 (WEA 31) 18:53	07:35 (WEA 02) 06:04 07:49 (WEA 02) 20:44	07:59 (WEA 06) 05:18 07:59 (WEA 06) 21:29	05:11 21:47
30	08:08 17:11	09:14 (WEA 28) 07:11 10:21 (WEA 28) 18:07	09:18 (WEA 31) 06:09 09:28 (WEA 31) 18:55	07:36 (WEA 02) 06:02 07:49 (WEA 02) 20:46	07:59 (WEA 06) 05:17 07:59 (WEA 06) 21:30	05:12 21:46
31	08:07 17:12	09:15 (WEA 28) 07:09 10:22 (WEA 28) 18:09	09:19 (WEA 31) 06:07 09:29 (WEA 31) 18:57	07:37 (WEA 02) 06:00 07:49 (WEA 02) 20:48	07:59 (WEA 06) 05:16 07:59 (WEA 06) 21:31	05:12 21:46
Sonnenscheinstunden	261	462	314	367	415	496
astr. max. mögl. Beschattung				515	311	87

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)
--------------	-----------------------	-------------------------	----------------------	----------------------------------	------------------------------	---------------------------	----------------------------

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-12 - SR-12, Am Ruhberg 16, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13										
2	05:13	3	05:43 (WEA 35)	05:48							
3	05:14		05:46 (WEA 35)	05:51							
4	05:15	2	05:45 (WEA 35)	05:53							
5	05:16	1	05:46 (WEA 35)	05:54							
6	05:16		05:54	05:56							
7	05:17		05:57	05:57							
8	05:18		05:59	05:59							
9	05:19		06:01	06:01							
10	05:20		06:02	06:02							
11	05:21		06:04	06:04							
12	05:22		06:05	06:05							
13	05:23		06:07	06:07							
14	05:24		06:08	06:08							
15	05:25		06:10	06:10							
16	05:27		06:12	06:12							
17	05:28		06:13	06:13							
18	05:29		06:15	06:15							
19	05:30		06:16	06:16							
20	05:32		06:18	06:18							
21	05:33		06:19	06:19							
22	05:34		06:21	06:21							
23	05:36		06:23	06:23							
24	05:37		06:24	06:24							
25	05:38		06:26	06:26							
26	05:40		06:27	06:27							
27	05:41		06:29	06:29							
28	05:42		06:31	06:31							
29	05:44		06:32	06:32							
30	05:45		06:34	06:34							
31	05:47		06:35	06:35							
Sonnenscheinstunden 499		452		381		332		268		246	
astr.max.mögl.Beschattung		7		248		451		261		404	

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-13 - SR-13, Am Ruhberg 10, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	09:46 (WEA 04)	08:05	09:13 (WEA 31)	07:13	07:03
2	16:27	09:58 (WEA 04)	17:14	09:36 (WEA 31)	18:05	19:58
3	08:31	09:17 (WEA 28)	08:04	09:12 (WEA 31)	07:11	07:01
4	16:28	09:58 (WEA 04)	17:16	09:36 (WEA 31)	18:06	19:59
5	08:31	09:16 (WEA 28)	08:02	09:13 (WEA 31)	07:09	06:59
6	16:29	09:58 (WEA 04)	17:18	09:37 (WEA 31)	18:08	20:01
7	08:31	09:15 (WEA 28)	08:01	09:13 (WEA 31)	07:06	06:57
8	16:30	09:58 (WEA 04)	17:20	09:37 (WEA 31)	18:10	20:03
9	08:31	09:15 (WEA 28)	07:59	09:13 (WEA 31)	07:04	06:54
10	16:32	09:58 (WEA 04)	17:21	09:37 (WEA 31)	18:12	20:04
11	08:30	09:14 (WEA 28)	07:57	09:14 (WEA 31)	07:02	06:52
12	16:33	09:57 (WEA 04)	17:23	09:37 (WEA 31)	18:14	20:06
13	08:30	09:15 (WEA 28)	07:56	09:14 (WEA 31)	07:00	06:50
14	16:34	09:56 (WEA 04)	17:25	09:37 (WEA 31)	18:15	20:08
15	08:30	09:14 (WEA 28)	07:54	09:15 (WEA 31)	06:58	06:48
16	16:35	09:57 (WEA 04)	17:27	09:36 (WEA 31)	18:17	20:09
17	08:29	09:15 (WEA 28)	07:52	09:16 (WEA 31)	06:56	06:45
18	16:37	09:58 (WEA 04)	17:29	09:35 (WEA 31)	18:19	20:11
19	08:29	09:15 (WEA 28)	07:51	09:17 (WEA 31)	06:53	06:43
20	16:38	09:58 (WEA 04)	17:30	09:33 (WEA 31)	18:20	20:13
21	08:28	09:14 (WEA 28)	07:49	09:19 (WEA 31)	06:51	06:41
22	16:39	09:59 (WEA 04)	17:32	09:31 (WEA 31)	18:22	20:14
23	08:27	09:14 (WEA 28)	07:47	09:23 (WEA 31)	06:49	06:39
24	16:41	09:59 (WEA 04)	17:34	09:27 (WEA 31)	18:24	20:16
25	08:27	09:15 (WEA 28)	07:45	09:27 (WEA 31)	06:47	06:37
26	16:42	09:59 (WEA 04)	17:36	09:26 (WEA 31)	18:26	20:18
27	08:26	09:16 (WEA 28)	07:43	09:25 (WEA 31)	06:44	06:35
28	16:44	09:59 (WEA 04)	17:38	09:25 (WEA 31)	18:27	20:19
29	08:25	09:16 (WEA 28)	07:41	09:25 (WEA 31)	06:42	06:32
30	16:45	09:59 (WEA 04)	17:40	09:24 (WEA 31)	18:29	20:21
31	08:24	09:16 (WEA 28)	07:39	09:24 (WEA 31)	06:40	06:30
32	16:47	09:59 (WEA 04)	17:41	09:23 (WEA 31)	18:31	20:23
33	08:24	09:17 (WEA 28)	07:37	09:23 (WEA 31)	06:38	06:28
34	16:48	09:59 (WEA 04)	17:43	09:22 (WEA 31)	18:32	20:24
35	08:23	09:17 (WEA 28)	07:36	09:22 (WEA 31)	06:36	06:26
36	16:50	09:59 (WEA 04)	17:45	09:21 (WEA 31)	18:34	20:26
37	08:22	09:17 (WEA 28)	07:34	09:21 (WEA 31)	06:33	06:24
38	16:52	09:59 (WEA 04)	17:47	09:20 (WEA 31)	18:36	20:28
39	08:21	09:18 (WEA 28)	07:32	09:20 (WEA 31)	06:31	06:22
40	16:53	09:59 (WEA 04)	17:49	09:19 (WEA 31)	18:37	20:29
41	08:20	09:19 (WEA 28)	07:30	09:19 (WEA 31)	06:28	06:20
42	16:55	09:59 (WEA 04)	17:50	09:18 (WEA 31)	18:39	20:31
43	08:19	09:21 (WEA 28)	07:28	09:18 (WEA 31)	06:26	06:18
44	16:57	09:59 (WEA 04)	17:52	09:17 (WEA 31)	18:41	20:33
45	08:17	09:23 (WEA 28)	07:26	09:17 (WEA 31)	06:24	06:16
46	16:58	09:59 (WEA 04)	17:54	09:16 (WEA 31)	18:43	20:34
47	08:16	09:18 (WEA 28)	07:23	09:16 (WEA 31)	06:22	06:13
48	17:00	09:27 (WEA 31)	17:56	09:15 (WEA 31)	18:44	20:36
49	08:15	09:17 (WEA 28)	07:21	09:15 (WEA 31)	06:19	06:11
50	17:02	09:30 (WEA 31)	17:58	09:14 (WEA 31)	18:46	20:38
51	08:14	09:15 (WEA 28)	07:19	09:14 (WEA 31)	06:17	06:09
52	17:03	09:31 (WEA 31)	17:59	09:13 (WEA 31)	18:48	20:39
53	08:12	09:15 (WEA 28)	07:17	09:13 (WEA 31)	06:15	06:07
54	17:05	09:33 (WEA 31)	18:01	09:13 (WEA 31)	18:49	20:41
55	08:11	09:13 (WEA 28)	07:15	09:13 (WEA 31)	06:13	06:05
56	17:07	09:33 (WEA 31)	18:03	09:12 (WEA 31)	18:51	20:43
57	08:10	09:13 (WEA 28)	07:14	09:12 (WEA 31)	06:10	06:04
58	17:09	09:35 (WEA 31)	18:05	09:12 (WEA 31)	18:53	20:44
59	08:08	09:13 (WEA 28)	07:13	09:12 (WEA 31)	06:08	06:02
60	17:11	09:35 (WEA 31)	18:06	09:12 (WEA 31)	18:54	20:46
61	08:07	09:13 (WEA 28)	07:12	09:12 (WEA 31)	06:06	06:01
62	17:12	09:36 (WEA 31)	18:07	09:12 (WEA 31)	18:56	20:48
63	08:06	09:14 (WEA 28)	07:11	09:12 (WEA 31)	06:04	06:00
64	17:13	09:37 (WEA 31)	18:08	09:12 (WEA 31)	18:57	20:50
65	08:05	09:15 (WEA 28)	07:10	09:12 (WEA 31)	06:02	05:58
66	17:14	09:38 (WEA 31)	18:09	09:12 (WEA 31)	18:58	20:52
67	08:04	09:16 (WEA 28)	07:09	09:12 (WEA 31)	06:00	05:56
68	17:15	09:39 (WEA 31)	18:10	09:12 (WEA 31)	18:59	20:54
69	08:03	09:17 (WEA 28)	07:08	09:12 (WEA 31)	05:58	05:54
70	17:16	09:40 (WEA 31)	18:11	09:12 (WEA 31)	19:00	20:56
71	08:02	09:18 (WEA 28)	07:07	09:12 (WEA 31)	05:56	05:52
72	17:17	09:41 (WEA 31)	18:12	09:12 (WEA 31)	19:01	20:58
73	08:01	09:19 (WEA 28)	07:06	09:12 (WEA 31)	05:54	05:50
74	17:18	09:42 (WEA 31)	18:13	09:12 (WEA 31)	19:02	21:00
75	08:00	09:20 (WEA 28)	07:05	09:12 (WEA 31)	05:52	05:48
76	17:19	09:43 (WEA 31)	18:14	09:12 (WEA 31)	19:03	21:02
77	07:59	09:21 (WEA 28)	07:04	09:12 (WEA 31)	05:50	05:46
78	17:20	09:44 (WEA 31)	18:15	09:12 (WEA 31)	19:04	21:04
79	07:58	09:22 (WEA 28)	07:03	09:12 (WEA 31)	05:48	05:44
80	17:21	09:45 (WEA 31)	18:16	09:12 (WEA 31)	19:05	21:06
81	07:57	09:23 (WEA 28)	07:02	09:12 (WEA 31)	05:46	05:42
82	17:22	09:46 (WEA 31)	18:17	09:12 (WEA 31)	19:06	21:08
83	07:56	09:24 (WEA 28)	07:01	09:12 (WEA 31)	05:44	05:40
84	17:23	09:47 (WEA 31)	18:18	09:12 (WEA 31)	19:07	21:10
85	07:55	09:25 (WEA 28)	07:00	09:12 (WEA 31)	05:42	05:38
86	17:24	09:48 (WEA 31)	18:19	09:12 (WEA 31)	19:08	21:12
87	07:54	09:26 (WEA 28)	06:59	09:12 (WEA 31)	05:40	05:36
88	17:25	09:49 (WEA 31)	18:20	09:12 (WEA 31)	19:09	21:14
89	07:53	09:27 (WEA 28)	06:58	09:12 (WEA 31)	05:38	05:34
90	17:26	09:50 (WEA 31)	18:21	09:12 (WEA 31)	19:10	21:16
91	07:52	09:28 (WEA 28)	06:57	09:12 (WEA 31)	05:36	05:32
92	17:27	09:51 (WEA 31)	18:22	09:12 (WEA 31)	19:11	21:18
93	07:51	09:29 (WEA 28)	06:56	09:12 (WEA 31)	05:34	05:30
94	17:28	09:52 (WEA 31)	18:23	09:12 (WEA 31)	19:12	21:20
95	07:50	09:30 (WEA 28)	06:55	09:12 (WEA 31)	05:32	05:28
96	17:29	09:53 (WEA 31)	18:24	09:12 (WEA 31)	19:13	21:22
97	07:49	09:31 (WEA 28)	06:54	09:12 (WEA 31)	05:30	05:26
98	17:30	09:54 (WEA 31)	18:25	09:12 (WEA 31)	19:14	21:24
99	07:48	09:32 (WEA 28)	06:53	09:12 (WEA 31)	05:28	05:24
100	17:31	09:55 (WEA 31)	18:26	09:12 (WEA 31)	19:15	21:26
101	07:47	09:33 (WEA 28)	06:52	09:12 (WEA 31)	05:26	05:22
102	17:32	09:56 (WEA 31)	18:27	09:12 (WEA 31)	19:16	21:28
103	07:46	09:34 (WEA 28)	06:51	09:12 (WEA 31)	05:24	05:20
104	17:33	09:57 (WEA 31)	18:28	09:12 (WEA 31)	19:17	21:30
105	07:45	09:35 (WEA 28)	06:50	09:12 (WEA 31)	05:22	05:18
106	17:34	09:58 (WEA 31)	18:29	09:12 (WEA 31)	19:18	21:32
107	07:44	09:36 (WEA 28)	06:49	09:12 (WEA 31)	05:20	05:16
108	17:35	09:59 (WEA 31)	18:30	09:12 (WEA 31)	19:19	21:34
109	07:43	09:37 (WEA 28)	06:48	09:12 (WEA 31)	05:18	05:14
110	17:36	10:00 (WEA 31)	18:31	09:12 (WEA 31)	19:20	21:36
111	07:42	09:38 (WEA 28)	06:47	09:12 (WEA 31)	05:16	05:12
112	17:37	10:01 (WEA 31)	18:32	09:12 (WEA 31)	19:21	21:38
113	07:41	09:39 (WEA 28)	06:46	09:12 (WEA 31)	05:14	05:10
114	17:38	10:02 (WEA 31)	18:33	09:12 (WEA 31)	19:22	21:40
115	07:40	09:40 (WEA 28)	06:45	09:12 (WEA 31)	05:12	05:08
116	17:39	10:03 (WEA 31)	18:34	09:12 (WEA 31)	19:23	21:42
117	07:39	09:41 (WEA 28)	06:44	09:12 (WEA 31)	05:10	05:06
118	17:40	10:04 (WEA 31)	18:35	09:12 (WEA 31)	19:24	21:44
119	07:38	09:42 (WEA 28)	06:43	09:12 (WEA 31)	05:08	05:04
120	17:41	10:05 (WEA 31)	18:36	09:12 (WEA 31)	19:25	21:46
121	07:37	09:43 (WEA 28)	06:42	09:12 (WEA 31)	05:06	05:02
122	17:42	10:06 (WEA 31)	18:37	09:12 (WEA 31)	19:26	21:48
123	07:36	09:44 (WEA 28)	06:41	09:12 (WEA 31)	05:04	05:00
124	17:43	10:07 (WEA 31)	18:38	09:12 (WEA 31)	19:27	21:50
125	07:35	09:45 (WEA 28)	06:40	09:12 (WEA 31)	05:02	04:58
126	17:44	10:08 (WEA 31)	18:39	09:12 (WEA 31)	19:28	21:52
127	07:34	09:46 (WEA 28)	06:39	09:12 (WEA 31)	05:00	04:54
128	17:45	10:09 (WEA 31)	18:40	09:12 (WEA 31)	19:29	21:54
129	07:33	09:47 (WEA 28)	06:38	09:12 (WEA 31)	04:58	04:54
130	17:46	10:10 (WEA 31)	18:41	09:12 (WEA 31)	19:30	21:56
131	07:32	09:48 (WEA 28)	06:37	09:12 (WEA 31)	04:56	04:52
132	17:47	10:11 (WEA 31)	18:42	09:12 (WEA 31)	19:31	21:58
133	07:31	09:49 (WEA 28)	06:36	09:12 (WEA 31)	04:54	04:50
134	17:48	10:12 (WEA 31)	18:43	09:12 (WEA 31)	19:32	22:00
135	07:30	09:50 (WEA 28)	06:35	09:12 (WEA 31)	04:52	04:48
136	17:49	10:13 (WEA 31)	18:44	09:12 (WEA 31)	19:33	22:02
137	07:29	09:51 (WEA 28)	06:34	09:12 (WEA 31)	04:50	04:46
138	17:50	10:14 (WEA 31)	18:45	0		

Sonnenscheinstrund	261	436	279	1712	415	336	496	39
astr.mast.modl.Beschattung	121	466	279	1712	415	336	496	39

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-13 - SR-13, Am Ruhberg 10, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:25	08:06 (WEA 12)	07:18
2	21:46	21:15	20:14	19:06	08:35 (WEA 02)	17:01
3	05:13	05:50	06:39	07:27	08:05 (WEA 12)	07:19
4	21:46	21:13	20:12	19:03	08:34 (WEA 02)	16:59
5	05:14	05:51	06:40	07:28	08:07 (WEA 12)	07:21
6	21:45	21:12	20:10	19:01	08:34 (WEA 02)	16:57
7	05:15	05:53	06:42	07:30	08:08 (WEA 02)	07:23
8	21:45	21:10	20:07	18:59	08:33 (WEA 02)	16:55
9	05:16	05:54	06:43	07:31	08:07 (WEA 02)	07:25
10	21:45	21:08	20:05	18:57	08:32 (WEA 02)	16:54
11	05:16	05:56	06:45	07:33	08:08 (WEA 02)	07:26
12	21:44	21:07	20:03	18:54	08:31 (WEA 02)	16:52
13	05:17	05:57	06:47	07:35	08:10 (WEA 02)	07:28
14	21:43	21:05	20:01	18:52	08:29 (WEA 02)	16:50
15	05:18	05:59	06:48	07:36	08:11 (WEA 02)	07:30
16	21:43	21:03	19:58	18:50	08:36 (WEA 02)	16:49
17	05:19	06:01	06:50	07:38	08:14 (WEA 02)	07:32
18	21:42	21:01	19:56	18:48	08:23 (WEA 02)	16:47
19	05:20	06:02	06:51	07:40	07:33	08:43 (WEA 31)
20	21:41	20:59	19:54	18:46	16:45	09:07 (WEA 31)
21	05:21	06:04	06:53	07:41	07:35	08:44 (WEA 31)
22	21:41	20:58	19:52	18:43	16:44	09:07 (WEA 31)
23	05:22	06:05	06:54	07:43	07:37	08:45 (WEA 31)
24	21:40	20:56	19:49	18:41	16:42	09:07 (WEA 31)
25	05:23	06:07	06:56	07:45	07:39	08:45 (WEA 31)
26	21:39	20:54	19:47	18:39	16:41	09:07 (WEA 31)
27	05:24	06:08	06:58	07:46	07:40	08:46 (WEA 31)
28	21:38	20:52	19:45	18:37	16:39	09:06 (WEA 31)
29	05:25	06:10	06:59	07:48	07:42	08:48 (WEA 31)
30	21:37	20:50	19:42	18:35	16:38	09:06 (WEA 31)
31	05:27	06:12	07:01	07:50	07:44	08:48 (WEA 31)
1	21:36	20:48	19:40	18:33	16:37	09:04 (WEA 31)
2	05:28	06:13	07:02	07:52	07:45	08:50 (WEA 31)
3	21:35	20:46	19:38	18:30	16:35	09:03 (WEA 31)
4	05:29	06:15	07:04	07:53	07:47	08:52 (WEA 31)
5	21:34	20:44	19:36	18:28	16:34	09:01 (WEA 31)
6	05:30	06:16	07:06	07:55	07:49	08:57 (WEA 28)
7	21:33	20:42	19:33	18:26	16:33	09:03 (WEA 28)
8	05:32	06:18	07:07	07:57	07:51	08:56 (WEA 28)
9	21:32	20:40	19:31	18:24	16:32	09:05 (WEA 28)
10	05:33	06:19	07:09	07:58	07:52	08:55 (WEA 28)
11	21:31	20:38	19:29	18:22	16:30	09:07 (WEA 28)
12	05:34	06:21	07:10	08:00	07:54	08:54 (WEA 28)
13	21:29	20:36	19:26	18:20	16:29	09:07 (WEA 28)
14	05:36	06:23	07:12	08:02	07:55	08:54 (WEA 28)
15	21:28	20:34	19:24	18:18	16:28	09:08 (WEA 28)
16	05:37	06:24	07:14	08:04	07:57	08:54 (WEA 28)
17	21:27	20:31	19:22	18:16	16:27	09:09 (WEA 28)
18	05:38	06:26	07:15	08:09	07:59	08:55 (WEA 28)
19	21:25	20:29	19:19	18:14	16:26	09:10 (WEA 28)
20	05:40	06:27	07:17	08:08	08:00	08:54 (WEA 28)
21	21:24	20:27	19:17	18:12	16:25	09:10 (WEA 28)
22	05:41	06:29	07:18	08:06	08:02	08:55 (WEA 28)
23	21:23	20:25	19:15	18:10	16:24	09:11 (WEA 28)
24	05:42	06:31	07:20	08:06	08:03	08:56 (WEA 28)
25	21:21	20:23	19:13	18:08	16:23	09:11 (WEA 28)
26	05:44	06:32	07:22	08:05	08:05	08:55 (WEA 28)
27	21:20	20:21	19:10	18:06	16:23	09:11 (WEA 28)
28	05:45	06:34	07:23	08:05	08:06	08:56 (WEA 28)
29	21:18	20:19	19:08	18:04	16:22	09:11 (WEA 28)
30	05:47	06:35	07:26	08:07	17:02	08:48 (WEA 31)
31	21:17	20:16	19:07	18:03	16:21	09:01 (WEA 31)
Sonnenscheinstunden	499	452	381	332	268	246
astr.max.mögl.Beschattung		276	420	221	524	531

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)
--------------	-----------------------	-------------------------	----------------------	----------------------------------	------------------------------	---------------------------	----------------------------

Projekt:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

KÖTTER Consulting Engineers GmbH & Co. KG

Bonifatiusstr. 400

DE-48432 Rheine

+49 5971 9710-31

Schaer / t.schaer@koetter-consulting.com

Berechnet:

18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-14 - SR-14, Radlinghauser Str. 15, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	09:30 (WEA 28) 08:05 09:45 (WEA 28) 17:14	09:51 (WEA 31) 07:13 10:00 (WEA 31) 18:05	07:48 (WEA 02) 07:03 08:07 (WEA 02) 19:58	07:47 (WEA 01) 06:00 07:53 (WEA 01) 20:47	05:15 21:32
2	08:31 16:28	09:30 (WEA 28) 08:04 09:46 (WEA 28) 17:16	07:11 18:06	07:47 (WEA 02) 07:01 08:09 (WEA 02) 19:59	07:46 (WEA 06) 05:51 20:49	05:15 21:33
3	08:31 16:29	09:31 (WEA 28) 08:02 09:47 (WEA 28) 17:18	07:09 18:08	07:46 (WEA 02) 06:59 08:10 (WEA 02) 20:01	20:49 20:51	05:14 21:34
4	08:31 16:30	09:31 (WEA 28) 08:01 09:46 (WEA 28) 17:20	07:06 18:10	07:44 (WEA 02) 06:57 08:10 (WEA 02) 20:03	05:54 20:52	05:13 21:35
5	08:31 16:32	09:32 (WEA 28) 07:59 09:50 (WEA 31) 17:21	07:04 18:12	07:43 (WEA 02) 06:54 08:10 (WEA 02) 20:04	07:49 (WEA 06) 05:52 07:57 (WEA 06) 20:54	05:12 21:36
6	08:30 16:33	09:32 (WEA 28) 07:57 09:52 (WEA 31) 17:23	07:02 18:14	07:43 (WEA 02) 06:52 08:11 (WEA 02) 20:06	07:46 (WEA 06) 05:51 08:00 (WEA 06) 20:56	05:12 21:37
7	08:30 16:34	09:33 (WEA 28) 07:56 09:54 (WEA 31) 17:25	07:00 18:15	07:42 (WEA 02) 06:50 08:11 (WEA 02) 20:08	07:43 (WEA 06) 05:49 08:01 (WEA 06) 20:57	05:11 21:38
8	08:30 16:35	09:34 (WEA 28) 07:54 09:55 (WEA 31) 17:27	06:58 18:17	07:42 (WEA 02) 06:48 08:11 (WEA 02) 20:09	07:42 (WEA 06) 05:47 08:02 (WEA 06) 20:59	05:11 21:39
9	08:29 16:37	09:35 (WEA 28) 07:52 09:57 (WEA 31) 17:29	06:55 18:19	07:41 (WEA 02) 06:45 08:10 (WEA 02) 20:11	07:41 (WEA 06) 05:45 08:03 (WEA 06) 21:00	05:10 21:40
10	08:29 16:38	09:36 (WEA 28) 07:51 09:58 (WEA 31) 17:30	06:53 18:20	07:41 (WEA 02) 06:43 08:10 (WEA 02) 20:13	07:40 (WEA 06) 05:44 08:03 (WEA 06) 21:02	05:10 21:41
11	08:28 16:39	09:36 (WEA 28) 07:49 09:59 (WEA 31) 17:32	06:51 18:22	07:42 (WEA 02) 06:41 08:10 (WEA 02) 20:14	07:40 (WEA 06) 05:42 08:03 (WEA 06) 21:03	05:10 21:41
12	08:27 16:41	09:37 (WEA 28) 07:47 09:59 (WEA 31) 17:34	06:49 18:24	07:41 (WEA 02) 06:39 08:08 (WEA 02) 20:16	07:38 (WEA 06) 05:40 08:03 (WEA 06) 21:05	05:09 21:42
13	08:27 16:42	09:40 (WEA 28) 07:45 10:01 (WEA 31) 17:36	06:47 18:26	07:42 (WEA 02) 06:37 08:07 (WEA 02) 20:18	07:38 (WEA 06) 05:39 08:02 (WEA 06) 21:07	05:09 21:43
14	08:26 16:44	09:41 (WEA 31) 07:43 10:02 (WEA 31) 17:38	06:44 18:27	07:43 (WEA 02) 06:35 08:06 (WEA 02) 20:19	07:38 (WEA 06) 05:37 08:02 (WEA 06) 21:08	05:09 21:43
15	08:25 16:45	09:41 (WEA 31) 07:41 10:03 (WEA 31) 17:40	06:42 18:29	07:45 (WEA 02) 06:32 08:05 (WEA 02) 20:21	07:38 (WEA 06) 05:36 08:02 (WEA 06) 21:10	05:09 21:44
16	08:24 16:47	09:41 (WEA 31) 07:39 10:03 (WEA 31) 17:41	06:40 18:31	07:46 (WEA 02) 06:30 08:02 (WEA 02) 20:23	07:38 (WEA 06) 05:34 08:01 (WEA 06) 21:11	05:08 21:44
17	08:24 16:48	09:41 (WEA 31) 07:37 10:04 (WEA 31) 17:43	06:38 18:32	07:49 (WEA 02) 06:28 07:58 (WEA 02) 20:24	07:39 (WEA 06) 05:33 08:00 (WEA 06) 21:13	05:08 21:45
18	08:23 16:50	09:41 (WEA 31) 07:36 10:05 (WEA 31) 17:45	06:35 18:34	06:26 06:55 (WEA 01) 06:24	07:40 (WEA 06) 05:31 07:59 (WEA 06) 21:14	05:08 21:45
19	08:22 16:52	09:40 (WEA 31) 07:34 10:04 (WEA 31) 17:47	06:33 18:36	06:24 06:59 (WEA 01) 06:28	07:41 (WEA 06) 05:30 07:57 (WEA 06) 21:16	05:08 21:46
20	08:21 16:53	09:40 (WEA 31) 07:32 10:05 (WEA 31) 17:49	06:31 18:37	06:22 06:51 (WEA 01) 06:20	07:43 (WEA 06) 05:29 07:55 (WEA 06) 21:17	05:08 21:46
21	08:20 16:55	09:41 (WEA 31) 07:30 10:06 (WEA 31) 17:50	06:28 18:39	06:20 07:03 (WEA 01) 06:18	07:46 (WEA 06) 05:27 07:51 (WEA 06) 21:18	05:09 21:46
22	08:19 16:57	09:41 (WEA 31) 07:28 10:06 (WEA 31) 17:52	06:26 18:41	06:18 07:03 (WEA 01) 06:16	05:26 21:20	05:09 21:46
23	08:17 16:58	09:42 (WEA 31) 07:26 10:07 (WEA 31) 17:54	06:24 18:43	06:16 07:03 (WEA 01) 06:13	05:25 21:21	05:09 21:47
24	08:16 17:00	09:42 (WEA 31) 07:23 10:06 (WEA 31) 17:56	06:22 18:44	06:13 07:03 (WEA 01) 06:11	05:24 21:22	05:09 21:47
25	08:15 17:02	09:43 (WEA 31) 07:21 10:06 (WEA 31) 17:58	06:19 18:46	06:11 07:03 (WEA 01) 06:09	05:22 21:24	05:10 21:47
26	08:14 17:03	09:43 (WEA 31) 07:19 10:06 (WEA 31) 17:59	06:17 18:48	06:09 07:02 (WEA 01) 06:07	05:21 21:25	05:10 21:47
27	08:12 17:05	09:44 (WEA 31) 07:17 10:06 (WEA 31) 18:01	06:15 18:49	06:07 07:02 (WEA 01) 06:05	05:20 21:26	05:10 21:47
28	08:11 17:07	09:44 (WEA 31) 07:15 10:05 (WEA 31) 18:03	06:13 18:51	06:05 07:01 (WEA 01) 06:04	05:19 21:28	05:11 21:47
29	08:10 17:09	09:46 (WEA 31) 07:13 10:05 (WEA 31) 18:05	06:10 18:53	06:04 07:01 (WEA 01) 06:03	05:18 21:29	05:11 21:47
30	08:08 17:11	09:47 (WEA 31) 07:11 10:03 (WEA 31) 18:07	06:08 19:54	06:02 07:42 (WEA 01) 06:02	05:17 21:30	05:12 21:46
31	08:07 17:12	09:49 (WEA 31) 07:09 10:02 (WEA 31) 18:09	06:06 19:56	06:01 07:43 (WEA 01) 06:01	05:16 21:31	05:12 21:46
Sonnenscheinstunden	261	279	367	415	483	496
astr. max. mögl. Beschattung	649	28	617	327		126

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	Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-14 - SR-14, Radlinghauser Str. 15, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:43 (WEA 35)	05:48	06:37	07:38 (WEA 06)	07:25	08:22 (WEA 02)	07:18	08:08	09:19 (WEA 28)	
2	21:46	05:47 (WEA 35)	21:15	20:14	08:02 (WEA 06)	18:06	08:46 (WEA 02)	17:01	18:21	09:41 (WEA 31)	22
3	05:13	05:43 (WEA 35)	05:50	06:39	07:38 (WEA 06)	07:27	08:20 (WEA 02)	07:19	08:09	09:19 (WEA 28)	
4	21:46	05:46 (WEA 35)	21:13	20:12	08:01 (WEA 06)	19:03	08:47 (WEA 02)	16:59	18:10	09:41 (WEA 31)	22
5	05:14	05:44 (WEA 35)	05:51	06:40	07:39 (WEA 06)	07:28	08:19 (WEA 02)	07:21	08:10	09:18 (WEA 28)	
6	21:45	05:47 (WEA 35)	21:12	20:10	08:01 (WEA 06)	19:01	08:48 (WEA 02)	16:57	18:20	09:40 (WEA 31)	22
7	05:15	05:45 (WEA 35)	05:53	06:42	07:39 (WEA 06)	07:30	08:19 (WEA 02)	07:23	08:12	09:19 (WEA 28)	
8	21:45	05:47 (WEA 35)	21:10	20:07	07:59 (WEA 06)	18:59	08:48 (WEA 02)	16:55	18:19	09:40 (WEA 31)	21
9	05:16	05:46 (WEA 35)	05:54	06:43	07:40 (WEA 06)	07:31	08:18 (WEA 02)	07:25	08:13	09:18 (WEA 28)	
10	21:45	05:47 (WEA 35)	21:08	20:05	07:58 (WEA 06)	18:57	08:47 (WEA 02)	16:54	18:19	09:39 (WEA 31)	21
11	05:16	05:46 (WEA 35)	05:56	06:45	07:41 (WEA 06)	07:33	08:18 (WEA 02)	07:26	08:14	09:18 (WEA 28)	
12	21:44	05:47 (WEA 35)	21:07	20:03	07:55 (WEA 06)	18:54	08:47 (WEA 02)	16:52	18:19	09:38 (WEA 31)	20
13	05:17	05:47 (WEA 35)	05:57	06:47	07:44 (WEA 06)	07:35	08:18 (WEA 02)	07:28	08:16	09:19 (WEA 28)	
14	21:43	05:48 (WEA 35)	21:05	20:01	07:53 (WEA 06)	18:52	08:47 (WEA 02)	16:50	18:18	09:38 (WEA 31)	19
15	05:18	05:49 (WEA 35)	05:59	06:48	07:45 (WEA 06)	07:36	08:18 (WEA 02)	07:30	08:17	09:19 (WEA 28)	
16	21:43	05:49 (WEA 35)	21:03	19:58	07:46 (WEA 06)	18:50	08:46 (WEA 02)	16:49	18:18	09:34 (WEA 28)	15
17	05:19	05:50 (WEA 35)	06:01	06:50	07:47 (WEA 06)	18:51	08:47 (WEA 02)	16:50	18:19	09:35 (WEA 28)	
18	21:42	05:50 (WEA 35)	21:01	19:56	07:48 (WEA 06)	18:48	08:45 (WEA 02)	16:47	18:18	09:35 (WEA 28)	16
19	05:20	05:51 (WEA 35)	06:02	06:51	07:49 (WEA 06)	18:49	08:46 (WEA 02)	16:48	18:19	09:36 (WEA 28)	
20	21:41	05:52 (WEA 35)	21:00	19:54	07:50 (WEA 06)	18:47	08:45 (WEA 02)	16:46	18:19	09:36 (WEA 28)	15
21	05:21	05:53 (WEA 35)	06:03	06:52	07:51 (WEA 06)	18:48	08:46 (WEA 02)	16:47	18:20	09:37 (WEA 28)	
22	21:41	05:54 (WEA 35)	20:59	19:52	07:52 (WEA 06)	18:49	08:47 (WEA 02)	16:48	18:21	09:38 (WEA 28)	16
23	05:22	05:55 (WEA 35)	06:04	06:53	07:53 (WEA 06)	18:50	08:48 (WEA 02)	16:49	18:22	09:39 (WEA 28)	
24	21:40	05:56 (WEA 35)	20:58	19:49	07:54 (WEA 06)	18:51	08:49 (WEA 02)	16:50	18:23	09:40 (WEA 28)	15
25	05:23	05:57 (WEA 35)	06:05	06:54	07:55 (WEA 06)	18:52	08:50 (WEA 02)	16:51	18:24	09:41 (WEA 28)	
26	21:39	05:58 (WEA 35)	20:54	19:47	07:56 (WEA 06)	18:53	08:51 (WEA 02)	16:52	18:25	09:42 (WEA 28)	14
27	05:24	05:59 (WEA 35)	06:06	06:55	07:57 (WEA 06)	18:54	08:52 (WEA 02)	16:53	18:26	09:43 (WEA 28)	
28	21:38	05:59 (WEA 35)	20:52	19:45	07:58 (WEA 06)	18:55	08:53 (WEA 02)	16:54	18:27	09:44 (WEA 28)	13
29	05:25	06:00 (WEA 35)	06:07	06:56	07:59 (WEA 06)	18:56	08:54 (WEA 02)	16:55	18:28	09:45 (WEA 28)	
30	21:37	06:01 (WEA 35)	20:50	19:42	08:00 (WEA 06)	18:57	08:55 (WEA 02)	16:56	18:29	09:46 (WEA 28)	12
31	05:27	06:12 (WEA 35)	06:08	06:58	08:01 (WEA 06)	18:58	08:56 (WEA 02)	16:57	18:30	09:47 (WEA 28)	
1	21:36	06:13 (WEA 35)	20:48	19:40	08:02 (WEA 06)	18:59	08:57 (WEA 02)	16:58	18:31	09:48 (WEA 28)	11
2	05:28	06:14 (WEA 35)	06:09	06:59	08:03 (WEA 06)	19:00	08:58 (WEA 02)	16:59	18:32	09:49 (WEA 28)	
3	21:35	06:15 (WEA 35)	20:46	19:38	08:04 (WEA 06)	18:57	08:59 (WEA 02)	16:58	18:33	09:50 (WEA 28)	10
4	05:29	06:16 (WEA 35)	06:10	07:00	08:05 (WEA 06)	19:01	09:00 (WEA 02)	17:00	18:34	09:51 (WEA 28)	
5	21:34	06:17 (WEA 35)	20:44	19:36	08:06 (WEA 06)	18:55	09:01 (WEA 02)	17:01	18:35	09:52 (WEA 28)	9
6	05:30	06:18 (WEA 35)	06:11	07:01	08:07 (WEA 06)	19:02	09:02 (WEA 02)	17:02	18:36	09:53 (WEA 28)	
7	21:33	06:19 (WEA 35)	20:42	19:33	08:08 (WEA 06)	18:56	09:03 (WEA 02)	17:03	18:37	09:54 (WEA 28)	8
8	05:32	06:20 (WEA 35)	06:12	07:02	08:09 (WEA 06)	19:03	09:04 (WEA 02)	17:04	18:38	09:55 (WEA 28)	
9	21:32	06:21 (WEA 35)	20:40	19:31	08:10 (WEA 06)	18:54	09:05 (WEA 02)	17:05	18:39	09:56 (WEA 28)	7
10	05:33	06:22 (WEA 35)	06:13	07:03	08:11 (WEA 06)	19:04	09:06 (WEA 02)	17:06	18:40	09:57 (WEA 28)	
11	21:31	06:23 (WEA 35)	20:38	19:29	08:12 (WEA 06)	18:53	09:07 (WEA 02)	17:07	18:41	09:58 (WEA 28)	6
12	05:34	06:24 (WEA 35)	06:14	07:04	08:13 (WEA 06)	19:05	09:08 (WEA 02)	17:08	18:42	09:59 (WEA 28)	
13	21:29	06:25 (WEA 35)	20:36	19:27	08:14 (WEA 06)	18:52	09:09 (WEA 02)	17:09	18:43	10:00 (WEA 28)	5
14	05:36	06:26 (WEA 35)	06:15	07:05	08:15 (WEA 06)	19:06	09:09 (WEA 02)	17:09	18:44	10:01 (WEA 28)	
15	21:28	06:27 (WEA 35)	20:34	19:24	08:16 (WEA 06)	18:51	09:10 (WEA 02)	17:10	18:45	10:02 (WEA 28)	4
16	05:37	06:28 (WEA 35)	06:16	07:06	08:17 (WEA 06)	19:07	09:11 (WEA 02)	17:11	18:46	10:03 (WEA 28)	
17	21:27	06:29 (WEA 35)	20:31	19:21	08:18 (WEA 06)	18:50	09:12 (WEA 02)	17:12	18:47	10:04 (WEA 28)	3
18	05:38	06:30 (WEA 35)	06:17	07:07	08:19 (WEA 06)	19:08	09:13 (WEA 02)	17:13	18:48	10:05 (WEA 28)	
19	21:25	06:31 (WEA 35)	20:29	19:19	08:20 (WEA 06)	18:49	09:14 (WEA 02)	17:14	18:49	10:06 (WEA 28)	2
20	05:40	06:32 (WEA 35)	06:18	07:08	08:21 (WEA 06)	19:09	09:15 (WEA 02)	17:15	18:50	10:07 (WEA 28)	
21	21:24	06:33 (WEA 35)	20:27	19:17	08:22 (WEA 06)	18:48	09:16 (WEA 02)	17:16	18:51	10:08 (WEA 28)	1
22	05:41	06:34 (WEA 35)	06:19	07:09	08:23 (WEA 06)	19:10	09:17 (WEA 02)	17:17	18:52	10:09 (WEA 28)	
23	21:23	06:35 (WEA 35)	20:25	19:15	08:24 (WEA 06)	18:47	09:18 (WEA 02)	17:18	18:53	10:10 (WEA 28)	0
24	05:42	06:36 (WEA 35)	06:20	07:10	08:25 (WEA 06)	19:11	09:19 (WEA 02)	17:19	18:54	10:11 (WEA 28)	
25	21:21	06:37 (WEA 35)	20:23	19:13	08:26 (WEA 06)	18:46	09:20 (WEA 02)	17:20	18:55	10:12 (WEA 28)	23
26	05:44	06:38 (WEA 35)	06:21	07:11	08:27 (WEA 06)	19:12	09:21 (WEA 02)	17:21	18:56	10:13 (WEA 28)	
27	21:20	06:39 (WEA 35)	20:21	19:11	08:28 (WEA 06)	18:45	09:22 (WEA 02)	17:22	18:57	10:14 (WEA 28)	22
28	05:45	06:40 (WEA 35)	06:22	07:12	08:29 (WEA 06)	19:13	09:23 (WEA 02)	17:23	18:58	10:15 (WEA 28)	
29	21:18	06:41 (WEA 35)	20:19	19:08	08:30 (WEA 06)	18:44	09:24 (WEA 02)	17:24	18:59	10:16 (WEA 28)	21
30	05:47	06:42 (WEA 35)	06:23	07:13	08:31 (WEA 06)	19:14	09:25 (WEA 02)	17:25	19:00	10:17 (WEA 28)	
31	21:17	06:43 (WEA 35)	20:16	19:06	08:32 (WEA 06)	18:43	09:26 (WEA 02)	17:26	19:01	10:18 (WEA 28)	20
Sonnenscheinstunden 499		452		381		332		268		246	
astr.-max.mögl.Beschattung 13		196		433		349		448		522	

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)	Schatteneinfang	Schattendeckung	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

KÖTTER Consulting Engineers GmbH & Co. KG

Bonifatiusstr. 400

DE-48432 Rheine

+49 5971 9710-31

Schaer / t.schaer@koetter-consulting.com

Berechnet:

18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-15 - SR-15, Radlinghauser Str. 11, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	09:48 (WEA 28) 08:05 10:21 (WEA 31) 17:14	07:13 18:05	07:52 (WEA 02) 07:03 08:20 (WEA 12) 19:58	06:00 20:47	05:15 21:32
2	08:31 16:28	09:50 (WEA 28) 08:04 10:22 (WEA 31) 17:16	07:11 18:06	07:51 (WEA 02) 07:01 08:20 (WEA 12) 19:59	08:02 (WEA 06) 20:49 08:03 (WEA 06) 20:49	05:15 21:33
3	08:31 16:29	09:52 (WEA 28) 08:02 10:23 (WEA 31) 17:18	07:09 18:08	07:51 (WEA 02) 06:59 08:20 (WEA 12) 20:01	07:56 (WEA 06) 20:56 08:09 (WEA 06) 20:51	05:14 21:34
4	08:31 16:30	09:58 (WEA 31) 08:01 10:23 (WEA 31) 17:20	07:06 18:10	07:50 (WEA 02) 06:57 08:20 (WEA 02) 20:03	07:54 (WEA 06) 20:54 08:11 (WEA 06) 20:52	05:13 21:35
5	08:31 16:32	09:59 (WEA 31) 07:59 10:24 (WEA 31) 17:21	07:04 18:12	07:49 (WEA 02) 06:54 08:20 (WEA 02) 20:04	07:52 (WEA 06) 20:52 08:13 (WEA 06) 20:54	05:12 21:36
6	08:30 16:33	09:58 (WEA 31) 07:57 10:24 (WEA 31) 17:23	07:02 18:13	07:49 (WEA 02) 06:52 08:20 (WEA 02) 20:06	07:51 (WEA 06) 20:51 08:14 (WEA 06) 20:56	05:12 21:37
7	08:30 16:34	09:59 (WEA 31) 07:56 10:25 (WEA 31) 17:25	07:00 18:15	07:50 (WEA 02) 06:50 08:20 (WEA 02) 20:08	07:49 (WEA 06) 20:49 08:14 (WEA 06) 20:57	05:11 21:38
8	08:30 16:35	09:59 (WEA 31) 07:54 10:25 (WEA 31) 17:27	06:58 18:17	07:50 (WEA 02) 06:48 08:19 (WEA 02) 20:09	07:48 (WEA 06) 20:47 08:14 (WEA 06) 20:59	05:11 21:39
9	08:29 16:37	10:00 (WEA 31) 07:52 10:26 (WEA 31) 17:29	06:55 18:19	07:49 (WEA 02) 06:45 08:18 (WEA 02) 20:11	07:48 (WEA 06) 20:45 08:14 (WEA 06) 21:00	05:10 21:40
10	08:29 16:38	10:00 (WEA 31) 07:51 10:26 (WEA 31) 17:30	06:53 18:20	07:50 (WEA 02) 06:43 08:17 (WEA 02) 20:13	07:48 (WEA 06) 20:44 08:14 (WEA 06) 21:02	05:10 21:41
11	08:28 16:39	10:00 (WEA 31) 07:49 10:26 (WEA 31) 17:32	06:51 18:22	07:51 (WEA 02) 06:41 08:16 (WEA 02) 20:14	07:47 (WEA 06) 20:42 08:14 (WEA 06) 21:03	05:09 21:41
12	08:27 16:41	10:01 (WEA 31) 07:47 10:26 (WEA 31) 17:34	06:49 18:24	07:51 (WEA 02) 06:39 08:14 (WEA 02) 20:16	07:46 (WEA 06) 20:40 08:13 (WEA 06) 21:05	05:09 21:42
13	08:27 16:42	10:02 (WEA 31) 07:45 10:27 (WEA 31) 17:36	06:47 18:26	07:53 (WEA 02) 06:37 08:12 (WEA 02) 20:18	07:47 (WEA 06) 20:39 08:12 (WEA 06) 21:07	05:09 21:43
14	08:26 16:44	10:02 (WEA 31) 07:43 10:27 (WEA 31) 17:38	06:44 18:27	07:55 (WEA 02) 06:35 08:10 (WEA 02) 20:19	07:47 (WEA 06) 20:37 08:12 (WEA 06) 21:08	05:09 21:43
15	08:25 16:45	10:03 (WEA 31) 07:41 10:27 (WEA 31) 17:40	06:42 18:29	08:00 (WEA 02) 06:32 08:05 (WEA 02) 20:21	07:47 (WEA 06) 20:36 08:11 (WEA 06) 21:10	05:09 21:44
16	08:24 16:47	10:03 (WEA 31) 07:39 10:27 (WEA 31) 17:41	06:40 18:31	08:00 (WEA 02) 06:30 07:48 (WEA 06) 20:34	08:11 (WEA 06) 21:10 07:48 (WEA 06) 20:34	05:08 21:44
17	08:24 16:48	10:04 (WEA 31) 07:37 10:27 (WEA 31) 17:43	06:38 18:32	08:00 (WEA 02) 06:28 07:05 (WEA 01) 20:24	08:09 (WEA 06) 21:11 07:49 (WEA 06) 20:33	05:08 21:45
18	08:23 16:50	10:05 (WEA 31) 07:36 10:27 (WEA 31) 17:45	06:35 18:34	08:00 (WEA 02) 06:26 07:07 (WEA 01) 20:26	08:08 (WEA 06) 21:13 07:50 (WEA 06) 20:31	05:08 21:45
19	08:22 16:52	10:05 (WEA 31) 07:34 10:26 (WEA 31) 17:47	06:33 18:36	08:00 (WEA 02) 06:24 07:07 (WEA 01) 20:28	08:06 (WEA 06) 21:14 07:53 (WEA 06) 20:30	05:08 21:46
20	08:21 16:53	10:06 (WEA 31) 07:32 10:26 (WEA 31) 17:49	06:31 18:37	08:00 (WEA 02) 06:22 07:08 (WEA 01) 20:29	08:04 (WEA 06) 21:16 07:51 (WEA 06) 20:32	05:08 21:46
21	08:20 16:55	10:07 (WEA 31) 07:30 10:26 (WEA 31) 17:50	06:28 18:39	08:00 (WEA 02) 06:20 07:09 (WEA 01) 20:31	08:04 (WEA 06) 21:17 07:51 (WEA 06) 20:33	05:08 21:46
22	08:19 16:57	10:09 (WEA 31) 07:28 10:25 (WEA 31) 17:52	06:26 18:41	08:00 (WEA 02) 06:18 07:09 (WEA 01) 20:33	08:04 (WEA 06) 21:18 07:51 (WEA 06) 20:34	05:09 21:47
23	08:17 16:58	10:11 (WEA 31) 07:26 10:24 (WEA 31) 17:54	06:24 18:43	08:00 (WEA 02) 06:15 07:08 (WEA 01) 20:34	08:04 (WEA 06) 21:19 07:51 (WEA 06) 20:35	05:09 21:47
24	08:16 17:00	10:13 (WEA 31) 07:23 10:22 (WEA 31) 17:56	06:22 18:44	08:00 (WEA 02) 06:13 07:08 (WEA 01) 20:36	08:04 (WEA 06) 21:20 07:51 (WEA 06) 20:36	05:09 21:47
25	08:15 17:02	10:15 (WEA 31) 07:21 10:22 (WEA 31) 17:58	06:20 18:46	08:00 (WEA 02) 06:11 07:09 (WEA 01) 20:38	08:04 (WEA 06) 21:21 07:51 (WEA 06) 20:37	05:09 21:48
26	08:14 17:03	10:17 (WEA 31) 07:19 10:24 (WEA 31) 17:59	06:18 18:48	08:00 (WEA 02) 06:09 07:06 (WEA 01) 20:39	08:04 (WEA 06) 21:22 07:51 (WEA 06) 20:38	05:09 21:49
27	08:12 17:05	10:19 (WEA 31) 07:17 10:25 (WEA 31) 18:01	06:16 18:50	08:00 (WEA 02) 06:07 07:06 (WEA 01) 20:41	08:04 (WEA 06) 21:23 07:51 (WEA 06) 20:39	05:09 21:50
28	08:11 17:07	10:21 (WEA 31) 07:15 10:26 (WEA 31) 18:03	06:14 18:52	08:00 (WEA 02) 06:05 07:06 (WEA 01) 20:43	08:04 (WEA 06) 21:24 07:51 (WEA 06) 20:40	05:09 21:51
29	08:10 17:09	10:23 (WEA 31) 07:13 10:27 (WEA 31) 18:05	06:12 18:54	08:00 (WEA 02) 06:03 07:06 (WEA 01) 20:45	08:04 (WEA 06) 21:25 07:51 (WEA 06) 20:41	05:09 21:52
30	08:08 17:11	10:25 (WEA 31) 07:11 10:28 (WEA 31) 18:07	06:10 18:56	08:00 (WEA 02) 06:01 07:06 (WEA 01) 20:47	08:04 (WEA 06) 21:26 07:51 (WEA 06) 20:42	05:09 21:53
31	08:07 17:12	10:27 (WEA 31) 07:09 10:29 (WEA 31) 18:09	06:08 18:58	08:00 (WEA 02) 05:59 07:06 (WEA 01) 20:49	08:04 (WEA 06) 21:27 07:51 (WEA 06) 20:43	05:09 21:54
Sonnenscheinstunden	261	279	367	415	483	496
astr. max. mögl. Beschattung	562	96	615	372	49	

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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Projekt:
216094-04 WP Brilon-MadfeldLizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender****Berechnung: Gesamtbelastung Schattenrezeptor: SR-15 - SR-15, Radlinghauser Str. 11, 59929 Brilon**
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:46 (WEA 06) 07:25	08:32 (WEA 02) 07:18	08:08
2	21:46	21:15	20:14	27 08:13 (WEA 06) 19:06	21 08:53 (WEA 02) 17:01	16:21 26 09:42 (WEA 31)
3	05:14	05:50	06:39	27 07:46 (WEA 06) 07:27	21 08:29 (WEA 02) 07:19	08:09 26 10:08 (WEA 31)
4	21:46	21:13	20:12	26 08:12 (WEA 06) 19:03	24 08:53 (WEA 02) 16:59	16:21 26 10:09 (WEA 31)
5	05:15	05:51	06:40	26 07:46 (WEA 06) 07:28	24 08:28 (WEA 02) 07:21	08:10 26 09:43 (WEA 31)
6	21:45	21:12	20:10	26 08:12 (WEA 06) 19:01	27 08:55 (WEA 02) 16:57	16:20 26 10:09 (WEA 31)
7	05:15	05:53	06:42	26 07:45 (WEA 06) 07:30	27 08:28 (WEA 02) 07:23	08:12 26 09:44 (WEA 31)
8	21:45	21:10	20:07	26 08:11 (WEA 06) 18:59	27 08:55 (WEA 02) 16:55	16:19 26 10:10 (WEA 31)
9	05:16	05:54	06:43	26 07:46 (WEA 06) 07:31	29 08:26 (WEA 02) 07:25	08:13 26 09:44 (WEA 31)
10	21:45	21:08	20:05	24 08:10 (WEA 06) 18:57	29 08:55 (WEA 02) 16:54	16:19 26 10:10 (WEA 31)
11	05:16	05:56	06:45	24 07:46 (WEA 06) 07:33	30 08:26 (WEA 02) 07:26	08:14 26 09:44 (WEA 31)
12	21:44	21:07	20:03	23 08:09 (WEA 06) 18:54	30 08:56 (WEA 02) 16:52	16:19 26 10:10 (WEA 31)
13	05:17	05:57	06:47	23 07:47 (WEA 06) 07:35	30 08:26 (WEA 02) 07:28	08:16 26 09:46 (WEA 31)
14	21:43	21:05	20:01	21 08:08 (WEA 06) 18:52	30 08:56 (WEA 02) 16:50	16:18 25 10:11 (WEA 31)
15	05:18	05:59	06:48	21 07:48 (WEA 06) 07:36	30 08:24 (WEA 02) 07:30	08:17 25 09:46 (WEA 31)
16	21:43	21:03	19:58	17 08:05 (WEA 06) 18:50	31 08:55 (WEA 02) 16:49	16:18 25 10:11 (WEA 31)
17	05:19	06:01	06:50	17 07:50 (WEA 06) 07:38	31 08:25 (WEA 02) 07:32	08:18 25 09:40 (WEA 28)
18	21:42	21:01	19:56	13 08:03 (WEA 06) 18:48	30 08:55 (WEA 02) 16:47	16:18 28 10:11 (WEA 31)
19	05:20	06:02	06:51	13 07:54 (WEA 06) 07:40	30 08:25 (WEA 02) 07:33	08:19 28 09:39 (WEA 28)
20	21:41	20:59	19:54	4 07:58 (WEA 06) 18:46	30 08:55 (WEA 02) 16:45	16:17 30 10:11 (WEA 31)
21	05:21	06:04	06:53	4 07:51 (WEA 06) 07:41	30 08:25 (WEA 02) 07:35	08:20 30 09:38 (WEA 28)
22	21:41	20:58	19:52	4 07:51 (WEA 06) 07:41	29 08:54 (WEA 12) 16:44	16:17 32 10:11 (WEA 31)
23	05:22	06:05	06:54	4 07:51 (WEA 06) 07:41	29 08:25 (WEA 02) 07:37	08:21 32 09:38 (WEA 28)
24	21:40	20:56	19:49	18 07:41 (WEA 06) 07:31	28 08:53 (WEA 12) 16:42	16:17 32 10:11 (WEA 31)
25	05:23	06:07	06:56	18 07:40 (WEA 06) 07:45	28 08:26 (WEA 02) 07:39	08:22 32 09:38 (WEA 28)
26	21:39	20:54	19:47	10 07:50 (WEA 01) 18:39	26 08:52 (WEA 12) 16:41	16:17 34 10:12 (WEA 31)
27	05:24	06:08	06:58	10 07:38 (WEA 01) 07:46	26 08:27 (WEA 02) 07:40	08:23 34 09:38 (WEA 28)
28	21:38	20:52	19:45	15 07:53 (WEA 01) 18:37	25 08:52 (WEA 12) 16:39	16:17 34 10:12 (WEA 31)
29	05:25	06:10	06:59	15 07:35 (WEA 01) 07:48	25 08:28 (WEA 02) 07:42	08:24 34 09:39 (WEA 28)
30	21:37	20:50	19:42	19 07:54 (WEA 01) 18:35	23 08:51 (WEA 12) 16:38	16:17 34 10:13 (WEA 31)
31	05:27	06:12	07:01	19 07:34 (WEA 01) 07:50	23 08:29 (WEA 02) 07:44	08:25 34 09:39 (WEA 28)
32	21:36	20:48	19:40	21 07:55 (WEA 01) 18:32	19 08:48 (WEA 12) 16:37	16:17 34 10:13 (WEA 31)
33	05:28	06:13	07:02	21 07:33 (WEA 01) 07:52	19 08:31 (WEA 02) 07:45	08:26 34 09:39 (WEA 28)
34	21:35	20:46	19:38	22 07:55 (WEA 01) 18:30	14 08:45 (WEA 12) 16:35	16:17 35 10:14 (WEA 31)
35	05:29	06:15	07:04	22 07:32 (WEA 01) 07:53	14 08:36 (WEA 02) 07:47	08:26 35 09:39 (WEA 28)
36	21:34	20:44	19:36	23 07:55 (WEA 01) 18:28	4 08:40 (WEA 02) 16:34	9 09:47 (WEA 31) 08:26 35 10:13 (WEA 31)
37	05:30	06:16	07:06	23 07:31 (WEA 01) 07:55	4 08:40 (WEA 02) 16:34	9 09:45 (WEA 31) 08:27 35 09:40 (WEA 28)
38	21:33	20:42	19:33	24 07:55 (WEA 01) 18:26	16:33 13 09:58 (WEA 31) 08:28 35 10:14 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:14 (WEA 31)
39	05:32	06:18	07:07	24 07:32 (WEA 01) 07:57	16:33 13 09:58 (WEA 31) 08:28 35 10:14 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:14 (WEA 31)
40	21:32	20:40	19:31	23 07:55 (WEA 01) 18:24	16:32 16 10:00 (WEA 31) 08:28 35 10:15 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:15 (WEA 31)
41	05:33	06:19	07:09	23 07:34 (WEA 01) 07:58	16:32 16 10:00 (WEA 31) 08:28 35 10:15 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:15 (WEA 31)
42	21:31	20:38	19:29	21 07:55 (WEA 01) 18:22	16:30 19 10:02 (WEA 31) 08:28 35 10:15 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:15 (WEA 31)
43	05:34	06:21	07:10	21 07:35 (WEA 01) 08:00	16:30 19 10:02 (WEA 31) 08:28 35 10:15 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:15 (WEA 31)
44	21:29	20:36	19:26	18 07:53 (WEA 01) 18:20	16:29 20 10:02 (WEA 31) 08:29 35 10:16 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:16 (WEA 31)
45	05:36	06:23	07:12	18 07:37 (WEA 01) 08:02	16:29 20 10:02 (WEA 31) 08:29 35 10:16 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:16 (WEA 31)
46	21:28	20:34	19:24	16 07:53 (WEA 01) 18:18	16:28 21 10:03 (WEA 31) 08:29 35 10:16 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:16 (WEA 31)
47	05:37	06:24	07:14	16 07:38 (WEA 01) 08:04	16:28 21 10:03 (WEA 31) 08:29 35 10:16 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:16 (WEA 31)
48	21:27	20:31	19:22	13 07:51 (WEA 01) 18:16	16:27 22 10:04 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
49	05:38	06:26	07:15	13 07:40 (WEA 01) 07:05	16:27 22 10:04 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
50	21:25	20:29	19:19	10 07:50 (WEA 01) 17:14	16:26 23 10:05 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
51	05:40	06:27	07:17	10 07:42 (WEA 01) 07:07	16:26 23 10:05 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
52	21:24	20:27	19:18	6 07:48 (WEA 01) 17:12	16:25 24 10:05 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
53	05:41	06:29	07:18	7 07:43 (WEA 01) 07:09	16:25 24 10:05 (WEA 31) 08:30 35 10:17 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:17 (WEA 31)
54	21:23	20:25	19:15	2 07:45 (WEA 01) 17:10	16:24 24 10:06 (WEA 31) 08:31 35 10:18 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:18 (WEA 31)
55	05:42	06:31	07:20	2 07:45 (WEA 01) 17:11	16:24 24 10:06 (WEA 31) 08:31 35 10:18 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:18 (WEA 31)
56	21:21	20:23	19:13	13 08:13 (WEA 06) 19:13	16:23 25 10:06 (WEA 31) 08:31 35 10:18 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:18 (WEA 31)
57	05:44	06:32	07:22	13 08:36 (WEA 02) 07:12	16:23 25 10:06 (WEA 31) 08:31 35 10:18 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:18 (WEA 31)
58	21:20	20:21	19:10	12 08:48 (WEA 02) 17:06	16:23 25 10:07 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
59	05:45	06:34	07:23	12 08:34 (WEA 02) 07:14	16:23 25 10:07 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
60	21:18	20:19	19:08	17 08:51 (WEA 02) 17:04	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
61	05:47	06:35	07:46 (WEA 06)	17:06	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
62	21:17	20:16	19:07	17 07:52 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
63	05:49	06:37	07:48 (WEA 06)	17:08	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
64	21:16	20:15	19:06	17 07:44 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
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70	21:13	20:12	19:03	17 07:02 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
71	05:53	06:41	07:52 (WEA 06)	17:16	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
72	21:12	20:11	19:02	17 06:48 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
73	05:54	06:42	07:53 (WEA 06)	17:18	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
74	21:11	20:10	19:01	17 06:34 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
75	05:55	06:43	07:54 (WEA 06)	17:20	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
76	21:10	20:09	19:00	17 06:20 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
77	05:56	06:44	07:55 (WEA 06)	17:22	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
78	21:09	20:08	18:59	17 06:06 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
79	05:57	06:45	07:56 (WEA 06)	17:24	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
80	21:08	20:07	18:58	17 05:52 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
81	05:58	06:46	07:57 (WEA 06)	17:26	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
82	21:07	20:06	18:57	17 05:38 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
83	05:59	06:47	07:58 (WEA 06)	17:28	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
84	21:06	20:05	18:56	17 05:24 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
85	06:00	06:48	07:59 (WEA 06)	17:30	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
86	21:05	20:04	18:55	17 05:10 (WEA 06)	16:22 25 10:08 (WEA 31) 08:31 35 10:19 (WEA 31)	9 09:45 (WEA 31) 08:27 35 10:19 (WEA 31)
87	06:01	06:49	07:59 (WEA 0			

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-16 - SR-16, Radlinghauser Str. 15, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:43 (WEA 35)	05:48		06:37	07:53 (WEA 06)	07:25	08:36 (WEA 02)	07:18		08:08	09:41 (WEA 31)
2	21:46	8 05:51 (WEA 35)	21:15		20:14	23 08:16 (WEA 06)	19:06	16 08:45 (WEA 02)	17:01		16:21	24 10:05 (WEA 31)
2	05:13	05:43 (WEA 35)	05:50		06:39	07:52 (WEA 06)	07:27	08:33 (WEA 02)	07:19		08:09	09:42 (WEA 31)
3	21:46	8 05:51 (WEA 35)	21:13		20:12	24 08:16 (WEA 06)	19:03	20 08:53 (WEA 02)	16:59		16:21	24 10:06 (WEA 31)
3	05:14	05:44 (WEA 35)	05:51		06:40	07:51 (WEA 06)	07:28	08:32 (WEA 02)	07:21		08:10	09:42 (WEA 31)
4	21:45	7 05:51 (WEA 35)	21:12		20:10	26 08:17 (WEA 06)	19:01	23 08:55 (WEA 02)	16:57		16:20	24 10:06 (WEA 31)
4	05:15	05:45 (WEA 35)	05:53		06:42	07:50 (WEA 06)	07:30	08:31 (WEA 02)	07:23		08:12	09:43 (WEA 31)
5	21:45	6 05:51 (WEA 35)	21:10		20:07	26 08:16 (WEA 06)	18:59	25 08:56 (WEA 02)	16:55		16:19	24 10:07 (WEA 31)
5	05:16	05:46 (WEA 35)	05:54		06:43	07:50 (WEA 06)	07:31	08:29 (WEA 02)	07:25		08:13	09:43 (WEA 31)
6	21:45	5 05:51 (WEA 35)	21:08		20:05	26 08:16 (WEA 06)	18:57	27 08:56 (WEA 02)	16:54		16:19	24 10:07 (WEA 31)
6	05:16	05:46 (WEA 35)	05:56		06:45	07:50 (WEA 06)	07:33	08:28 (WEA 02)	07:26		08:14	09:43 (WEA 31)
7	21:44	5 05:51 (WEA 35)	21:07		20:03	25 08:15 (WEA 06)	18:54	29 08:57 (WEA 02)	16:52		16:19	24 10:07 (WEA 31)
7	05:17	05:47 (WEA 35)	05:57		06:47	07:50 (WEA 06)	07:35	08:28 (WEA 02)	07:28		08:16	09:44 (WEA 31)
8	21:43	3 05:50 (WEA 35)	21:05		20:01	25 08:15 (WEA 06)	18:52	29 08:57 (WEA 02)	16:50		16:18	24 10:08 (WEA 31)
8	05:18	05:48 (WEA 35)	05:59		06:48	07:50 (WEA 06)	07:36	08:27 (WEA 02)	07:30		08:17	09:44 (WEA 31)
9	21:43	2 05:50 (WEA 35)	21:03		19:58	24 08:14 (WEA 06)	18:50	29 08:56 (WEA 02)	16:49		16:18	24 10:08 (WEA 31)
9	05:19	05:49 (WEA 35)	06:01		06:50	07:51 (WEA 06)	07:38	08:27 (WEA 02)	07:32		08:18	09:45 (WEA 31)
10	21:42	1 05:50 (WEA 35)	21:01		19:56	22 08:13 (WEA 06)	18:48	30 08:57 (WEA 02)	16:47		16:18	23 10:08 (WEA 31)
10	05:20	06:02	06:51		06:51	07:51 (WEA 06)	07:40	08:27 (WEA 02)	07:33		08:19	09:39 (WEA 28)
11	21:41	20:59	19:54		20 08:11 (WEA 06)	18:46	30 08:57 (WEA 02)	16:45	16:17	28 10:09 (WEA 31)		
11	05:21	06:04	06:53		07:52 (WEA 06)	07:41	08:27 (WEA 02)	07:35	08:20	09:38 (WEA 28)		
12	21:41	20:58	19:52		18 08:10 (WEA 06)	18:43	29 08:56 (WEA 12)	16:44	16:17	30 10:09 (WEA 31)		
12	05:22	06:05	06:54		07:53 (WEA 06)	07:43	08:26 (WEA 02)	07:37	08:21	09:38 (WEA 28)		
13	21:40	20:56	19:49		13 08:08 (WEA 06)	18:41	30 08:56 (WEA 12)	16:42	16:17	31 10:09 (WEA 31)		
13	05:23	06:07	06:56		07:58 (WEA 06)	07:45	08:27 (WEA 02)	07:39	08:22	09:38 (WEA 28)		
14	21:39	20:54	19:47		4 08:02 (WEA 06)	18:39	29 08:56 (WEA 12)	16:41	16:17	31 10:09 (WEA 31)		
14	05:24	06:08	06:58		07:45 (WEA 01)	07:46	08:28 (WEA 02)	07:40	08:23	09:38 (WEA 28)		
15	21:38	20:52	19:45		6 07:51 (WEA 01)	18:27	27 08:55 (WEA 12)	16:39	16:17	32 10:10 (WEA 31)		
15	05:25	06:10	06:59		07:41 (WEA 01)	07:48	08:29 (WEA 02)	07:42	08:24	09:38 (WEA 28)		
16	21:37	20:50	19:42		13 07:54 (WEA 01)	18:35	26 08:55 (WEA 12)	16:38	16:17	32 10:10 (WEA 31)		
16	05:27	06:12	07:01		07:39 (WEA 01)	07:50	08:29 (WEA 02)	07:44	08:25	09:39 (WEA 28)		
17	21:36	20:48	19:40		17 07:56 (WEA 01)	18:32	24 08:53 (WEA 12)	16:37	16:17	32 10:11 (WEA 31)		
17	05:28	06:13	07:02		07:37 (WEA 01)	07:52	08:31 (WEA 02)	07:45	08:26	09:39 (WEA 28)		
18	21:35	20:46	19:38		19 07:56 (WEA 01)	18:30	21 08:52 (WEA 12)	16:35	16:17	32 10:11 (WEA 31)		
18	05:29	06:15	07:04		07:36 (WEA 01)	07:53	08:33 (WEA 02)	07:47	08:26	09:39 (WEA 28)		
19	21:34	20:44	19:36		21 07:57 (WEA 01)	18:28	17 08:50 (WEA 12)	16:34	16:18	32 10:11 (WEA 31)		
19	05:30	06:16	07:06		07:34 (WEA 01)	07:55	08:38 (WEA 02)	07:49	08:27	09:39 (WEA 28)		
20	21:33	20:42	19:33		23 07:57 (WEA 01)	18:26	4 08:42 (WEA 02)	16:33	8 09:46 (WEA 31)	16:18	33 10:12 (WEA 31)	
20	05:32	06:18	07:07		07:34 (WEA 01)	07:57	07:51		09:44 (WEA 31)	08:28	09:40 (WEA 28)	
21	21:32	20:40	19:31		23 07:57 (WEA 01)	18:24	16:32	12 09:56 (WEA 31)	16:18	33 10:13 (WEA 31)		
21	05:33	06:19	07:09		07:34 (WEA 01)	07:58	07:52	09:43 (WEA 31)	08:28	09:40 (WEA 28)		
22	21:31	20:38	19:29		23 07:57 (WEA 01)	18:22	16:30	15 09:58 (WEA 31)	16:19	33 10:13 (WEA 31)		
22	05:34	06:21	07:10		07:35 (WEA 01)	08:00	07:54	09:41 (WEA 31)	08:29	09:41 (WEA 28)		
23	21:29	20:36	19:26		21 07:56 (WEA 01)	18:20	16:29	18 09:59 (WEA 31)	16:19	33 10:14 (WEA 31)		
23	05:36	06:23	07:12		07:37 (WEA 01)	08:02	07:55	09:41 (WEA 31)	08:29	09:41 (WEA 28)		
24	21:28	20:34	19:24		19 07:56 (WEA 01)	18:18	16:28	19 10:00 (WEA 31)	16:20	33 10:14 (WEA 31)		
24	05:37	06:24	07:14		07:38 (WEA 01)	08:04	07:57	09:41 (WEA 31)	08:30	09:42 (WEA 28)		
25	21:27	20:31	19:22		17 07:55 (WEA 01)	18:16	16:27	20 10:01 (WEA 31)	16:20	33 10:15 (WEA 31)		
25	05:38	06:26	07:15		07:40 (WEA 01)	07:05	07:59	09:41 (WEA 31)	08:30	09:42 (WEA 28)		
26	21:25	20:29	19:19		14 07:54 (WEA 01)	17:14	16:26	22 10:03 (WEA 31)	16:21	33 10:15 (WEA 31)		
26	05:40	06:27	07:17		07:42 (WEA 01)	07:07	08:00	09:40 (WEA 31)	08:30	09:43 (WEA 28)		
27	21:24	20:27	19:17		11 07:53 (WEA 01)	17:12	16:25	23 10:03 (WEA 31)	16:22	32 10:15 (WEA 31)		
27	05:41	06:29	07:18	08:03 (WEA 06)	07:43 (WEA 01)	07:09	08:02	09:41 (WEA 31)	08:31	09:43 (WEA 28)		
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29	05:44	06:32	07:22	07:57 (WEA 06)	07:22		17:12	08:05	09:41 (WEA 31)	08:31	09:45 (WEA 28)	
30	21:20	20:21	19:10	16 08:13 (WEA 06)	07:10		07:06	16:23	24 10:05 (WEA 31)	16:24	32 10:17 (WEA 31)	
30	05:45	06:34	07:23	07:53 (WEA 06)	07:23	08:40 (WEA 02)	07:14	08:06	09:41 (WEA 31)	08:31	09:45 (WEA 28)	
31	21:18	20:19	19:08	20 08:15 (WEA 06)	07:14	9 08:49 (WEA 02)	07:16	16:22	25 10:06 (WEA 31)	16:25	32 10:17 (WEA 31)	
31	05:47	06:35	07:25	07:55 (WEA 06)			07:14			08:31	09:46 (WEA 28)	
31	21:17	20:16	19:07	22 08:15 (WEA 06)			17:02			16:26	32 10:18 (WEA 31)	
Sonnenscheinstunden 499		452		381		332		268		246		
astr.max.mögl.Beschattung		45		76		522		465		233		

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung **Schattenrezeptor:** SR-17 - SR-17, Radlinghauser Str. 3, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	08:05 17:14	07:13 18:05	07:41 (WEA N03) 08:40 (WEA 02)	07:03 19:58	08:16 (WEA 06) 20:47	06:00 21:32
2	08:31 16:28	08:04 17:16	07:11 18:06	07:41 (WEA N03) 08:40 (WEA 02)	07:01 19:59	08:15 (WEA 06) 20:49	05:58 21:33
3	08:31 16:29	08:02 17:18	07:09 18:08	07:40 (WEA N03) 08:39 (WEA 02)	06:59 20:01	08:15 (WEA 06) 20:51	05:56 21:34
4	08:31 16:30	08:01 17:20	07:06 18:10	07:40 (WEA N03) 08:37 (WEA 02)	06:57 20:03	08:15 (WEA 06) 20:52	05:54 21:35
5	08:31 16:32	07:59 17:21	07:04 18:12	07:40 (WEA N03) 08:36 (WEA 02)	06:54 20:04	08:15 (WEA 06) 20:54	05:52 21:36
6	08:30 16:33	07:57 17:23	07:02 18:13	07:41 (WEA N03) 08:34 (WEA 02)	06:52 20:06	08:15 (WEA 06) 20:56	05:51 21:37
7	08:30 16:34	07:56 17:25	07:00 18:15	07:42 (WEA N03) 08:32 (WEA 02)	06:50 20:08	08:15 (WEA 06) 20:57	05:49 21:38
8	08:30 16:35	07:54 17:27	06:58 18:17	07:44 (WEA N03) 08:29 (WEA 02)	06:48 20:09	08:16 (WEA 06) 20:59	05:47 21:39
9	08:29 16:37	07:52 17:29	06:55 18:19		06:45 20:11	08:17 (WEA 06) 21:00	05:45 21:40
10	08:29 16:38	07:51 17:30	06:53 18:20		06:43 20:13	08:18 (WEA 06) 21:02	05:44 21:41
11	08:28 16:39	07:49 17:32	06:51 18:22		06:41 20:14	08:20 (WEA 06) 21:03	05:42 21:41
12	08:27 16:41	07:47 17:34	06:49 18:24		06:39 20:16	08:23 (WEA 06) 21:05	05:40 21:42
13	08:27 16:42	07:45 17:36	06:47 18:26		06:37 20:18		05:39 21:43
14	08:26 16:44	07:43 17:38	06:44 18:27		06:35 20:19		05:37 21:43
15	08:25 16:45	07:41 17:40	06:42 18:29		06:32 20:21		05:36 21:44
16	08:24 16:47	07:39 17:41	06:40 18:31		06:30 20:23		05:34 21:44
17	08:24 16:48	07:37 17:43	06:38 18:32		06:28 20:24		05:33 21:45
18	08:23 16:50	07:36 17:45	06:35 18:34		06:26 20:26		05:31 21:45
19	08:22 16:52	07:34 17:47	06:33 18:36		06:24 20:28		05:30 21:46
20	08:21 16:53	07:32 17:49	06:31 18:37		06:22 20:29		05:29 21:46
21	08:20 16:55	07:30 17:50	06:28 18:39		06:20 20:31		05:27 21:46
22	08:19 16:57	07:28 17:52	06:26 18:41		06:18 20:33		05:26 21:46
23	08:17 16:58	07:25 17:54	06:24 18:43		06:15 20:34		05:25 21:47
24	08:16 17:00	07:23 17:56	06:22 18:44		06:13 20:36		05:24 21:47
25	08:15 17:02	07:21 17:58	06:19 18:46		06:11 20:38		05:22 21:47
26	08:14 17:03	07:19 17:59	06:17 18:48		06:09 20:39		05:21 21:47
27	08:12 17:05	07:17 18:01	06:15 18:49		06:07 20:41		05:20 21:47
28	08:11 17:07	07:15 18:03	06:12 18:51		06:05 20:43		05:19 21:47
29	08:10 17:09		07:10 19:53		06:04 20:44		05:18 21:46
30	08:08 17:10		07:08 19:54		06:02 20:46		05:17 21:46
31	08:07 17:12		07:06 19:56		06:00 20:46		05:16 21:31
Sonnenscheinstunden	261	279	367	415	483	496	
astr.max.mögl.Beschattung		624	787	297		17	

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: SR-17 - SR-17, Radlinghauser Str. 3, 59929 Brilon
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	08:19 (WEA 06) 07:25	07:50 (WEA 01) 07:18	08:08
2	21:46	21:15	20:14	08:34 (WEA 06) 19:06	08:00 (WEA 01) 17:01	16:21
3	05:13	05:50	06:39	08:16 (WEA 06) 07:27	07:51 (WEA 01) 07:19	08:09
4	21:46	21:13	20:12	08:36 (WEA 06) 19:03	07:57 (WEA 01) 16:59	16:21
5	05:14	05:51	06:40	08:15 (WEA 06) 07:28	07:53 (WEA 01) 07:21	08:10
6	21:45	21:12	20:10	08:37 (WEA 06) 19:01	07:54 (WEA 01) 16:57	16:20
7	05:15	05:53	06:42	08:13 (WEA 06) 07:30	07:23	08:12
8	21:45	21:10	20:07	08:38 (WEA 06) 18:59	16:55	16:19
9	05:16	05:54	06:43	08:12 (WEA 06) 07:31	08:22 (WEA N03) 07:25	08:13
10	21:45	21:08	20:05	08:39 (WEA 06) 18:57	09:01 (WEA 02) 16:54	16:19
11	05:16	05:56	06:45	08:10 (WEA 06) 07:33	08:19 (WEA N03) 07:26	08:14
12	21:44	21:07	20:03	08:39 (WEA 06) 18:54	09:07 (WEA 02) 16:52	16:19
13	05:17	05:57	06:47	08:10 (WEA 06) 07:35	08:17 (WEA N03) 07:28	08:16
14	21:43	21:05	20:01	08:40 (WEA 06) 18:52	09:09 (WEA 02) 16:50	16:18
15	05:18	05:59	06:48	08:09 (WEA 06) 07:36	08:15 (WEA N03) 07:30	08:17
16	21:43	21:03	19:58	08:39 (WEA 06) 18:50	09:10 (WEA 02) 16:49	16:18
17	05:19	06:01	06:50	08:09 (WEA 06) 07:38	08:15 (WEA N03) 07:32	08:18
18	21:42	21:01	19:56	08:40 (WEA 06) 18:48	09:11 (WEA 02) 16:47	16:18
19	05:20	06:02	06:51	08:08 (WEA 06) 07:40	08:15 (WEA N03) 07:33	08:19
20	21:41	20:59	19:54	08:39 (WEA 06) 18:45	09:13 (WEA 02) 16:45	16:17
21	05:21	06:04	06:53	08:08 (WEA 06) 07:41	08:15 (WEA N03) 07:35	08:20
22	21:41	20:58	19:52	08:39 (WEA 06) 18:43	09:13 (WEA 02) 16:44	16:17
23	05:22	06:05	06:54	08:08 (WEA 06) 07:43	08:14 (WEA N03) 07:37	08:21
24	21:40	20:56	19:49	08:39 (WEA 06) 18:41	09:13 (WEA 02) 16:42	16:17
25	05:23	06:07	06:56	08:08 (WEA 06) 07:45	08:14 (WEA N03) 07:39	08:22
26	21:39	20:54	19:47	08:37 (WEA 06) 18:39	09:14 (WEA 02) 16:41	16:17
27	05:24	06:08	06:58	08:09 (WEA 06) 07:46	08:15 (WEA N03) 07:40	08:23
28	21:38	20:52	19:45	08:37 (WEA 06) 18:37	09:14 (WEA 02) 16:39	16:17
29	05:25	06:10	06:59	08:08 (WEA 06) 07:48	08:16 (WEA N03) 07:42	08:24
30	21:37	20:50	19:42	08:35 (WEA 06) 18:35	09:14 (WEA 02) 16:38	16:17
31	05:27	06:12	07:01	08:10 (WEA 06) 07:50	08:18 (WEA N03) 07:44	08:25
1	21:36	20:48	19:40	08:34 (WEA 06) 18:32	09:18 (WEA 12) 16:37	16:17
2	05:28	06:13	07:02	07:53 (WEA 01) 07:52	08:41 (WEA 02) 07:45	08:26
3	21:35	20:46	19:38	08:32 (WEA 06) 18:30	09:20 (WEA 12) 16:35	16:17
4	05:29	06:15	07:04	07:49 (WEA 01) 07:53	08:41 (WEA 02) 07:47	08:26
5	21:34	20:44	19:35	08:30 (WEA 06) 18:28	09:22 (WEA 12) 16:34	16:18
6	05:30	06:16	07:06	07:46 (WEA 01) 07:55	08:41 (WEA 02) 07:49	08:27
7	21:33	20:42	19:33	08:27 (WEA 06) 18:26	09:23 (WEA 12) 16:33	16:18
8	05:32	06:18	07:07	07:44 (WEA 01) 07:57	08:42 (WEA 02) 07:51	08:28
9	21:32	20:40	19:31	08:04 (WEA 01) 18:24	09:24 (WEA 12) 16:32	16:18
10	05:33	06:19	07:09	07:43 (WEA 01) 07:58	08:42 (WEA 02) 07:52	08:28
11	21:31	20:38	19:29	08:06 (WEA 01) 18:22	09:24 (WEA 12) 16:30	16:19
12	05:34	06:21	07:10	07:42 (WEA 01) 08:00	08:43 (WEA 02) 07:54	08:29
13	21:29	20:36	19:26	08:05 (WEA 01) 18:20	09:24 (WEA 12) 16:29	16:19
14	05:35	06:23	07:12	07:41 (WEA 01) 08:02	08:44 (WEA 02) 07:55	08:29
15	21:28	20:34	19:24	08:06 (WEA 01) 18:18	09:24 (WEA 12) 16:28	16:20
16	05:37	06:24	07:14	07:40 (WEA 01) 08:04	08:45 (WEA 02) 07:57	08:30
17	21:27	20:31	19:22	08:05 (WEA 01) 18:16	09:24 (WEA 12) 16:27	16:20
18	05:38	06:26	07:15	07:40 (WEA 01) 07:05	07:47 (WEA 02) 07:59	08:30
19	21:25	20:29	19:19	08:06 (WEA 01) 17:14	08:24 (WEA 12) 16:26	16:21
20	05:40	06:27	07:17	07:42 (WEA 01) 07:07	07:50 (WEA 02) 08:00	08:30
21	21:24	20:27	19:17	08:05 (WEA 01) 17:12	08:24 (WEA 12) 16:25	16:22
22	05:41	06:29	07:18	07:43 (WEA 01) 07:09	08:03 (WEA 12) 08:02	08:31
23	21:23	20:25	19:15	08:04 (WEA 01) 17:10	08:23 (WEA 12) 16:24	16:22
24	05:42	06:31	07:20	07:45 (WEA 01) 07:11	08:03 (WEA 12) 08:03	08:31
25	21:21	20:23	19:13	08:04 (WEA 01) 17:08	08:21 (WEA 12) 16:23	16:23
26	05:44	06:32	07:22	07:46 (WEA 01) 07:12	08:04 (WEA 12) 08:05	08:31
27	21:20	20:21	19:10	08:02 (WEA 01) 17:06	08:20 (WEA 12) 16:23	16:24
28	05:45	06:34	07:23	07:48 (WEA 01) 07:14	08:05 (WEA 12) 08:06	08:31
29	21:18	20:18	19:08	08:01 (WEA 01) 17:04	08:19 (WEA 12) 16:22	16:25
30	05:47	06:35	08:22 (WEA 06)	07:16	08:08 (WEA 12)	08:31
31	21:17	20:16	08:30 (WEA 06)	17:02	08:17 (WEA 12)	16:26
Sonnenscheinstunden	499	452	381	332	268	246
astr.max.mögl.Beschattung		8	752	965		194

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	(WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattende	(WEA mit letztem Schatten)
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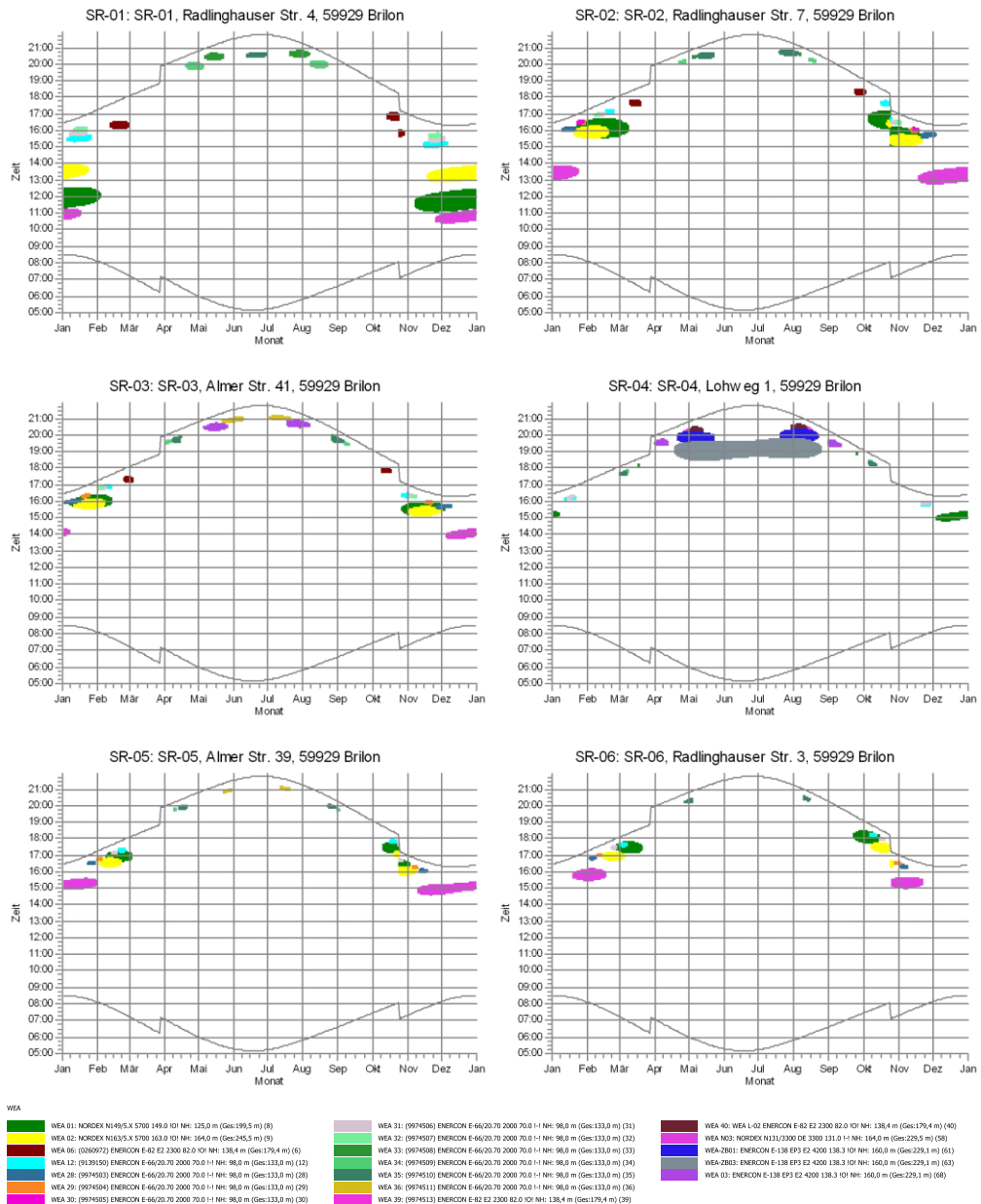
Anlage A4: SHADOW-Grafischer Kalender mit Darstellung der Schattenzeiten je Immissionsort durch die einzelnen WEA über das ganze Jahr

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung

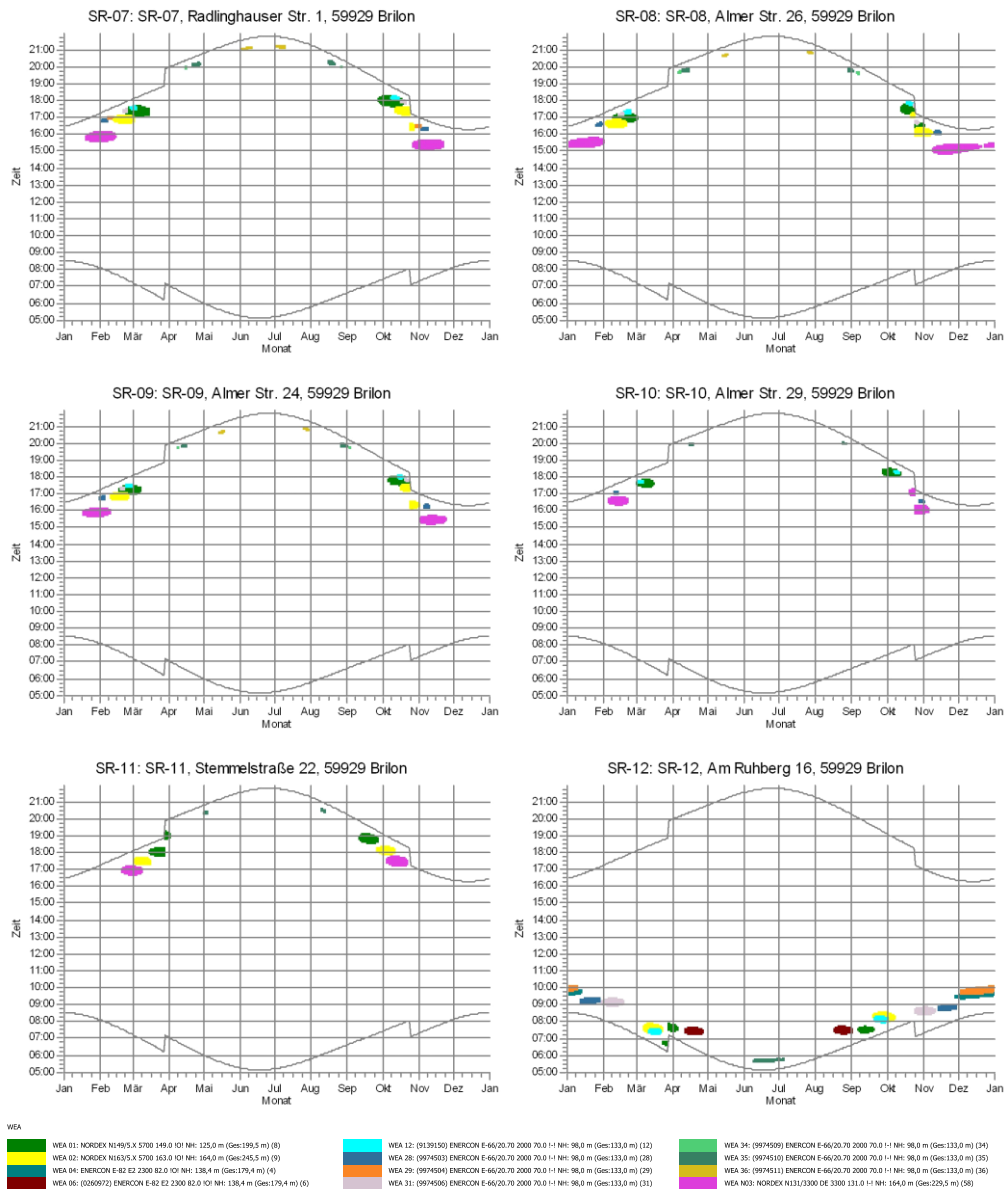


Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung

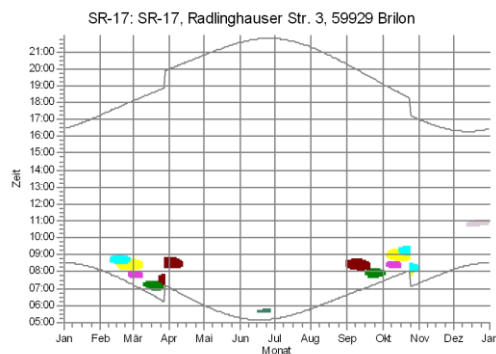
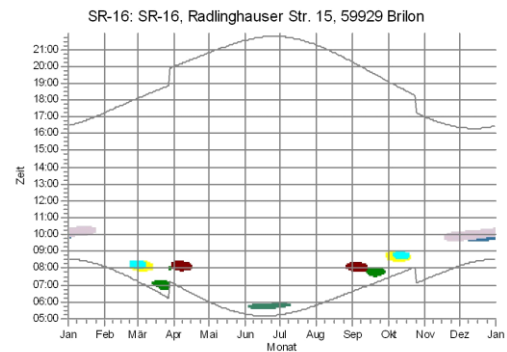
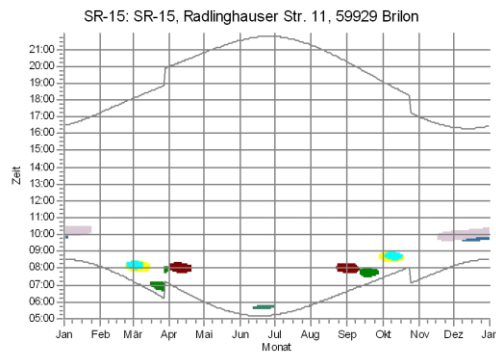
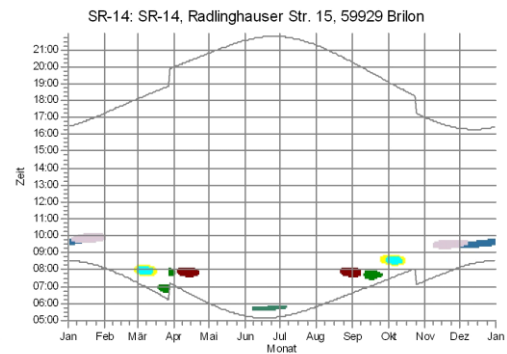
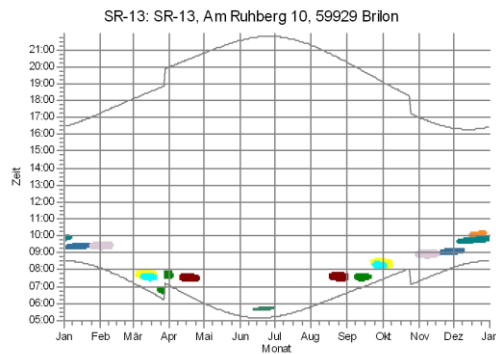


Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA 01: NORDEX N149/5 X 5700 149,0 101 NH: 125,0 m (Ges:199,5 m) (8)	WEA 12: (9139150) ENERCON E-66/20.70 2000 70,0 1-1 NH: 98,0 m (Ges:133,0 m) (12)	WEA 35: (9974510) ENERCON E-66/20.70 2000 70,0 1-1 NH: 98,0 m (Ges:133,0 m) (35)
WEA 02: NORDEX N149/5 X 5700 149,0 101 NH: 125,0 m (Ges:199,5 m) (9)	WEA 26: (9974503) ENERCON E-66/20.70 2000 70,0 1-1 NH: 98,0 m (Ges:133,0 m) (26)	WEA 103: NORDEX N131/3300 DE 3300 131,0 1-1 NH: 164,0 m (Ges:229,5 m) (58)
WEA 04: ENERCON E-62 E2 2300 82,0 101 NH: 138,4 m (Ges:179,4 m) (4)	WEA 29: (9974504) ENERCON E-66/20.70 2000 70,0 1-1 NH: 98,0 m (Ges:133,0 m) (29)	
WEA 06: (0260972) ENERCON E-82 E2 2300 82,0 101 NH: 138,4 m (Ges:179,4 m) (6)	WEA 31: (9974506) ENERCON E-66/20.70 2000 70,0 1-1 NH: 98,0 m (Ges:133,0 m) (31)	

Anlage A5: SHADOW-Kalender pro WEA mit Darstellung der Beschattungszeiten je WEA über das ganze Jahr

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 01 - NORDEX N149/5.X 5700 149.0 !O! NH: 125,0 m (Ges:199,5 m) (8)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 15:03-15:19/16 16:27 11:21-12:27/66	08:05 15:41-16:30/49 17:14 11:50-12:17/27	07:13 16:45-17:39/54 18:05 15:44-16:32/48	07:03 07:28-07:53/25 19:58 18:56-19:04/8	06:00 20:47 21:32	05:15 21:32
2	08:31 15:04-15:19/15 16:28 11:22-12:28/66	08:04 15:41-16:31/50 17:16 11:53-12:14/21	07:11 16:47-17:41/54 18:06 15:45-16:30/45	07:01 07:29-07:49/20 19:59 20:49	05:58 05:15 21:33	05:14 21:34
3	08:31 15:04-15:18/14 16:29 11:21-12:27/66	08:02 15:42-16:33/51 17:18 12:00-12:08/8	07:09 16:50-17:43/53 18:08 15:47-16:29/42	06:59 07:29-07:46/17 20:01 20:51	05:56 05:14 21:34	05:14 21:34
4	08:31 15:06-15:18/12 16:30 11:22-12:28/66	08:01 15:41-16:33/52 17:19 17:21	07:06 17:01-17:44/43 18:10 15:48-16:26/38	06:57 07:30-07:43/13 20:03 20:52	05:54 05:13 21:35	05:13 21:35
5	08:31 15:07-15:18/11 16:31 11:23-12:29/66	07:59 15:41-16:34/53 17:21 17:21	07:04 17:03-17:46/43 18:12 15:50-16:24/34	06:54 07:34-07:38/4 20:04 20:54	05:52 05:12 21:36	05:12 21:36
6	08:30 15:09-15:17/8 16:33 11:23-12:29/66	07:57 15:40-16:35/55 17:23 17:23	07:02 17:05-17:48/43 18:13 15:53-16:22/29	06:52 20:06 20:55	05:50 05:12 21:37	05:12 21:37
7	08:30 15:12-15:16/4 16:34 11:24-12:29/65	07:56 15:40-16:36/56 17:25 17:25	07:00 17:06-17:50/44 18:15 15:56-16:19/23	06:50 20:08 20:57	05:49 05:11 21:38	05:11 21:38
8	08:30 15:49-15:56/7 16:35 11:24-12:29/65	07:54 15:39-16:37/58 17:27 17:27	06:58 17:06-17:49/43 18:17 16:01-16:13/12	06:48 20:09 20:59	05:47 05:11 21:39	05:11 21:39
9	08:29 15:48-16:00/12 16:37 11:25-12:30/65	07:52 16:53-17:00/7 17:29 15:39-16:37/58	06:55 17:06-17:49/43 18:19 18:19	06:45 20:11 21:00	05:45 05:10 21:40	05:10 21:40
10	08:29 15:46-16:01/15 16:38 11:26-12:30/64	07:50 16:49-17:02/13 17:30 15:38-16:37/59	06:53 17:07-17:49/42 18:20 18:20	06:43 20:13 21:02	05:44 05:10 21:41	05:10 21:41
11	08:28 15:45-16:03/18 16:39 11:26-12:30/64	07:49 16:47-17:04/17 17:32 15:38-16:38/60	06:51 07:14-07:18/4 18:22 17:08-17:49/41	06:41 20:14 21:03	05:42 05:09 21:41	05:09 21:41
12	08:27 15:44-16:04/20 16:41 11:26-12:30/64	07:47 16:45-17:06/21 17:34 15:38-16:38/60	06:49 07:11-07:19/8 18:24 17:08-17:47/39	06:39 20:16 21:05	05:40 05:09 21:42	05:09 21:42
13	08:27 15:43-16:06/23 16:42 11:28-12:31/63	07:45 16:44-17:08/24 17:36 15:37-16:38/61	06:46 07:09-07:21/12 18:26 17:10-17:46/36	06:37 20:18 21:07	05:39 05:09 21:43	05:09 21:43
14	08:26 15:43-16:08/25 16:44 11:28-12:31/63	07:43 16:42-17:10/28 17:38 15:37-16:38/61	06:44 07:07-07:22/15 18:27 17:12-17:45/33	06:34 20:19 21:08	05:37 05:08 21:43	05:08 21:43
15	08:25 15:43-16:09/26 16:45 11:29-12:31/62	07:41 16:42-17:12/30 17:40 15:37-16:38/61	06:42 07:05-07:23/18 18:29 17:12-17:42/30	06:32 20:21 21:10	05:36 05:08 21:44	05:08 21:44
16	08:24 15:42-16:10/28 16:47 11:29-12:31/62	07:39 16:41-17:12/31 17:41 15:37-16:38/61	06:40 07:02-07:22/20 17:13-17:41/28 18:31 17:59-18:05/6	06:30 20:23 21:11	05:34 05:08 21:44	05:08 21:44
17	08:24 15:42-16:11/29 16:48 11:30-12:31/61	07:37 16:40-17:13/33 17:43 15:37-16:38/61	06:37 07:00-07:23/23 17:14-17:40/26 18:32 17:56-18:07/11	06:28 20:24 21:13	05:33 05:08 21:45	05:08 21:45
18	08:23 15:41-16:12/31 16:50 11:31-12:31/60	07:35 16:40-17:17/37 17:45 15:37-16:38/61	06:35 06:58-07:23/25 17:15-17:39/24 18:34 17:55-18:09/14	06:26 20:26 21:14	05:31 05:08 21:45	05:08 21:45
19	08:22 15:40-16:13/33 16:52 11:31-12:30/59	07:33 16:40-17:19/39 17:47 15:37-16:38/61	06:33 06:55-07:22/27 17:17-17:36/19 18:36 17:52-18:10/18	06:24 20:28 21:15	05:30 05:08 21:46	05:08 21:46
20	08:21 15:40-16:14/34 16:53 11:32-12:30/58	07:31 16:40-17:21/41 17:49 15:38-16:38/60	06:31 06:53-07:22/29 17:20-17:33/13 18:37 17:51-18:12/21	06:22 20:29 21:17	05:28 05:08 21:46	05:08 21:46
21	08:20 15:40-16:15/35 16:55 11:33-12:30/57	07:29 16:40-17:23/43 17:50 15:38-16:38/60	06:28 06:51-07:21/30 18:39 17:51-18:14/23	06:20 20:31 21:18	05:27 05:09 21:46	05:09 21:46
22	08:18 15:40-16:16/36 16:57 11:34-12:30/56	07:27 16:40-17:25/45 17:52 15:38-16:37/59	06:26 06:49-07:20/31 18:41 17:49-18:15/26	06:17 20:33 21:20	05:26 05:09 21:46	05:09 21:46
23	08:17 15:39-16:16/37 16:58 11:34-12:29/55	07:25 16:40-17:27/47 17:54 15:39-16:37/58	06:24 06:46-07:18/32 18:42 17:49-18:15/26	06:15 20:34 21:21	05:25 05:09 21:47	05:09 21:47
24	08:16 15:40-16:17/37 17:00 11:36-12:28/52	07:23 16:40-17:30/50 17:56 15:40-16:37/57	06:22 06:44-07:17/33 18:44 17:49-18:15/26	06:13 20:36 21:22	05:23 05:09 21:47	05:09 21:47
25	08:15 15:40-16:18/38 17:02 11:37-12:28/51	07:21 16:41-17:32/51 17:58 15:40-16:36/56	06:19 06:42-07:15/33 18:46 17:49-18:15/26	06:11 20:37 21:24	05:22 05:10 21:47	05:10 21:47
26	08:14 15:39-16:20/41 17:03 11:38-12:27/49	07:19 16:42-17:34/52 17:59 15:41-16:35/54	06:17 06:39-07:10/31 18:47 17:48-18:14/26	06:09 20:39 21:25	05:21 05:10 21:47	05:10 21:47
27	08:12 15:40-16:23/43 17:05 11:40-12:26/46	07:17 16:42-17:35/53 18:01 15:41-16:34/53	06:15 06:37-07:06/29 18:49 17:49-18:13/24	06:07 20:41 21:26	05:20 05:10 21:47	05:10 21:47
28	08:11 15:39-16:24/45 17:07 11:41-12:25/44	07:15 16:43-17:37/54 18:03 15:42-16:33/51	06:12 06:35-07:05/30 18:51 17:49-18:13/24	06:05 20:42 21:28	05:19 05:11 21:47	05:11 21:47
29	08:10 15:40-16:26/46 17:09 11:43-12:24/41	17:09 11:43-12:24/41	07:10 07:33-08:03/30 19:53 18:49-19:11/22	06:03 20:44 21:29	05:18 05:11 21:46	05:11 21:46
30	08:08 15:40-16:27/47 17:10 11:45-12:22/37	17:10 11:45-12:22/37	07:08 07:30-08:00/30 19:54 18:51-19:09/18	06:02 20:46 21:30	05:17 05:12 21:46	05:12 21:46
31	08:07 15:41-16:29/48 17:12 11:47-12:20/33	17:12 11:47-12:20/33	07:06 07:28-07:56/28 19:56 18:53-19:07/14	20:46 21:31 21:31	05:16 05:11 21:31	05:11 21:31
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	2626	2368	1865	87	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 01 - NORDEX N149/5.X 5700 149.0 !O! NH: 125,0 m (Ges:199,5 m) (8)

Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:25 07:50-08:00/10	07:17 16:19-16:31/12	08:08 15:27-15:45/18
2	21:46	21:15	20:14	19:06 17:49-18:26/37	17:01 15:08-16:07/59	16:21 11:08-12:12/64
3	05:13	05:50	06:38	07:26 07:51-07:57/6	07:19 16:24-16:29/5	08:09 15:29-15:45/16
4	21:46	21:13	20:12	19:03 17:46-18:26/40	16:59 15:09-16:07/58	16:21 11:09-12:13/64
5	05:14	05:51	06:40	07:28 07:53-07:54/1	07:21 15:09-16:06/57	08:10 15:31-15:43/12
6	21:45	21:12	20:10	19:01 17:45-18:27/42	16:57	16:20 11:08-12:13/65
7	05:15	05:53	06:42	07:30 17:44-18:27/43	07:23 15:10-16:06/56	08:12 15:33-15:40/7
8	21:45	21:10	20:07	18:59	16:55	16:19 11:09-12:14/65
9	05:15	05:54	06:43	07:31 17:43-18:26/43	07:25 15:11-16:05/54	08:13 14:57-15:00/3
10	21:44	21:08	20:05	18:57	16:53	16:19 11:09-12:15/66
11	05:16	05:56	06:45	07:33 17:42-18:26/44	07:26 15:10-16:04/54	08:14 14:55-15:03/8
12	21:44	21:07	20:03	18:54 16:34-16:53/19	16:52	16:18 11:09-12:15/66
13	05:17	05:57	06:46 07:30-07:33/3	07:35 17:42-18:25/43	07:28 15:11-16:03/52	08:15 14:54-15:04/10
14	21:43	21:05	20:01	18:52 16:30-16:57/27	16:50	16:18 11:10-12:16/66
15	05:18	05:59	06:48 07:25-07:37/12	07:36 17:39-18:22/43	07:30 15:12-16:02/50	08:17 14:54-15:06/12
16	21:43	21:03	19:58	18:50 16:26-16:58/32	16:48 11:29-11:39/10	16:18 11:10-12:16/66
17	05:19	06:00	06:50 07:23-07:40/17	07:38 17:37-18:20/43	07:32 15:12-16:02/50	08:18 14:53-15:07/14
18	21:42	21:01	19:56	18:48 16:24-17:00/36	16:47 11:23-11:45/22	16:17 11:10-12:16/66
19	05:20	06:02	06:51 07:22-07:42/20	07:40 17:36-18:18/42	07:33 15:12-16:01/49	08:19 14:53-15:08/15
20	21:41	20:59	19:54	18:45 16:22-17:02/40	16:45 11:20-11:48/28	16:17 11:11-12:17/66
21	05:21	06:04	06:53 07:20-07:44/24	07:41 17:23-18:16/53	07:35 15:12-16:00/48	08:20 14:53-15:09/16
22	21:41	20:57	19:51 18:49-18:55/6	18:43 16:20-17:04/44	16:44 11:18-11:51/33	16:17 11:11-12:17/66
23	05:22	06:05	06:54 07:20-07:48/28	07:43 17:19-18:13/54	07:37 15:12-15:59/47	08:21 14:53-15:10/17
24	21:40	20:56	19:49 18:44-18:58/14	18:41 16:18-17:04/46	16:42 11:16-11:54/38	16:17 11:11-12:18/67
25	05:23	06:07	06:56 07:21-07:50/29	07:45 17:17-18:11/54	07:39 15:12-15:58/46	08:22 14:53-15:11/18
26	21:39	20:54	19:47 18:42-19:00/18	18:39 16:16-17:05/49	16:41 11:15-11:56/41	16:17 11:12-12:18/66
27	05:24	06:08	06:58 07:23-07:53/30	07:46 17:16-18:09/53	07:40 15:12-15:57/45	08:23 14:53-15:11/18
28	21:38	20:52	19:45 18:41-19:02/21	18:37 16:15-17:06/51	16:39 11:14-11:57/43	16:17 11:12-12:19/67
29	05:25	06:10	06:59 07:24-07:54/30	07:48 17:15-18:07/52	07:42 15:13-15:55/42	08:24 14:53-15:12/19
30	21:37	20:50	19:42 18:39-19:02/23	18:35 16:14-17:07/53	16:38 11:13-11:59/46	16:17 11:13-12:19/66
31	05:27	06:11	07:01 07:26-07:56/30	07:50 17:13-18:04/51	07:44 15:12-15:53/41	08:25 14:54-15:13/19
32	21:36	20:48	19:40 18:38-19:03/25	18:32 16:12-17:07/55	16:37 11:11-12:00/49	16:17 11:13-12:20/67
33	05:28	06:13	07:02 07:27-07:57/30	07:51 17:12-18:02/50	07:45 15:13-15:51/38	08:26 14:54-15:14/20
34	21:35	20:46	19:38 18:37-19:02/25	18:30 16:11-17:07/56	16:35 11:10-12:01/51	16:17 11:14-12:20/66
35	05:29	06:15	07:04 07:29-08:02/33	07:53 17:12-18:00/48	07:47 15:14-15:51/37	08:26 14:54-15:14/20
36	21:34	20:44	19:35 18:36-19:03/27	18:28 16:11-17:08/57	16:34 11:10-12:02/52	16:18 11:14-12:20/66
37	05:30	06:16	07:05 07:30-08:03/33	07:55 17:11-17:58/47	07:49 15:14-15:51/37	08:27 14:54-15:15/21
38	21:33	20:42	19:33 18:35-19:02/27	18:26 16:10-17:09/59	16:33 11:09-12:04/55	16:18 11:15-12:21/66
39	05:31	06:18	07:07 07:32-08:04/32	07:57 17:10-17:55/45	07:50 15:15-15:51/36	08:28 14:55-15:16/21
40	21:32	20:40	19:31 18:35-19:02/27	18:24 16:10-17:09/59	16:31 11:09-12:05/56	16:18 11:15-12:22/67
41	05:33	06:19	07:09 07:34-08:06/32	07:58 17:10-17:53/43	07:52 15:15-15:50/35	08:28 14:55-15:16/21
42	21:31	20:38	19:29 18:35-19:01/26	18:22 16:08-17:08/60	16:30 11:09-12:06/57	16:19 11:15-12:22/67
43	05:34	06:21	07:10 07:35-08:05/30	08:00 17:10-17:51/41	07:54 15:16-15:50/34	08:29 14:56-15:17/21
44	21:29	20:36	19:26 18:35-18:59/24	18:20 16:08-17:09/61	16:29 11:08-12:06/58	16:19 11:16-12:23/67
45	05:35	06:23	07:12 07:37-08:06/29 18:06-18:16/10	08:02 17:10-17:49/39	07:55 15:17-15:50/33	08:29 14:56-15:17/21
46	21:28	20:33	19:24 18:36-18:57/21	18:18 16:08-17:09/61	16:28 11:08-12:07/59	16:20 11:16-12:23/67
47	05:37	06:24	07:13 07:38-08:05/27 18:01-18:18/17	08:03 17:10-17:47/37	07:57 15:19-15:50/31	08:30 14:56-15:17/21
48	21:27	20:31	19:22 18:36-18:54/18	18:16 16:07-17:09/62	16:27 11:08-12:08/60	16:20 11:16-12:23/67
49	05:38	06:26	07:15 07:40-08:06/26 17:59-18:21/22	07:05 16:11-16:43/32	07:59 15:19-15:48/29	08:30 14:58-15:18/20
50	21:25	20:29	19:19 18:37-18:53/16	17:14 15:07-16:09/62	16:26 11:07-12:08/61	16:21 11:18-12:24/66
51	05:40	06:27	07:17 07:42-08:05/23 17:56-18:21/25	07:07 16:12-16:43/31	08:00 15:20-15:48/28	08:30 14:58-15:18/20
52	21:24	20:27	19:17 18:37-18:50/13	17:12 15:07-16:09/62	16:25 11:08-12:09/61	16:22 11:18-12:24/66
53	05:41	06:29	07:18 07:43-08:04/21 17:55-18:23/28	07:09 16:11-16:41/30	08:02 15:22-15:48/26	08:31 14:58-15:18/20
54	21:23	20:25	19:15 18:40-18:48/8	17:10 15:06-16:08/62	16:24 11:08-12:10/62	16:22 11:18-12:25/67
55	05:42	06:31	07:20 07:45-08:04/19	07:10 16:12-16:39/27	08:03 15:22-15:47/25	08:31 14:59-15:18/19
56	21:21	20:23	19:12 17:54-18:24/30	17:08 15:07-16:08/61	16:23 11:07-12:10/63	16:23 11:19-12:25/66
57	05:44	06:32	07:22 07:46-08:02/16	07:12 16:13-16:37/24	08:05 15:24-15:47/23	08:31 15:00-15:18/18
58	21:20	20:21	19:10 17:52-18:24/32	17:06 15:07-16:08/61	16:23 11:08-12:11/63	16:24 11:19-12:25/66
59	05:45	06:34	07:23 07:48-08:01/13	07:14 16:15-16:35/20	08:06 15:26-15:46/20	08:31 15:00-15:19/19
60	21:18	20:18	19:08 17:50-18:25/35	17:04 15:07-16:07/60	16:22 11:08-12:12/64	16:25 11:19-12:26/67
61	05:47	06:35		07:16 16:17-16:33/16		08:31 15:01-15:19/18
62	21:17	20:16		17:02 15:08-16:07/59		16:26 11:20-12:26/66
Sonneneinstrahlung	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	1125	2638	2389	2572

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 02 - NORDEX N163/5.X 5700 163.0 !O! NH: 164,0 m (Ges:245,5 m) (9)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 13:07-13:50/43 16:27	08:05 15:35-16:11/36 17:14		07:13 07:48-08:40/52 18:05 16:44-17:07/23		07:03 06:00 19:58 20:47	05:15 21:32	
2	08:31 13:08-13:51/43 16:28	08:04 15:35-16:11/36 17:16		07:11 07:47-08:40/53 18:06 16:46-17:06/20		07:01 05:58 19:59 20:49	05:15 21:33	
3	08:31 13:08-13:50/42 16:29	08:02 16:28-16:38/10 17:18 15:35-16:13/38		07:09 07:46-08:39/53 16:47-17:05/18 18:08 17:26-17:36/10		06:59 05:56 20:01 20:51	05:14 21:34	
4	08:31 13:09-13:51/42 16:30	08:01 16:25-16:42/17 17:19 15:35-16:13/38		07:06 07:43-08:37/54 16:49-17:01/12 18:10 17:22-17:38/16		06:57 05:54 20:03 20:52	05:13 21:35	
5	08:31 13:10-13:52/42 16:32	07:59 16:24-16:43/19 17:21 15:35-16:13/38		07:04 07:37-08:36/59 16:55-16:56/1 18:12 17:21-17:39/18		06:54 05:52 20:04 20:54	05:12 21:36	
6	08:30 13:10-13:51/41 16:33	07:57 16:22-16:45/23 17:23 15:34-16:13/39		07:02 07:35-08:34/59 18:13 17:20-17:40/20		06:52 05:50 20:06 20:55	05:12 21:37	
7	08:30 13:11-13:52/41 16:34	07:56 16:22-16:47/25 17:25 15:35-16:14/39		07:00 07:32-08:32/60 18:15 17:19-17:41/22		06:50 05:49 20:08 20:57	05:11 21:38	
8	08:30 13:11-13:52/41 16:35	07:54 16:21-16:47/26 17:27 15:35-16:13/38		06:58 07:29-08:29/60 18:17 17:18-17:40/22		06:48 05:47 20:09 20:59	05:11 21:39	
9	08:29 13:13-13:53/40 16:37	07:52 16:21-16:48/27 17:29 15:36-16:13/37		06:55 07:27-08:19/52 18:19 17:18-17:41/23		06:45 05:45 20:11 21:00	05:10 21:40	
10	08:29 13:13-13:52/39 16:38	07:50 16:20-16:53/33 17:30 15:36-16:13/37		06:53 07:25-08:17/52 18:20 17:18-17:41/23		06:43 05:44 20:13 21:02	05:10 21:41	
11	08:28 13:14-13:52/38 16:39	07:49 16:20-16:56/36 17:32 15:36-16:12/36		06:51 07:24-08:16/52 18:22 17:18-17:40/22		06:41 05:42 20:14 21:03	05:09 21:41	
12	08:27 15:42-15:50/8 16:41	07:47 16:20-16:57/37 17:34 15:37-16:12/35		06:49 07:23-08:14/51 18:24 17:18-17:39/21		06:39 05:40 20:16 21:05	05:09 21:42	
13	08:27 15:40-15:52/12 16:42	07:45 16:20-16:59/39 17:36 15:38-16:11/33		06:46 07:22-08:12/50 18:26 17:18-17:38/20		06:37 05:39 20:18 21:07	05:09 21:43	
14	08:26 15:40-15:55/15 16:44	07:43 16:20-17:00/40 17:38 15:39-16:10/31		06:44 07:22-08:10/48 18:27 17:19-17:37/18		06:34 05:37 20:19 21:08	05:09 21:43	
15	08:25 15:39-15:56/17 16:45	07:41 08:25-08:28/3 15:40-16:09/29 17:40 16:21-17:02/41		06:42 07:22-08:05/43 18:29 17:20-17:35/15		06:32 05:36 20:21 21:10	05:08 21:44	
16	08:24 15:38-15:58/20 16:47	07:39 08:20-08:33/13 15:41-16:08/27 17:41 16:21-17:04/43		06:40 07:21-08:02/41 18:31 17:22-17:32/10		06:30 05:34 20:23 21:11	05:08 21:44	
17	08:24 15:38-15:59/21 16:48	07:37 08:17-08:36/19 15:43-16:06/23 17:43 16:22-17:06/44		06:37 07:22-07:58/36 18:32		06:28 05:33 20:24 21:13	05:08 21:45	
18	08:23 15:38-16:00/22 16:50	07:35 08:14-08:37/23 15:45-16:04/19 17:45 16:23-17:07/44		06:35 07:22-07:52/30 18:34		06:26 05:31 20:26 21:14	05:08 21:45	
19	08:22 15:36-16:00/24 16:52	07:33 08:13-08:38/25 15:48-16:01/13 17:47 16:24-17:08/44		06:33 07:22-07:50/28 18:36		06:24 05:30 20:28 21:15	05:08 21:46	
20	08:21 15:36-16:01/25 16:53	07:32 08:12-08:39/27 17:49 16:26-17:09/43		06:31 07:23-07:48/25 18:37		06:22 05:29 20:29 21:17	05:08 21:46	
21	08:20 15:36-16:02/26 16:55	07:30 08:11-08:40/29 16:30-16:36/6 17:50 16:39-17:10/31		06:28 07:24-07:45/21 18:39		06:20 05:27 20:31 21:18	05:09 21:46	
22	08:18 15:37-16:03/26 16:57	07:27 08:10-08:41/31 17:52 16:40-17:10/30		06:26 07:26-07:41/15 18:41		06:17 05:26 20:33 21:20	05:09 21:46	
23	08:17 15:36-16:03/27 16:58	07:25 08:04-08:41/37 17:54 16:41-17:10/29		06:24 07:29-07:36/7 18:42		06:15 05:25 20:34 21:21	05:09 21:47	
24	08:16 15:36-16:04/28 17:00	07:23 08:01-08:42/41 17:56 16:41-17:10/29		06:22 07:28-07:35/15 18:44		06:13 05:23 20:36 21:22	05:09 21:47	
25	08:15 15:37-16:05/28 17:02	07:21 07:59-08:42/43 17:58 16:42-17:10/28		06:19 07:27-07:34/15 18:46		06:11 05:22 20:37 21:24	05:10 21:47	
26	08:14 15:36-16:06/30 17:03	07:19 07:57-08:42/45 17:59 16:42-17:10/28		06:17 07:26-07:33/15 18:48		06:09 05:21 20:39 21:25	05:10 21:47	
27	08:12 15:37-16:07/30 17:05	07:17 07:54-08:41/47 18:01 16:42-17:09/27		06:15 07:25-07:32/15 18:49		06:07 05:20 20:41 21:26	05:10 21:47	
28	08:11 15:36-16:08/32 17:07	07:15 07:51-08:41/50 18:03 16:43-17:08/25		06:12 07:24-07:31/15 18:51		06:05 05:19 20:42 21:28	05:11 21:47	
29	08:10 15:36-16:09/33 17:09			07:10 07:23-07:30/15 19:53		06:03 05:18 20:44 21:29	05:11 21:46	
30	08:08 15:36-16:10/34 17:10			07:08 07:22-07:29/15 19:54		06:02 05:17 20:46 21:30	05:12 21:46	
31	08:07 15:36-16:11/35 17:12			07:06 07:21-07:28/15 19:56		05:16 21:31		
Sonneneinstrunden	261	279		367		415	483	496
Anzahl Minuten mit Schatten	1281	1879		1335		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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 02 - NORDEX N163/5.X 5700 163.0 !O! NH: 164,0 m (Ges:245,5 m) (9)

Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:25 08:02-08:53/51	07:18 15:50-16:22/32	08:08 15:27-15:29/2
	21:46	21:15	20:14	19:06 17:58-18:18/20	17:01 15:06-15:42/36	16:21 12:56-13:34/38
2	05:13	05:50	06:39	07:26 08:02-08:53/51	07:19 15:51-16:17/26	08:09 12:56-13:36/40
	21:46	21:13	20:12	19:03 17:56-18:18/22	16:59 15:05-15:43/38	16:21
3	05:14	05:51	06:40	07:28 08:03-08:55/52	07:21 15:51-16:17/26	08:10 12:56-13:36/40
	21:45	21:12	20:10	19:01 17:56-18:18/22	16:57 15:05-15:43/38	16:20
4	05:15	05:53	06:42	07:30 08:04-08:56/52	07:23 15:52-16:16/24	08:12 12:56-13:37/41
	21:45	21:10	20:07	18:59 17:56-18:18/22	16:55 15:05-15:43/38	16:19
5	05:16	05:54	06:43	07:31 08:57-09:01/4 17:55-18:17/22	07:25 15:53-16:15/22	08:13 12:56-13:37/41
	21:44	21:08	20:05	18:57 08:04-08:56/52	16:54 15:05-15:43/38	16:19
6	05:16	05:56	06:45	07:33 08:06-09:07/61	07:26 15:54-16:13/19	08:14 12:56-13:38/42
	21:44	21:07	20:03	18:54 17:55-18:17/22	16:52 15:04-15:42/38	16:18
7	05:17	05:57	06:46	07:35 08:10-09:09/59	07:28 15:55-16:11/16	08:15 12:57-13:39/42
	21:43	21:05	20:01	18:52 17:56-18:16/20	16:50 15:05-15:42/37	16:18
8	05:18	05:59	06:48	07:36 08:11-09:10/59	07:30 15:58-16:07/9	08:17 12:57-13:39/42
	21:43	21:03	19:58	18:50 17:55-18:15/20	16:48 15:05-15:42/37	16:18
9	05:19	06:01	06:50	07:38 08:14-09:11/57 17:26-17:35/9	07:32 15:06-15:42/36	08:18 12:57-13:39/42
	21:42	21:01	19:56	18:48 17:57-18:13/16	16:47	16:18
10	05:20	06:02	06:51	07:40 08:19-09:13/54 17:22-17:38/16	07:33 15:06-15:42/36	08:19 12:57-13:40/43
	21:41	20:59	19:54	18:45 17:58-18:12/14	16:45	16:17
11	05:21	06:04	06:53	07:41 08:20-09:13/53 17:21-17:40/19	07:35 15:07-15:42/35	08:20 12:57-13:40/43
	21:41	20:57	19:52	18:43 18:00-18:08/8	16:44	16:17
12	05:22	06:05	06:54	07:43 08:21-09:13/52	07:37 15:08-15:42/34	08:21 12:58-13:41/43
	21:40	20:56	19:49	18:41 17:18-17:40/22	16:42	16:17
13	05:23	06:07	06:56	07:45 08:22-09:14/52	07:39 15:08-15:41/33	08:22 12:58-13:41/43
	21:39	20:54	19:47	18:39 17:17-17:41/24	16:41	16:17
14	05:24	06:08	06:58	07:46 08:25-09:14/49	07:40 15:09-15:41/32	08:23 12:58-13:42/44
	21:38	20:52	19:45	18:37 17:16-17:42/26	16:39	16:17
15	05:25	06:10	06:59	07:48 08:28-09:14/46	07:42 15:10-15:40/30	08:24 12:59-13:42/43
	21:37	20:50	19:42	18:35 17:15-17:42/27	16:38	16:17
16	05:27	06:11	07:01	07:50 08:29-09:13/44	07:44 15:09-15:39/30	08:25 13:00-13:43/43
	21:36	20:48	19:40	18:32 17:13-17:41/28	16:37	16:17
17	05:28	06:13	07:02	07:51 08:31-09:13/42	07:45 15:10-15:38/28	08:26 13:00-13:44/44
	21:35	20:46	19:38	18:30 17:13-17:42/29	16:35	16:17
18	05:29	06:15	07:04	07:53 08:33-09:13/40	07:47 15:10-15:38/28	08:26 13:00-13:44/44
	21:34	20:44	19:35	18:28 17:12-17:42/30	16:34	16:18
19	05:30	06:16	07:06	07:55 08:38-09:12/34	07:49 15:11-15:38/27	08:27 13:01-13:44/43
	21:33	20:42	19:33	18:26 17:12-17:42/30	16:33 13:07-13:17/10	16:18
20	05:32	06:18	07:07 08:18-08:20/2	07:57 08:42-09:12/30	07:50 15:12-15:38/26	08:28 13:02-13:45/43
	21:32	20:40	19:31	18:24 17:10-17:40/30	16:31 13:04-13:21/17	16:18
21	05:33	06:19	07:09 08:13-08:25/12	07:58 08:42-09:10/28 16:59-17:08/9	07:52 15:11-15:37/26	08:28 13:01-13:45/44
	21:31	20:38	19:29	18:22 17:09-17:40/31	16:30 13:02-13:23/21	16:19
22	05:34	06:21	07:10 08:09-08:29/20	08:00 08:43-09:09/26 16:24-16:26/2	07:54 15:12-15:37/25	08:29 13:02-13:46/44
	21:29	20:36	19:26	18:20 16:56-17:39/43	16:29 13:00-13:24/24	16:19
23	05:35	06:23	07:12 08:08-08:32/24	08:02 08:44-09:08/24 16:18-16:32/14	07:55 15:14-15:37/23	08:29 13:02-13:46/44
	21:28	20:33	19:24	18:18 16:54-17:38/44	16:28 12:59-13:26/27	16:20
24	05:37	06:24	07:14 08:06-08:33/27	08:03 08:45-09:07/22 16:15-16:35/20	07:57 15:15-15:37/22	08:30 13:03-13:46/43
	21:27	20:31	19:22	18:16 16:53-17:37/44	16:27 12:59-13:28/29	16:20
25	05:38	06:26	07:15 08:05-08:34/29	07:05 07:47-08:05/18 15:13-15:37/24	07:59 15:15-15:36/21	08:30 13:04-13:48/44
	21:25	20:29	19:19	17:14 15:52-16:36/44	16:26 12:57-13:28/31	16:21
26	05:40	06:27	07:17 08:04-08:39/35	07:07 07:50-08:02/12 15:11-15:38/27	08:00 15:16-15:36/20	08:30 13:04-13:48/44
	21:24	20:27	19:17	17:12 15:51-16:34/43	16:25 12:57-13:30/33	16:22
27	05:41	06:29	07:18 08:03-08:42/39	07:09 15:50-16:31/41	08:02 15:18-15:36/18	08:31 13:04-13:48/44
	21:23	20:25	19:15 18:06-18:13/7	17:10 15:09-15:39/30	16:24 12:57-13:31/34	16:22
28	05:42	06:31	07:20 08:03-08:45/42	07:10 15:50-16:29/39	08:03 15:19-15:34/15	08:31 13:05-13:48/43
	21:21	20:23	19:12 18:02-18:16/14	17:08 15:08-15:40/32	16:23 12:56-13:32/36	16:23
29	05:44	06:32	07:22 08:02-08:48/46	07:12 15:50-16:28/38	08:05 15:21-15:34/13	08:31 13:05-13:49/44
	21:20	20:21	19:10 18:00-18:16/16	17:06 15:07-15:41/34	16:23 12:56-13:33/37	16:24
30	05:45	06:34	07:23 08:02-08:51/49	07:14 15:50-16:27/37	08:06 15:24-15:33/9	08:31 13:06-13:49/43
	21:18	20:18	19:08 17:58-18:18/20	17:04 15:06-15:41/35	16:22 12:56-13:34/38	16:25
31	05:47	06:35		07:16 15:50-16:25/35		08:31 13:06-13:50/44
	21:17	20:16		17:02 15:06-15:42/36		16:26
Sonneneinstrahlung		499	452	381	332	268
Anzahl Minuten mit Schatten		0	0	382	2324	1378
						1327

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 01 - ENERCON E-82 E2 2300 82.0 IO! NH: 138,4 m (Ges:179,4 m) (1)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:47	05:15 21:32	05:13 21:46	05:48 21:15	06:37 20:14	07:25 19:06	07:18 17:01	08:08 16:21
2	08:31 16:28	08:04 17:16	07:11 18:07	07:01 19:59	05:58 20:49	05:15 21:33	05:13 21:46	05:50 21:13	06:39 20:12	07:27 19:03	07:19 16:59	08:09 16:21
3	08:31 16:29	08:02 17:18	07:09 18:08	06:59 20:01	05:56 20:51	05:14 21:34	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	07:21 16:57	08:10 16:20
4	08:31 16:30	08:01 17:20	07:06 18:10	06:57 20:03	05:54 20:52	05:13 21:35	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	07:23 16:55	08:12 16:20
5	08:31 16:32	07:59 17:21	07:04 18:12	06:54 20:04	05:52 20:54	05:13 21:36	05:16 21:44	05:54 21:08	06:43 20:05	07:31 18:57	07:25 16:54	08:13 16:19
6	08:30 16:33	07:57 17:23	07:02 18:14	06:52 20:06	05:51 20:56	05:12 21:37	05:16 21:44	05:56 21:07	06:45 20:03	07:33 18:54	07:26 16:52	08:14 16:19
7	08:30 16:34	07:56 17:25	07:00 18:15	06:50 20:08	05:49 20:57	05:11 21:38	05:17 21:43	05:58 21:05	06:47 20:01	07:35 18:52	07:28 16:50	08:16 16:18
8	08:30 16:35	07:54 17:27	06:58 18:17	06:48 20:09	05:47 20:59	05:11 21:39	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	07:30 16:49	08:17 16:18
9	08:29 16:37	07:52 17:29	06:56 18:19	06:46 20:11	05:45 21:00	05:10 21:40	05:19 21:42	06:01 21:01	06:50 19:56	07:38 18:48	07:32 16:47	08:18 16:18
10	08:29 16:38	07:50 17:31	06:53 18:20	06:43 20:13	05:44 21:02	05:10 21:41	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:46	07:33 16:45	08:19 16:17
11	08:28 16:39	07:49 17:32	06:51 18:22	06:41 20:14	05:42 21:03	05:10 21:41	05:21 21:41	06:04 20:58	06:53 19:52	07:41 18:43	07:35 16:44	08:20 16:17
12	08:27 16:41	07:47 17:34	06:49 18:24	06:39 20:16	05:40 21:05	05:09 21:42	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:42	08:21 16:17
13	08:27 16:42	07:45 17:36	06:47 18:26	06:37 20:18	05:39 21:07	05:09 21:43	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:39 16:41	08:22 16:17
14	08:26 16:44	07:43 17:38	06:44 18:27	06:35 20:19	05:37 21:08	05:09 21:43	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37	07:40 16:39	08:23 16:17
15	08:25 16:45	07:41 17:40	06:42 18:29	06:32 20:21	05:36 21:10	05:09 21:44	05:26 21:37	06:10 20:50	06:59 19:42	07:48 18:35	07:42 16:38	08:24 16:17
16	08:24 16:47	07:39 17:41	06:40 18:31	06:30 20:23	05:34 21:11	05:08 21:44	05:27 21:36	06:12 20:48	07:01 19:40	07:50 18:33	07:44 16:37	08:25 16:17
17	08:24 16:48	07:37 17:43	06:38 18:32	06:28 20:24	05:33 21:13	05:08 21:45	05:28 21:35	06:13 20:46	07:02 19:38	07:52 18:30	07:45 16:35	08:26 16:18
18	08:23 16:50	07:36 17:45	06:35 18:34	06:26 20:26	05:31 21:14	05:08 21:45	05:29 21:34	06:15 20:44	07:04 19:36	07:53 18:28	07:47 16:34	08:26 16:18
19	08:22 16:52	07:34 17:47	06:33 18:36	06:24 20:28	05:30 21:15	05:08 21:46	05:30 21:33	06:16 20:42	07:06 19:33	07:55 18:26	07:49 16:33	08:27 16:18
20	08:21 16:53	07:32 17:49	06:31 18:37	06:22 20:29	05:29 21:17	05:09 21:46	05:32 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:50 16:32	08:28 16:18
21	08:20 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 21:18	05:09 21:46	05:33 21:31	06:20 20:38	07:09 19:29	07:58 18:22	07:52 16:30	08:28 16:19
22	08:19 16:57	07:28 17:52	06:26 18:41	06:18 20:33	05:26 21:20	05:09 21:46	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 16:29	08:29 16:19
23	08:17 16:58	07:26 17:54	06:24 18:43	06:16 20:34	05:25 21:21	05:09 21:47	05:36 21:28	06:23 20:34	07:12 19:24	08:02 18:18	07:55 16:28	08:29 16:20
24	08:16 17:00	07:23 17:56	06:22 18:44	06:13 20:36	05:24 21:22	05:09 21:47	05:37 21:27	06:24 20:31	07:14 19:22	08:04 18:16	07:57 16:27	08:30 16:20
25	08:15 17:02	07:21 17:58	06:19 18:46	06:11 20:38	05:22 21:24	05:10 21:47	05:38 21:25	06:26 20:29	07:15 19:19	07:05 17:14	07:59 16:26	08:30 16:21
26	08:14 17:03	07:19 17:59	06:17 18:48	06:09 20:39	05:21 21:25	05:10 21:47	05:40 21:24	06:27 20:27	07:17 19:17	07:07 17:12	08:00 16:25	08:31 16:22
27	08:12 17:05	07:17 18:01	06:15 18:49	06:07 20:41	05:20 21:26	05:11 21:47	05:41 21:23	06:29 20:25	07:18 19:15	07:09 17:10	08:02 16:24	08:31 16:22
28	08:11 17:07	07:15 18:03	06:13 18:51	06:06 20:43	05:19 21:28	05:11 21:47	05:43 21:21	06:31 20:23	07:20 19:13	07:11 17:08	08:03 16:24	08:31 16:23
29	08:10 17:09		07:10 19:53	06:04 20:44	05:18 21:29	05:12 21:46	05:44 21:20	06:32 20:21	07:22 19:10	07:12 17:06	08:05 16:23	08:31 16:24
30	08:08 17:11		07:08 19:54	06:02 20:46	05:17 21:30	05:12 21:46	05:45 21:18	06:34 20:19	07:23 19:08	07:14 17:04	08:06 16:22	08:31 16:25
31	08:07 17:12		07:06 19:56		05:16 21:31		05:47 21:17	06:35 20:16		07:16 17:03		08:31 16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 01 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (66)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:39	07:27	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:36	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:44	21:05	20:01	18:52	16:50	16:18
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	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
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14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
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17	08:24	07:38	06:38	06:28	05:33	05:08	05:28	06:13	07:02	07:52	07:46	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:52	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:28	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:47	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:26	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:43	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:23	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	07:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:26	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:40	06:27	07:17	07:07	08:00	08:31
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:22
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:31	07:20	07:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:19	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 02 - ENERCON E-82 E2 2300 82.0 IO! NH: 138,4 m (Ges:179,4 m) (2)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:16	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:15	05:13	05:50	06:39	07:27	07:19	08:09
	16:28	17:16	18:07	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:21
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:20	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:20
5	08:31	07:59	07:04	06:54	05:52	05:13	05:16	05:54	06:43	07:31	07:25	08:13
	16:32	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:54	16:19
6	08:30	07:57	07:02	06:52	05:51	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:14	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:19
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:58	06:47	07:35	07:28	08:15
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:49	16:18
9	08:29	07:52	06:55	06:46	05:45	05:10	05:19	06:01	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:18
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	16:38	17:31	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:46	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:10	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
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13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:35	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
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15	08:25	07:41	06:42	06:32	05:36	05:09	05:26	06:10	06:59	07:48	07:42	08:24
	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:27	06:12	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:33	16:37	16:17
17	08:24	07:37	06:38	06:28	05:33	05:08	05:28	06:13	07:02	07:52	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:18
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:36	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:52	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:29	05:09	05:32	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:32	16:18
21	08:20	07:30	06:28	06:20	05:27	05:09	05:33	06:20	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
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	16:58	17:54	18:43	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:24	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
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	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	17:14	16:26	16:21
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	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	17:12	16:25	16:22
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	17:10	16:24	16:22
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	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	17:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:11		19:54	20:46	21:30	21:46	21:18	20:18	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:03		16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 02 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (67)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:15	05:13	05:50	06:39	07:27	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
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	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
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8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:51	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:42	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:04	21:42	21:41	20:58	19:52	18:43	16:44	16:17
12	08:28	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
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14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
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	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
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	16:47	17:41	18:31	20:23	21:11	21:45	21:36	20:48	19:40	18:32	16:37	16:17
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
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	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
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	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	17:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	17:06	16:23	16:24
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31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 03 - ENERCON E-82 E2 2300 82.0 IO! NH: 138,4 m (Ges:179,4 m) (3)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:15	05:13	05:50	06:39	07:27	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:21
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:20	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
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	16:32	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:54	16:19
6	08:30	07:57	07:02	06:52	05:51	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:19
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	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:49	16:18
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	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:18
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
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	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
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	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:22
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	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:11		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 03 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (68)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 08:05 07:13	07:03 07:03 19:29-19:32/3	06:00 05:15 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13	05:45 05:13 05:13
2	08:27 17:14 18:05	19:58 19:58 19:58	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47	20:47 20:47 20:47
3	08:31 08:04 07:11	07:01 07:01 19:26-19:33/7	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13	05:58 05:15 05:13
4	08:28 17:16 18:06	19:59 19:59 19:59	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49	20:49 20:49 20:49
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6	08:29 17:18 18:08	20:01 20:01 20:01	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51	20:51 20:51 20:51
7	08:31 08:01 07:06	06:57 06:57 19:24-19:37/13	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15	05:54 05:13 05:15
8	08:30 07:59 07:04	06:54 06:54 19:24-19:39/15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15	05:52 05:12 05:15
9	08:29 07:52 06:55	06:45 06:45 19:23-19:40/17	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16
10	08:30 07:57 07:02	06:52 06:52 19:23-19:40/17	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16	05:50 05:12 05:16
11	08:33 17:23 18:13	20:06 20:06 20:06	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56	20:56 20:56 20:56
12	08:30 07:56 07:00	06:50 06:50 19:23-19:42/19	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17	05:49 05:11 05:17
13	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
14	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
15	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
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17	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
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19	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
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21	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
22	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
23	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
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27	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
28	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
29	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
30	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18
31	08:30 07:54 06:58	06:48 06:48 19:23-19:42/19	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18	05:47 05:11 05:18

Sonneneinstrahlung
Anzahl Minuten mit Schatten

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 04 - ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (4)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 09:34-09:58/24	08:05 07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:18	08:08 09:23-09:32/9	16:21
2	16:27	17:14 18:05	19:58 20:47	21:32 21:46	21:15 20:14	19:06 17:01	08:09 09:23-09:33/10	16:21	16:21	16:21	16:21	16:21
3	08:31 09:35-09:58/23	08:02 07:09	06:59 05:56	05:14 05:14	05:51 06:40	07:28 07:21	08:10 09:22-09:34/12	16:20	16:20	16:20	16:20	16:20
4	08:31 09:35-09:58/23	08:01 07:06	06:57 05:54	05:13 05:15	05:53 06:42	07:30 07:23	08:12 09:23-09:35/12	16:19	16:19	16:19	16:19	16:19
5	08:31 09:36-09:58/22	07:59 07:04	06:54 05:52	05:12 05:16	05:54 06:43	07:31 07:25	08:13 09:38-09:41/3	16:19	16:19	16:19	16:19	16:19
6	08:30 09:36-09:57/21	07:57 07:02	06:52 05:51	05:12 05:16	05:56 06:45	07:33 07:26	08:14 09:22-09:43/21	16:18	16:18	16:18	16:18	16:18
7	08:30 09:53-09:56/3	07:56 07:00	06:50 05:49	05:11 05:17	05:57 06:46	07:35 07:28	08:15 09:23-09:45/22	16:18	16:18	16:18	16:18	16:18
8	08:30 09:38-09:50/12	07:54 06:58	06:48 05:47	05:11 05:18	05:59 06:48	07:36 07:30	08:17 09:23-09:46/23	16:18	16:18	16:18	16:18	16:18
9	08:29 09:39-09:51/12	07:52 06:55	06:45 05:45	05:10 05:19	06:01 06:50	07:38 07:32	08:18 09:23-09:46/23	16:18	16:18	16:18	16:18	16:18
10	08:29 09:40-09:50/10	07:50 06:53	06:43 05:44	05:10 05:20	06:02 06:51	07:40 07:33	08:19 09:23-09:47/24	16:17	16:17	16:17	16:17	16:17
11	08:28 09:40-09:50/10	07:49 06:51	06:41 05:42	05:10 05:21	06:04 06:53	07:41 07:35	08:20 09:24-09:48/24	16:17	16:17	16:17	16:17	16:17
12	08:27 09:42-09:49/7	07:47 06:49	06:39 05:40	05:09 05:22	06:05 06:54	07:43 07:37	08:21 09:24-09:48/24	16:17	16:17	16:17	16:17	16:17
13	08:27 09:44-09:49/5	07:45 06:47	06:37 05:39	05:09 05:23	06:07 06:56	07:45 07:39	08:22 09:25-09:49/24	16:17	16:17	16:17	16:17	16:17
14	08:26 16:42	07:43 18:26	06:34 20:16	05:09 21:42	06:10 20:56	07:48 18:41	08:23 09:25-09:50/25	16:17	16:17	16:17	16:17	16:17
15	08:25 16:45	07:41 18:24	06:32 20:16	05:09 21:42	06:10 20:56	07:48 18:41	08:24 09:26-09:50/24	16:17	16:17	16:17	16:17	16:17
16	08:24 16:47	07:39 18:22	06:30 20:14	05:08 21:41	06:12 20:57	07:50 18:43	08:25 09:26-09:51/25	16:17	16:17	16:17	16:17	16:17
17	08:24 16:48	07:37 18:21	06:28 20:13	05:08 21:40	06:13 20:58	07:51 18:44	08:26 09:27-09:52/25	16:17	16:17	16:17	16:17	16:17
18	08:23 16:50	07:35 18:18	06:26 20:11	05:08 21:39	06:15 20:59	07:53 18:46	08:26 09:27-09:52/25	16:18	16:18	16:18	16:18	16:18
19	08:22 16:52	07:34 18:16	06:24 20:10	05:08 21:38	06:16 20:58	07:55 18:47	08:27 09:28-09:52/24	16:18	16:18	16:18	16:18	16:18
20	08:21 16:53	07:32 18:15	06:22 20:09	05:08 21:37	06:18 20:59	07:57 18:48	08:28 09:28-09:53/25	16:18	16:18	16:18	16:18	16:18
21	08:20 16:55	07:30 18:13	06:20 20:07	05:09 21:36	06:19 20:58	07:58 18:49	08:28 09:28-09:53/25	16:19	16:19	16:19	16:19	16:19
22	08:18 16:57	07:27 18:11	06:18 20:05	05:09 21:35	06:21 20:59	07:59 18:50	08:29 09:29-09:54/25	16:19	16:19	16:19	16:19	16:19
23	08:17 16:58	07:25 18:10	06:15 20:04	05:09 21:34	06:23 20:58	08:00 18:51	08:29 09:29-09:54/25	16:20	16:20	16:20	16:20	16:20
24	08:16 17:00	07:23 18:08	06:13 20:02	05:09 21:33	06:24 20:59	08:03 18:52	08:30 09:31-09:55/24	16:20	16:20	16:20	16:20	16:20
25	08:15 17:02	07:21 18:06	06:11 20:00	05:10 21:32	06:26 20:57	08:05 18:53	08:30 09:31-09:55/24	16:21	16:21	16:21	16:21	16:21
26	08:14 17:03	07:19 18:04	06:09 20:00	05:10 21:31	06:27 20:58	08:06 18:54	08:30 09:31-09:56/25	16:22	16:22	16:22	16:22	16:22
27	08:12 17:05	07:17 18:02	06:07 20:00	05:10 21:30	06:29 20:59	08:07 18:55	08:31 09:31-09:56/25	16:22	16:22	16:22	16:22	16:22
28	08:11 17:07	07:15 18:00	06:05 20:00	05:11 21:29	06:31 20:59	08:08 18:56	08:31 09:32-09:56/24	16:23	16:23	16:23	16:23	16:23
29	08:10 17:09	07:14 18:00	06:04 20:00	05:11 21:28	06:32 20:59	08:09 18:57	08:31 09:32-09:56/24	16:24	16:24	16:24	16:24	16:24
30	08:08 17:11	07:13 18:00	06:02 20:00	05:12 21:27	06:34 20:59	08:10 18:58	08:31 09:32-09:57/25	16:25	16:25	16:25	16:25	16:25
31	08:07 17:12	07:12 18:00	06:01 20:00	05:13 21:26	06:35 20:59	08:11 18:59	08:31 09:33-09:57/24	16:26	16:26	16:26	16:26	16:26
Sonnenscheinstunden												
Anzahl Minuten mit Schatten												
	261	279	367	415	483	496	499	452	381	332	268	688

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 04 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (69)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:47	05:15 21:32	05:13 21:46	05:48 21:15	06:37 20:14	07:25 19:06	07:18 17:01	08:08 16:21
2	08:31 16:28	08:04 17:16	07:11 18:06	07:01 19:59	05:58 20:49	05:15 21:33	05:13 21:46	05:50 21:13	06:39 20:12	07:27 19:03	07:19 16:59	08:09 16:21
3	08:31 16:29	08:02 17:18	07:09 18:08	06:59 20:01	05:56 20:51	05:14 21:34	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	07:21 16:57	08:10 16:20
4	08:31 16:30	08:01 17:19	07:06 18:10	06:57 20:03	05:54 20:52	05:13 21:35	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	07:23 16:55	08:12 16:19
5	08:31 16:31	07:59 17:21	07:04 18:12	06:54 20:04	05:52 20:54	05:12 21:36	05:15 21:45	05:54 21:08	06:43 20:05	07:31 18:57	07:25 16:54	08:13 16:19
6	08:30 16:33	07:57 17:23	07:02 18:13	06:52 20:06	05:50 20:56	05:12 21:37	05:16 21:44	05:56 21:07	06:45 20:03	07:33 18:54	07:26 16:52	08:14 16:18
7	08:30 16:34	07:56 17:25	07:00 18:15	06:50 20:08	05:49 20:57	05:11 21:38	05:17 21:44	05:57 21:05	06:46 20:01	07:35 18:52	07:28 16:50	08:16 16:18
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11	08:28 16:39	07:49 17:32	06:51 18:22	06:41 20:14	05:42 21:04	05:09 21:42	05:21 21:41	06:04 20:58	06:53 19:52	07:41 18:43	07:35 16:44	08:20 16:17
12	08:27 16:41	07:47 17:34	06:49 18:24	06:39 20:16	05:40 21:05	05:09 21:42	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:42	08:21 16:17
13	08:27 16:42	07:45 17:36	06:47 18:26	06:37 20:18	05:39 21:07	05:09 21:43	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:39 16:41	08:22 16:17
14	08:26 16:44	07:43 17:38	06:44 18:27	06:34 20:19	05:37 21:08	05:09 21:43	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37	07:40 16:39	08:23 16:17
15	08:25 16:45	07:41 17:40	06:42 18:29	06:32 20:21	05:36 21:10	05:08 21:44	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:35	07:42 16:38	08:24 16:17
16	08:24 16:47	07:39 17:41	06:40 18:31	06:30 20:23	05:34 21:11	05:08 21:45	05:27 21:36	06:11 20:48	07:01 19:40	07:50 18:32	07:44 16:37	08:25 16:17
17	08:24 16:48	07:37 17:43	06:38 18:32	06:28 20:24	05:33 21:13	05:08 21:45	05:28 21:35	06:13 20:46	07:02 19:38	07:52 18:30	07:46 16:35	08:26 16:17
18	08:23 16:50	07:36 17:45	06:35 18:34	06:26 20:26	05:31 21:14	05:08 21:45	05:29 21:34	06:15 20:44	07:04 19:35	07:53 18:28	07:47 16:34	08:26 16:18
19	08:22 16:52	07:34 17:47	06:33 18:36	06:24 20:28	05:30 21:16	05:08 21:46	05:30 21:33	06:16 20:42	07:06 19:33	07:55 18:26	07:49 16:33	08:27 16:18
20	08:21 16:53	07:32 17:49	06:31 18:37	06:22 20:29	05:28 21:17	05:08 21:46	05:31 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:51 16:31	08:28 16:18
21	08:20 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 21:18	05:08 21:46	05:33 21:31	06:19 20:38	07:09 19:29	07:58 18:22	07:52 16:30	08:28 16:19
22	08:19 16:57	07:28 17:52	06:26 18:41	06:17 20:33	05:26 21:20	05:09 21:47	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 16:29	08:29 16:19
23	08:17 16:58	07:26 17:54	06:24 18:43	06:15 20:34	05:25 21:21	05:09 21:47	05:35 21:28	06:23 20:34	07:12 19:24	08:02 18:18	07:55 16:28	08:29 16:20
24	08:16 17:00	07:23 17:56	06:22 18:44	06:13 20:36	05:23 21:22	05:09 21:47	05:37 21:27	06:24 20:31	07:14 19:22	08:04 18:16	07:57 16:27	08:30 16:20
25	08:15 17:02	07:21 17:58	06:19 18:46	06:11 20:38	05:22 21:24	05:10 21:47	05:38 21:26	06:26 20:29	07:15 19:19	07:05 17:14	07:59 16:26	08:30 16:21
26	08:14 17:03	07:19 17:59	06:17 18:48	06:09 20:39	05:21 21:25	05:10 21:47	05:40 21:24	06:27 20:27	07:17 19:17	07:07 17:12	08:00 16:25	08:31 16:22
27	08:12 17:05	07:17 18:01	06:15 18:49	06:07 20:41	05:20 21:26	05:10 21:47	05:41 21:23	06:29 20:25	07:18 19:15	07:09 17:10	08:02 16:24	08:31 16:22
28	08:11 17:07	07:15 18:03	06:12 18:51	06:05 20:43	05:19 21:28	05:11 21:47	05:42 21:21	06:31 20:23	07:20 19:12	07:11 17:08	08:03 16:23	08:31 16:23
29	08:10 17:09		06:10 19:53	06:03 20:44	05:18 21:29	05:11 21:47	05:44 21:20	06:32 20:21	07:22 19:10	07:12 17:06	08:05 16:23	08:31 16:24
30	08:08 17:10		06:08 19:54	06:02 20:46	05:17 21:30	05:12 21:46	05:45 21:18	06:34 20:19	07:23 19:08	07:14 17:04	08:06 16:22	08:31 16:25
31	08:07 17:12		06:06 19:56		05:16 21:31		05:47 21:17	06:35 20:16		07:16 17:02		08:31 16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 05 - (28143) ENERCON E-40/5.40 500 40.3 !O! NH: 48,0 m (Ges:68,2 m) (5)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:17	08:07
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:15	05:13	05:50	06:39	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:21
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:20	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:16	05:54	06:43	07:31	07:25	08:13
	16:32	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:54	16:19
6	08:30	07:57	07:02	06:52	05:51	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:55	21:37	21:44	21:06	20:03	18:54	16:52	16:19
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:15
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:29	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:49	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:01	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:18
10	08:28	07:50	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:10	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:57	19:51	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:06	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:09	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:40	18:29	20:21	21:09	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:27	06:12	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:37	16:17
17	08:23	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:25
	16:48	17:43	18:32	20:24	21:12	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:33	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:52	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:31	06:31	06:22	05:29	05:08	05:32	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:32	16:18
21	08:19	07:29	06:28	06:20	05:27	05:09	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:18	07:27	06:26	06:18	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:57	17:52	18:41	20:32	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:36	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:46	21:28	20:33	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:24	05:09	05:37	06:24	07:14	08:03	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:10	05:38	06:26	07:15	07:05	07:58	08:30
	17:02	17:58	18:46	20:37	21:24	21:47	21:25	20:29	19:19	17:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:40	06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	17:12	16:25	16:22
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	17:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:31	07:20	07:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:27	21:46	21:21	20:23	19:12	17:08	16:23	16:23
29	08:10		07:10	06:04	05:18	05:11	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	17:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:16	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 06 - (0260972) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (6)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	08:05 17:14	07:13 18:05	17:13-17:25/12 19:58	08:00-08:47/47 20:47	05:15 21:32
2	08:31 16:28	08:04 17:16	07:11 18:06	17:13-17:25/12 19:59	07:58-08:46/48 20:49	05:15 21:33
3	08:31 16:29	08:02 17:18	07:09 18:08	17:14-17:24/10 20:01	07:56-08:45/49 20:51	05:14 21:34
4	08:31 16:30	08:01 17:19	07:06 18:10	17:15-17:21/6 20:03	07:54-08:45/51 20:52	05:13 21:35
5	08:31 16:32	07:59 17:21	07:04 18:12	20:04	07:49-08:45/56 20:52	05:12 21:36
6	08:30 16:33	07:57 17:23	07:02 18:13	20:06	07:46-08:44/58 20:50	05:12 21:37
7	08:30 16:34	07:56 17:25	07:00 18:15	20:08	07:43-08:42/59 20:57	05:11 21:38
8	08:30 16:35	07:54 17:27	06:58 18:17	20:09	07:42-08:41/59 20:59	05:11 21:39
9	08:29 16:37	07:52 17:29	06:55 18:19	20:11	07:41-08:39/58 21:00	05:10 21:40
10	08:29 16:38	07:50 17:30	06:53 18:20	20:13	07:40-08:38/58 21:02	05:10 21:41
11	08:28 16:39	07:49 17:32	06:51 18:22	20:14	08:20-08:35/15 07:29-07:39/10 21:03	05:09 21:41
12	08:27 16:41	07:47 17:34	06:49 18:24	20:16	08:23-08:30/7 07:23-08:15/52 21:05	05:09 21:42
13	08:27 16:42	07:45 17:36	06:47 18:26	20:18	07:20-08:14/54 21:07	05:09 21:43
14	08:26 16:44	07:43 17:38	06:44 18:27	20:19	07:19-08:12/53 21:08	05:09 21:43
15	08:25 16:45	07:41 17:40	06:42 18:29	20:21	07:18-08:11/53 21:10	05:08 21:44
16	08:24 16:47	07:39 17:41	06:40 18:31	20:23	07:17-08:09/52 21:11	05:08 21:44
17	08:24 16:48	07:37 17:43	06:37 18:32	20:24	07:16-08:08/52 21:13	05:08 21:45
18	08:23 16:50	07:35 17:45	06:35 18:34	20:26	07:16-08:06/50 21:14	05:08 21:45
19	08:22 16:52	07:34 17:47	06:33 18:36	20:28	07:16-08:04/48 21:15	05:08 21:46
20	08:21 16:53	07:32 17:49	06:31 18:37	20:29	07:43-07:55/12 07:16-07:42/26 21:17	05:08 21:46
21	08:20 16:55	07:30 17:50	06:28 18:39	20:31	07:46-07:51/5 07:16-07:42/26 21:18	05:09 21:46
22	08:18 16:57	07:28 17:52	06:26 18:41	20:33	07:16-07:41/25 21:20	05:09 21:46
23	08:17 16:58	07:25 17:54	06:24 18:42	20:34	07:17-07:39/22 21:21	05:09 21:47
24	08:16 17:00	07:23 17:56	06:22 18:44	20:36	07:18-07:38/20 21:22	05:09 21:47
25	08:15 17:02	07:21 17:58	06:19 18:46	20:38	07:19-07:36/17 21:24	05:10 21:47
26	08:14 17:03	07:19 17:59	06:17 18:48	20:39	07:22-07:43/21 07:28-07:32/4 21:25	05:10 21:47
27	08:12 17:05	07:17 18:01	06:15 18:49	20:41	07:23-07:26/3 21:26	05:10 21:47
28	08:11 17:07	07:15 18:03	06:12 18:51	20:42	07:19-07:46/27 21:27	05:11 21:47
29	08:10 17:09		07:10 19:53	20:44	08:18-08:47/29 21:29	05:11 21:46
30	08:08 17:10		07:08 19:54	20:46	08:17-08:46/29 21:30	05:12 21:46
31	08:07 17:12		07:06 19:56		08:16-08:46/30 08:03-08:15/12 21:31	05:16 21:46
Sonneneinstrahlung	261	279	367	415	483	496
Anzahl Minuten mit Schatten	0	329	361	1186	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 06 - (0260972) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (6)

Voraussetzungen für Berechnung des Schattenwurfs

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

	July	August	September	Oktober	November	Dezember
1	05:13 21:46	05:48 21:15	06:37 20:14	08:19-08:34/15 07:28-08:16/48	07:25 19:06	18:13-18:26/13 17:01 16:21
2	05:13 21:46	05:50 21:13	06:39 20:12	07:38-08:36/58 20:12	07:26 19:03	18:13-18:24/11 16:59 16:21
3	05:14 21:45	05:51 21:12	06:40 20:10	07:39-08:37/58 20:10	07:28 19:01	18:16-18:21/5 16:57 16:20
4	05:15 21:45	05:53 21:10	06:42 20:07	07:39-08:38/59 20:07	07:30 18:59	17:23 16:55 16:19
5	05:16 21:44	05:54 21:08	06:43 20:05	07:40-08:39/59 20:05	07:31 18:57	17:25 16:54 16:19
6	05:16 21:44	05:56 21:07	06:45 20:03	07:41-08:39/58 20:03	07:33 18:54	17:26 16:52 16:18
7	05:17 21:43	05:57 21:05	06:46 20:01	07:44-08:40/56 20:01	07:35 18:52	17:28 16:50 16:18
8	05:18 21:43	05:59 21:03	06:48 19:58	07:48-08:39/51 19:58	07:36 18:50	17:30 16:49 16:18
9	05:19 21:42	06:01 21:01	06:50 19:56	07:50-08:40/50 19:56	07:38 18:48	17:32 16:47 16:18
10	05:20 21:41	06:02 20:59	06:51 19:54	07:51-08:39/48 19:54	07:40 18:45	17:49-17:57/8 16:45 16:17
11	05:21 21:41	06:04 20:58	06:53 19:52	07:52-08:39/47 19:52	07:41 18:43	17:48-17:58/10 16:44 16:17
12	05:22 21:40	06:05 20:56	06:54 19:49	07:55-08:39/44 19:49	07:43 18:41	17:46-17:58/12 16:42 16:17
13	05:23 21:39	06:07 20:54	06:56 19:47	08:08-08:37/29 07:58-08:02/4	07:45 18:39	17:46-17:58/12 16:41 16:17
14	05:24 21:38	06:08 20:52	06:58 19:45	08:09-08:37/28 19:45	07:46 18:37	17:46-17:58/12 16:41-16:57/10 16:39 16:17
15	05:25 21:37	06:10 20:50	06:59 19:42	08:08-08:35/27 19:42	07:48 18:35	17:46-17:58/12 16:44-16:59/15 16:38 16:17
16	05:27 21:36	06:12 20:48	07:01 19:40	08:10-08:34/24 19:40	07:50 18:32	17:46-17:55/9 16:42-17:00/18 16:37 16:17
17	05:28 21:35	06:13 20:46	07:02 19:38	08:10-08:32/22 19:38	07:51 18:30	17:49-17:53/4 16:41-17:01/20 16:35 16:17
18	05:29 21:34	06:15 20:44	07:04 19:35	08:12-08:30/18 19:35	07:53 18:28	16:40-17:01/21 16:34 16:18
19	05:30 21:33	06:16 20:42	07:06 19:33	08:13-08:27/14 19:33	07:55 18:26	16:39-17:02/23 16:33 16:18
20	05:32 21:32	06:18 20:40	07:07 19:31	07:22-07:45/23 19:31	07:57 18:24	16:39-17:02/23 16:31 16:18
21	05:33 21:31	06:19 20:38	07:09 19:29	07:21-07:45/24 19:29	07:58 18:22	16:38-17:01/23 16:30 16:19
22	05:34 21:29	06:21 20:36	07:10 19:26	07:50-07:57/7 20:36	08:00 18:20	16:38-17:01/23 16:29 16:19
23	05:35 21:28	06:23 20:34	07:12 19:24	08:01-08:02/1 20:34	08:02 18:18	16:38-17:01/23 16:28 16:20
24	05:37 21:27	06:24 20:31	07:14 19:22	07:19-08:08/49 20:31	08:04 18:16	16:39-17:00/21 16:27 16:20
25	05:38 21:25	06:26 20:29	07:15 19:19	07:19-08:09/50 20:29	07:05 17:14	15:39-16:00/21 16:26 16:21
26	05:40 21:24	06:27 20:27	07:17 19:17	07:19-08:11/52 20:27	07:07 17:12	15:40-15:59/19 16:25 16:22
27	05:41 21:23	06:29 20:25	07:18 19:15	07:19-08:11/52 20:25	07:09 17:10	15:41-15:57/16 16:24 16:22
28	05:42 21:21	06:31 20:23	07:20 19:12	07:20-08:13/53 20:23	07:11 17:08	15:43-15:55/12 16:23 16:23
29	05:44 21:20	06:32 20:21	07:22 19:10	07:20-08:13/53 20:21	07:12 17:06	15:46-15:52/6 16:23 16:24
30	05:45 21:18	06:34 20:18	07:23 19:08	07:21-08:15/54 20:18	07:14 17:04	16:23 16:22 16:25
31	05:47 21:17	06:35 20:16	08:22-08:30/8 07:23-08:15/52	08:22-08:30/8 07:23-08:15/52	07:16 17:02	16:22 16:26 16:26
	Sonnenscheinstunden	499	452	381	332	268
	Anzahl Minuten mit Schatten	0	593	909	402	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 07 - (8251110) NORDEX N29-250 250-45 29.7 !-! NH: 50,0 m (Ges:64,8 m) (7)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:16	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
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	16:28	17:16	18:07	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:21
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:07	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
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	16:32	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:54	16:19
6	08:30	07:57	07:02	06:52	05:51	05:12	05:17	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:14	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:19
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	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:35	05:37	05:09	05:24	06:09	06:58	07:46	07:40	08:23
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17	08:24	07:38	06:38	06:28	05:33	05:08	05:28	06:13	07:02	07:52	07:45	08:26
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:36	18:28	16:34	16:18
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20	08:21	07:32	06:31	06:22	05:29	05:09	05:32	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:38	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:32	16:19
21	08:20	07:30	06:29	06:20	05:27	05:09	05:33	06:20	07:09	07:58	07:52	08:28
	16:55	17:51	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:31	16:19
22	08:19	07:28	06:26	06:18	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
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23	08:17	07:26	06:24	06:16	05:25	05:09	05:36	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:43	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:14	05:24	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
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26	08:14	07:19	06:17	06:10	05:21	05:10	05:40	06:28	07:17	07:07	08:00	08:30
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28	08:11	07:15	06:13	06:06	05:19	05:11	05:43	06:31	07:20	07:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:13	17:08	16:24	16:23
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	17:11		19:54	20:46	21:30	21:46	21:18	20:19	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:03		16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	0	0	0

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

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Sonnenuntergang (SS:MM) Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 08 - (8251176) NORDEX N29-250 250-45 29.7 !-! NH: 50,0 m (Ges:64,8 m) (8)
Voraussetzungen für Berechnung des Schattenwurfs

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

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	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
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	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:49	16:18
9	08:29	07:52	06:56	06:46	05:45	05:10	05:19	06:01	06:50	07:38	07:32	08:18
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10	08:29	07:51	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:31	18:21	20:13	21:02	21:41	21:41	20:59	19:54	18:46	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:10	05:21	06:04	06:53	07:41	07:35	08:20
	16:40	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:55	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:35	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
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15	08:25	07:41	06:42	06:32	05:36	05:09	05:26	06:10	06:59	07:48	07:42	08:24
	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
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24	08:16	07:23	06:22	06:14	05:24	05:09	05:37	06:24	07:14	08:04	07:57	08:30
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26	08:14	07:19	06:17	06:10	05:21	05:10	05:40	06:28	07:17	07:07	08:00	08:30
	17:04	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	17:12	16:25	16:22
27	08:12	07:17	06:15	06:08	05:20	05:11	05:41	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	17:10	16:24	16:23
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Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 09 - (9111291) DEWIND D6/64-1,25MW 1250 64.0 !O! NH: 91,5 m (Ges:123,5 m) (9)
Voraussetzungen für Berechnung des Schattenwurfs

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
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	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:56	16:53	16:19
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	16:33	17:23	18:13	20:06	20:55	21:37	21:44	21:07	20:03	18:54	16:52	16:18
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	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
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	16:36	17:28	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
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15	08:25	07:41	06:42	06:32	05:35	05:08	05:25	06:10	06:59	07:48	07:42	08:24
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16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:17
19	08:22	07:33	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:31	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:50	08:28
	16:53	17:48	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:29	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:28	18:22	16:30	16:19
22	08:18	07:27	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:22	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:33	19:24	18:18	16:28	16:20
24	08:16	07:23	06:21	06:13	05:23	05:09	05:37	06:24	07:13	08:03	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:57	18:46	20:37	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	08:07	08:00	08:30
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:52	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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) Schattende/Minuten mit Schatten
Sonnenuntergang (SS:MM) Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 11 - (9138727) FUHLÄNDER FL-MD77 1500 77.0 !-! NH: 100,0 m (Ges:138,5 m) (11)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:36	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:27	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:13	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	07:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	07:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA 12** - (9139150) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (12)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	08:05 17:14	07:13 08:00-08:22/22 18:05 17:30-17:39/9	07:03 19:58	06:00 20:47	05:15 21:32
2	08:31 16:28	08:04 17:16	07:11 07:53-08:22/29 18:06 17:30-17:41/11	07:01 19:59	05:58 20:49	05:15 21:33
3	08:31 16:29	08:02 17:18	07:09 07:50-08:22/32 18:08 17:31-17:43/12	06:59 20:01	05:56 20:51	05:14 21:34
4	08:31 16:30	08:01 17:19	07:06 07:48-08:21/33 18:10 17:31-17:44/13	06:57 20:03	05:54 20:52	05:13 21:35
5	08:31 16:32	07:59 17:21	07:04 07:47-08:20/33 18:12 17:34-17:46/12	06:54 20:04	05:52 20:54	05:12 21:36
6	08:30 15:25-15:30/5 16:33	07:57 17:23	07:02 07:47-08:18/31 18:13 17:35-17:45/10	06:52 20:06	05:50 20:56	05:12 21:37
7	08:30 15:24-15:32/8 16:34	07:56 16:49-16:55/6 17:25	07:00 07:47-08:17/30 18:15 17:38-17:40/2	06:50 20:08	05:49 20:57	05:11 21:38
8	08:30 15:23-15:33/10 16:35	07:54 16:48-16:56/8 17:27	06:58 07:47-08:16/29 18:17	06:48 20:09	05:47 20:59	05:11 21:39
9	08:29 15:24-15:35/11 16:37	07:52 16:47-16:57/10 17:29	06:55 07:46-08:12/26 18:19 07:33-07:37/4	06:45 20:11	05:45 21:00	05:10 21:40
10	08:29 15:23-15:36/13 16:38	07:50 16:47-16:57/10 17:30	06:53 07:46-08:04/18 18:20 07:30-07:41/11	06:43 20:13	05:44 21:02	05:10 21:41
11	08:28 15:23-15:36/13 16:39	07:49 08:38-08:48/10 17:32 16:47-16:57/10	06:51 07:47-08:03/16 18:22 07:28-07:42/14	06:41 20:14	05:42 21:03	05:09 21:41
12	08:27 15:22-15:37/15 16:41	07:47 08:35-08:50/15 17:34 16:47-16:56/9	06:49 07:48-08:01/13 18:24 07:23-07:42/19	06:39 20:16	05:40 21:05	05:09 21:42
13	08:27 16:06-16:09/3 16:42 15:23-15:39/16	07:45 08:34-08:51/17 17:36 16:48-16:55/7	06:47 07:50-07:59/9 18:26 07:20-07:43/23	06:37 20:18	05:39 21:07	05:09 21:43
14	08:26 16:07-16:11/4 16:44 15:23-15:39/16	07:43 08:33-08:52/19 17:38	06:44 07:19-07:43/24 18:27	06:34 20:19	05:37 21:08	05:09 21:43
15	08:25 16:07-16:13/6 16:45 15:23-15:40/17	07:41 08:33-08:54/21 17:40	06:42 07:18-07:43/25 18:29	06:32 20:21	05:36 21:10	05:08 21:44
16	08:24 16:07-16:15/8 16:47 15:23-15:40/17	07:39 08:32-08:54/22 17:41	06:40 07:16-07:42/26 18:31	06:30 20:23	05:34 21:11	05:08 21:44
17	08:24 16:07-16:16/9 16:48 15:24-15:41/17	07:37 08:32-08:55/23 17:43 17:03-17:11/8	06:37 07:16-07:42/26 18:32	06:28 20:24	05:33 21:13	05:08 21:45
18	08:23 16:08-16:16/8 16:50 15:24-15:41/17	07:35 08:31-08:54/23 17:45 17:02-17:13/11	06:35 07:16-07:41/25 18:34	06:26 20:26	05:31 21:14	05:08 21:45
19	08:22 16:08-16:15/7 16:52 15:23-15:41/18	07:34 08:31-08:54/23 17:01-17:13/12 17:47 17:17-17:19/2	06:33 07:16-07:38/22 18:36	06:24 20:28	05:30 21:15	05:08 21:46
20	08:21 16:09-16:15/6 16:53 15:24-15:41/17	07:32 08:31-08:54/23 17:01-17:14/13 17:49 17:16-17:21/5	06:31 07:16-07:35/19 18:37	06:22 20:29	05:29 21:17	05:08 21:46
21	08:20 16:11-16:15/4 16:55 15:25-15:41/16	07:30 08:31-08:53/22 17:01-17:14/13 17:50 17:15-17:23/8	06:28 07:18-07:30/12 18:39	06:20 20:31	05:27 21:18	05:09 21:46
22	08:18 15:26-15:42/16 16:57	07:28 08:32-08:53/21 17:01-17:13/12 17:52 17:15-17:24/9	06:26 07:20-07:28/8 18:41	06:18 20:33	05:26 21:20	05:09 21:46
23	08:17 15:26-15:41/15 16:58	07:25 08:33-08:52/19 17:15-17:24/9 17:54 08:10-08:16/6 17:02-17:13/11	06:24 18:42	06:15 20:34	05:25 21:21	05:09 21:47
24	08:16 15:27-15:40/13 17:00	07:23 08:34-08:50/16 17:25-17:30/5 17:04-17:11/7 17:56 08:07-08:19/12 17:16-17:23/7	06:22 18:44	06:13 20:36	05:23 21:22	05:09 21:47
25	08:15 15:29-15:40/11 17:02	07:21 08:36-08:48/12 17:25-17:32/7 17:58 08:06-08:21/15 17:18-17:21/3	06:19 18:46	06:11 20:38	05:22 21:24	05:10 21:47
26	08:14 15:31-15:38/7 17:03	07:19 08:40-08:44/4 17:23-17:32/9 17:59 08:04-08:22/18	06:17 18:48	06:09 20:39	05:21 21:25	05:10 21:47
27	08:12 17:05	07:17 08:01-08:22/21 17:33-17:35/2 18:01 17:24-17:31/7	06:15 18:49	06:07 20:41	05:20 21:26	05:10 21:47
28	08:11 17:07	07:15 08:00-08:22/22 17:31-17:37/6 18:03 17:25-17:30/5	06:12 18:51	06:05 20:42	05:19 21:28	05:11 21:47
29	08:10 17:09		07:10 19:53	06:04 20:44	05:18 21:29	05:11 21:46
30	08:08 17:10		07:08 19:54	06:02 20:46	05:17 21:30	05:12 21:46
31	08:07 17:12		07:06 19:56		05:16 21:31	
Sonneneinstrahlung	261	279	367	415	483	496
Anzahl Minuten mit Schatten	343	615	648	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 12 - (9139150) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (12)
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:25 08:28-08:40/12	07:18 16:16-16:27/11	08:08 15:05-15:18/13
	21:46	21:15	20:14	19:06 08:01-08:22/21	17:01	16:21
2	05:13	05:50	06:39	07:26 08:26-08:41/15	07:19 16:17-16:26/9	08:09 15:06-15:19/13
	21:46	21:13	20:12	19:03 08:05-08:21/16	16:59	16:21
3	05:14	05:51	06:40	07:28 08:25-08:42/17	07:21 16:17-16:26/9	08:10 15:07-15:18/11
	21:45	21:12	20:10	19:01 08:07-08:19/12	16:57	16:20
4	05:15	05:53	06:42	07:30 08:43-08:48/5 08:09-08:17/8	07:23 16:19-16:25/6	08:12 15:08-15:18/10
	21:45	21:10	20:07	18:59 08:24-08:42/18	16:55	16:19
5	05:16	05:54	06:43	07:31 08:23-08:51/28	07:25	08:13 15:09-15:17/8
	21:44	21:08	20:05	18:57	16:54	16:19
6	05:16	05:56	06:45	07:33 08:22-08:52/30	07:26	08:14 15:11-15:16/5
	21:44	21:07	20:03	18:54	16:52	16:19
7	05:17	05:57	06:46	07:35 08:23-08:54/31	07:28	08:15
	21:43	21:05	20:01	18:52 18:12-18:20/8	16:50	16:18
8	05:18	05:59	06:48	07:36 08:22-08:54/32	07:30	08:17
	21:43	21:03	19:58	18:50 18:10-18:21/11	16:49	16:18
9	05:19	06:01	06:50	07:38 08:23-08:55/32	07:32	08:18
	21:42	21:01	19:56	18:48 18:07-18:20/13	16:47	16:18
10	05:20	06:02	06:51	07:40 08:24-08:56/32	07:33	08:19
	21:41	20:59	19:54	18:45 18:05-18:18/13	16:45	16:17
11	05:21	06:04	06:53	07:41 08:25-08:56/31	07:35	08:20
	21:41	20:57	19:52	18:43 18:03-18:16/13	16:44	16:17
12	05:22	06:05	06:54	07:43 08:27-08:56/29	07:37	08:21
	21:40	20:56	19:49	18:41 18:03-18:13/10	16:42	16:17
13	05:23	06:07	06:56	07:45 08:33-08:56/23	07:39	08:22
	21:39	20:54	19:47	18:39 18:04-18:11/7	16:41	16:17
14	05:24	06:08	06:58	07:46 08:34-08:55/21 18:05-18:09/4	07:40	08:23
	21:38	20:52	19:45	18:37 17:58-18:04/6	16:39	16:17
15	05:25	06:10	06:59	07:48 08:35-08:55/20	07:42	08:24
	21:37	20:50	19:42	18:35 17:57-18:05/8	16:38	16:17
16	05:27	06:12	07:01	07:50 09:09-09:18/9 17:56-18:04/8	07:44 15:03-15:11/8	08:25
	21:36	20:48	19:40	18:32 08:36-08:53/17	16:37	16:17
17	05:28	06:13	07:02	07:51 09:07-09:20/13 17:56-18:02/6 17:37-17:40/3	07:45 15:02-15:13/11	08:26
	21:35	20:46	19:38	18:30 08:38-08:52/14 17:48-17:53/5	16:35	16:17
18	05:29	06:15	07:04	07:53 09:05-09:22/17 17:57-18:00/3 17:34-17:43/9	07:47 15:01-15:14/13	08:26
	21:34	20:44	19:35	18:28 08:40-08:50/10 17:47-17:55/8	16:34	16:18
19	05:30	06:16	07:06	07:55 09:04-09:23/19 17:33-17:44/11	07:49 15:01-15:16/15	08:27
	21:33	20:42	19:33	18:26 17:46-17:55/9	16:33	16:18
20	05:32	06:18	07:07	07:57 09:03-09:24/21	07:50 15:01-15:17/16	08:28
	21:32	20:40	19:31	18:24 17:33-17:54/21	16:32	16:18
21	05:33	06:19	07:09 08:06-08:12/6	07:58 09:02-09:24/22 17:31-17:44/13	07:52 15:46-15:50/4	08:28
	21:31	20:38	19:29	18:22 17:45-17:53/8	16:30 15:01-15:17/16	16:19
22	05:34	06:21	07:10 08:03-08:14/11	08:00 09:01-09:24/23 17:31-17:44/13	07:54 15:45-15:51/6	08:29
	21:29	20:36	19:26	18:20 17:46-17:51/5	16:29 15:00-15:17/17	16:19
23	05:35	06:23	07:12 08:01-08:18/17	08:02 09:01-09:24/23 17:32-17:44/12	07:55 15:45-15:52/7	08:29
	21:28	20:34	19:24	18:18 17:48-17:49/1	16:28 15:00-15:18/18	16:20
24	05:37	06:24	07:14 08:00-08:21/21	08:04 09:01-09:24/23	07:57 15:45-15:53/8	08:30
	21:27	20:31	19:22	18:16 17:33-17:43/10	16:27 15:01-15:18/17	16:20
25	05:38	06:26	07:15 07:59-08:23/24	07:05 08:02-08:24/22	07:59 15:45-15:53/8	08:30
	21:25	20:29	19:19	17:14 16:35-16:41/6	16:26 15:01-15:18/17	16:21
26	05:40	06:27	07:17 07:59-08:24/25	07:07 08:02-08:24/22	08:00 15:45-15:53/8	08:30
	21:24	20:27	19:17	17:12	16:25 15:01-15:18/17	16:22
27	05:41	06:29	07:18 07:58-08:24/26	07:09 08:03-08:23/20	08:02 15:46-15:52/6	08:31
	21:23	20:25	19:15	17:10	16:24 15:02-15:19/17	16:22
28	05:42	06:31	07:20 07:58-08:24/26	07:10 08:03-08:21/18	08:03 15:46-15:50/4	08:31
	21:21	20:23	19:12	17:08 16:20-16:22/2	16:23 15:02-15:18/16	16:23
29	05:44	06:32	07:22 07:58-08:23/25	07:12 08:04-08:20/16	08:05 15:48-15:50/2	08:31
	21:20	20:21	19:10	17:06 16:18-16:25/7	16:23 15:03-15:19/16	16:24
30	05:45	06:34	07:23 08:31-08:37/6	07:14 08:05-08:19/14	08:06 15:04-15:19/15	08:31
	21:18	20:18	19:08 07:59-08:23/24	17:04 16:17-16:26/9	16:22	16:25
31	05:47	06:35		07:16 08:08-08:17/9		08:31
	21:17	20:16		17:02 16:16-16:26/10		16:26
Sonnenscheinstunden	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	211	1037	317	60

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 13 - (9140523) FUHLÄNDER FL-MD77 1500 77.0 !-! NH: 100,0 m (Ges:138,5 m) (13)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:36	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:28	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:13	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	08:07	08:00	08:31
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:11	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 14 - (9140539) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (14)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:36	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
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	16:38	17:30	18:20	20:13	21:02	21:41	21:42	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:04	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
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13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
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14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
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	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:36	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:28	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
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	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:13	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	08:07	08:00	08:31
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	0	0	0

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

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Sonnenuntergang (SS:MM) Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattenende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 15 - (9140540) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (15)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
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	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
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	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
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	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
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10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:03	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:51	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
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14	08:26	07:43	06:44	06:34	05:37	05:08	05:24	06:08	06:57	07:46	07:40	08:23
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15	08:25	07:41	06:42	06:32	05:35	05:08	05:25	06:10	06:59	07:48	07:42	08:24
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	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
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	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
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	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 16 - (9140541) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (16)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
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	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 17 - (9140543) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (17)
Voraussetzungen für Berechnung des Schattenwurfs

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

- Die Sonne scheint täglich von Sonnenauf- bis -untergang
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Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

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	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:17
19	08:22	07:33	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:31	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
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	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:28	18:22	16:30	16:19
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	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
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	17:02	17:57	18:46	20:37	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:52	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 19 - (9140545) ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (19)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:36	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:57	19:51	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
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15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
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23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:33	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:13	08:03	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 20 - (9140546) ENERCON E-48 800 48.0 !O! NH: 75,6 m (Ges:99,6 m) (20)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
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10	08:29	07:50	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
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21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
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	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	08:07	08:00	08:31
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 28 - (9974503) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (28)
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 09:48-09:56/8	08:05 16:41-16:44/3	07:13	07:03	06:00	05:15
	16:27 09:30-09:45/15	17:14	18:05	19:58	20:47	21:32
2	08:31 09:50-09:56/6 09:17-09:19/2	08:04 16:40-16:46/6	07:11	07:01	05:58	05:15
	16:28 09:30-09:46/16	17:16	18:06	19:59	20:49	21:33
3	08:31 09:52-09:55/3 09:16-09:22/6	08:02 16:41-16:49/8	07:09	06:59	05:56	05:14
	16:29 09:31-09:47/16 15:53-15:55/2	17:18	18:08	20:01	20:51	21:34
4	08:31 09:31-09:46/15 15:53-15:56/3	08:01 16:42-16:50/8	07:06	06:57	05:54	05:13
	16:30 09:15-09:22/7	17:20	18:10	20:03	20:52	21:35
5	08:31 09:32-09:47/15 15:53-15:58/5	07:59 16:42-16:52/10	07:04	06:54	05:52	05:12
	16:32 09:15-09:24/9	17:21	18:12	20:04	20:54	21:36
6	08:30 09:32-09:47/15 15:53-15:59/6	07:57 16:43-16:53/10	07:02	06:52	05:51	05:12
	16:33 09:14-09:25/11	17:23	18:13	20:06	20:56	21:37
7	08:30 09:33-09:48/15 15:53-16:00/7	07:56 16:46-16:53/7	07:00	06:50	05:49	05:11
	16:34 09:15-09:26/11	17:25	18:15	20:08	20:57	21:38
8	08:30 09:34-09:47/13 15:53-16:01/8	07:54 16:47-16:52/5	06:58	06:48	05:47	05:11
	16:35 09:14-09:27/13	17:27	18:17	20:09	20:59	21:39
9	08:29 09:35-09:48/13 15:54-16:02/8	07:52	06:55	06:45	05:45	05:10
	16:37 09:15-09:28/13	17:29	18:19	20:11	21:00	21:40
10	08:29 09:36-09:47/11 15:54-16:04/10	07:50 16:59-17:02/3	06:53	06:43	05:44	05:10
	16:38 09:15-09:28/13	17:30	18:20	20:13	21:02	21:41
11	08:28 09:36-09:47/11 15:54-16:05/11	07:49 16:59-17:04/5	06:51	06:41	05:42	05:10
	16:39 09:14-09:29/15	17:32	18:22	20:14	21:03	21:41
12	08:27 09:37-09:46/9 15:54-16:06/12	07:47 16:59-17:05/6	06:49	06:39	05:40	05:09
	16:41 09:14-09:29/15	17:34	18:24	20:16	21:05	21:42
13	08:27 09:40-09:46/6 09:08-09:14/6	07:45 17:01-17:04/3	06:47	06:37	05:39	05:09
	16:42 09:15-09:31/16 15:55-16:07/12	17:36	18:26	20:18	21:07	21:43
14	08:26 09:07-09:31/24	07:43	06:44	06:34	05:37	05:09
	16:44 15:57-16:08/11	17:38	18:27	20:19	21:08	21:43
15	08:25 09:07-09:31/24	07:41	06:42	06:32	05:36	05:09
	16:45 15:58-16:09/11	17:40	18:29	20:21	21:10	21:44
16	08:24 09:06-09:32/26	07:39	06:40	06:30	05:34	05:08
	16:47 15:59-16:09/10	17:41	18:31	20:23	21:11	21:44
17	08:24 09:06-09:32/26	07:37	06:37	06:28	05:33	05:08
	16:48 15:59-16:10/11	17:43	18:32	20:24	21:13	21:45
18	08:23 09:06-09:32/26	07:35	06:35	06:26	05:31	05:08
	16:50 16:00-16:10/10	17:45	18:34	20:26	21:14	21:45
19	08:22 09:05-09:31/26	07:34	06:33	06:24	05:30	05:08
	16:52 16:00-16:09/9	17:47	18:36	20:28	21:15	21:46
20	08:21 09:05-09:31/26	07:32	06:31	06:22	05:29	05:08
	16:53 16:01-16:09/8	17:49	18:37	20:29	21:17	21:46
21	08:20 09:06-09:31/25	07:30	06:28	06:20	05:27	05:09
	16:55 16:03-16:08/5	17:50	18:39	20:31	21:18	21:46
22	08:18 09:07-09:30/23	07:27	06:26	06:18	05:26	05:09
	16:57	17:52	18:41	20:33	21:20	21:46
23	08:17 09:23-09:29/6	07:25	06:24	06:15	05:25	05:09
	16:58 09:07-09:22/15	17:54	18:42	20:34	21:21	21:47
24	08:16 09:07-09:21/14	07:23	06:22	06:13	05:24	05:09
	17:00 16:28-16:29/1	17:56	18:44	20:36	21:22	21:47
25	08:15 09:08-09:21/13	07:21	06:19	06:11	05:22	05:10
	17:02 16:28-16:31/3	17:58	18:46	20:38	21:24	21:47
26	08:14 09:09-09:20/11	07:19	06:17	06:09	05:21	05:10
	17:03 16:27-16:32/5	17:59	18:48	20:39	21:25	21:47
27	08:12 09:11-09:20/9	07:17	06:15	06:07	05:20	05:10
	17:05 16:27-16:35/8	18:01	18:49	20:41	21:26	21:47
28	08:11 09:12-09:18/6	07:15	06:12	06:05	05:19	05:11
	17:07 16:27-16:36/9	18:03	18:51	20:42	21:28	21:47
29	08:10 16:28-16:38/10		07:10	06:04	05:18	05:11
	17:09		19:53	20:44	21:29	21:46
30	08:08 16:29-16:37/8		07:08	06:02	05:17	05:12
	17:10		19:54	20:46	21:30	21:46
31	08:07 16:33-16:37/4		07:06		05:16	
	17:12		19:56		21:31	
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	831	74	0	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:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 28 - (9974503) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (28)
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13 21:46	05:48 21:15	06:37 20:14	07:25 19:06	07:18 16:29-16:31/2 17:01	08:08 09:19-09:29/10 15:36-15:47/11 16:21 08:56-09:11/15
2	05:13 21:46	05:50 21:13	06:39 20:12	07:26 19:03	07:19 16:59	08:09 09:19-09:30/11 15:37-15:47/10 16:21 08:58-09:12/14
3	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	07:21 16:17-16:22/5 16:57	08:10 09:18-09:31/13 15:37-15:45/8 16:20 08:58-09:11/13
4	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	07:23 16:15-16:23/8 16:55	08:12 09:19-09:32/13 15:37-15:45/8 16:19 08:59-09:12/13
5	05:16 21:44	05:54 21:08	06:43 20:05	07:31 18:57	07:25 16:13-16:24/11 16:54	08:13 09:18-09:33/15 15:38-15:46/8 16:19 09:00-09:11/11
6	05:16 21:44	05:56 21:07	06:45 20:03	07:33 18:54	07:26 16:12-16:21/9 16:52	08:14 09:18-09:33/15 15:39-15:45/6 16:19 09:00-09:11/11
7	05:17 21:43	05:57 21:05	06:46 20:01	07:35 18:52	07:28 16:11-16:20/9 16:50	08:15 09:19-09:34/15 15:39-15:44/5 16:18 09:02-09:11/9
8	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	07:30 16:11-16:18/7 16:49	08:17 09:19-09:34/15 15:41-15:44/3 16:18 09:03-09:11/8
9	05:19 21:42	06:01 21:01	06:50 19:56	07:38 18:48	07:32 16:11-16:17/6 16:47	08:18 09:40-09:43/3 09:04-09:10/6 16:18 09:19-09:35/16 15:42-15:44/2
10	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:45	07:33 16:12-16:15/3 16:45	08:19 09:39-09:45/6 09:06-09:09/3 16:17 09:20-09:35/15
11	05:21 21:41	06:04 20:57	06:53 19:52	07:41 18:43	07:35 16:04-16:08/4 16:44	08:20 09:38-09:46/8 16:17 09:20-09:36/16
12	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:01-16:09/8 16:42	08:21 09:38-09:47/9 16:17 09:20-09:36/16
13	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:39 16:00-16:10/10 16:41	08:22 09:38-09:48/10 16:17 09:21-09:36/15
14	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37	07:40 08:45-08:51/6 16:39 16:00-16:09/9	08:23 09:38-09:49/11 16:17 09:21-09:37/16
15	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:35	07:42 08:43-08:53/10 16:38 15:59-16:07/8	08:24 09:38-09:50/12 16:17 09:22-09:37/15
16	05:27 21:36	06:12 20:48	07:01 19:40	07:50 18:32	07:44 08:42-08:53/11 16:37 16:00-16:05/5	08:25 09:39-09:50/11 16:17 09:22-09:38/16
17	05:28 21:35	06:13 20:46	07:02 19:38	07:51 18:30	07:45 08:41-08:54/13 16:35 16:01-16:04/3	08:26 09:23-09:51/28 16:17
18	05:29 21:34	06:15 20:44	07:04 19:35	07:53 18:28	07:47 08:41-08:55/14 16:34 16:02-16:03/1	08:26 09:39-09:51/12 16:18 09:23-09:38/15
19	05:30 21:33	06:16 20:42	07:06 19:33	07:55 18:26	07:49 08:57-09:03/6 16:33 08:41-08:56/15	08:27 09:24-09:52/28 16:18
20	05:32 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:50 08:42-09:05/23 16:32	08:28 09:24-09:53/29 16:18
21	05:33 21:31	06:19 20:38	07:09 19:29	07:58 18:22	07:52 08:42-09:07/25 16:30 15:38-15:43/5	08:28 09:24-09:53/29 16:19
22	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 08:42-09:07/25 16:29 15:37-15:45/8	08:29 09:25-09:54/29 16:19
23	05:36 21:28	06:23 20:34	07:12 19:24	08:02 18:18	07:55 08:42-09:08/26 16:28 15:37-15:46/9	08:29 09:25-09:54/29 16:20
24	05:37 21:27	06:24 20:31	07:14 19:22	08:04 18:16	07:57 08:43-09:09/26 16:27 15:37-15:47/10	08:30 09:27-09:55/28 16:20
25	05:38 21:25	06:26 20:29	07:15 19:19	07:05 17:14	07:59 08:44-09:10/26 16:26 15:36-15:47/11	08:30 09:27-09:55/28 16:21
26	05:40 21:24	06:27 20:27	07:17 19:17	07:07 17:12	08:00 08:44-09:10/26 16:25 15:37-15:47/10	08:30 09:27-09:55/28 16:22
27	05:41 21:23	06:29 20:25	07:18 19:15	07:09 17:10	08:02 08:46-09:11/25 16:24 15:37-15:48/11	08:31 09:27-09:55/28 16:22
28	05:42 21:21	06:31 20:23	07:20 19:12	07:10 17:08	08:03 08:47-09:11/24 16:23 15:36-15:47/11	08:31 09:44-09:55/11 16:23 09:28-09:43/15
29	05:44 21:20	06:32 20:21	07:22 19:10	07:12 16:30-16:34/4 17:06	08:05 09:20-09:26/6 15:36-15:48/12 16:23 08:48-09:11/23	08:31 09:45-09:56/11 16:24 09:28-09:44/16
30	05:45 21:18	06:34 20:18	07:23 19:08	07:14 16:29-16:35/6 17:04	08:06 09:20-09:28/8 15:37-15:48/11 16:22 08:56-09:11/15	08:31 09:45-09:56/11 16:25 09:28-09:44/16
31	05:47 21:17	06:35 20:16	07:16 19:02	16:29-16:33/4 17:02	16:22 08:56-09:11/15 17:02	08:31 09:46-09:56/10 16:26 09:29-09:45/16
Sonneneinstrahlung	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	14	559	883

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA: WEA 29 - (9974504) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (29)**
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 09:49-10:04/15 16:27	08:05 16:43-16:44/1 17:14	07:13 07:03 18:05 19:58	06:00 20:47 21:32	05:15 21:46 21:15	05:13 20:14 20:14	05:48 19:06 19:06	06:37 17:25 17:25	07:25 16:26-16:31/5 17:01	08:08 16:21 16:21	07:18 16:26-16:30/4 17:01	08:09 16:21 16:21
2	08:31 09:50-10:05/15 16:28	08:04 16:42-16:46/4 17:16	07:11 07:01 18:06 19:59	05:58 20:49 21:33	05:15 21:46 21:13	05:13 20:12 20:12	05:48 19:03 19:03	06:37 17:28 17:28	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
3	08:31 09:51-10:05/14 16:29	08:02 16:43-16:49/6 17:18	07:09 06:59 18:08 20:01	05:56 20:51 21:34	05:14 21:45 21:12	05:11 20:10 20:10	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
4	08:31 09:51-10:05/14 16:30	08:01 16:43-16:50/7 17:20	07:06 06:57 18:04 20:03	05:54 20:52 21:35	05:13 21:45 21:10	05:11 20:07 20:07	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
5	08:31 09:52-10:05/13 16:32	07:59 16:44-16:48/4 17:21	07:04 06:54 18:12 20:04	05:52 20:54 21:36	05:12 21:44 21:08	05:10 20:05 20:05	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
6	08:30 09:52-10:04/12 16:33	07:57 17:23 17:23	07:02 06:52 18:13 20:06	05:51 20:56 21:37	05:12 21:44 21:07	05:10 20:03 20:03	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
7	08:30 09:54-10:05/11 16:34	07:56 17:25 17:25	07:00 06:50 18:15 20:08	05:49 20:57 21:38	05:11 21:43 21:05	05:10 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
8	08:30 09:55-10:04/9 16:35	07:54 16:57-16:58/1 17:29	06:58 06:48 18:17 20:09	05:47 20:59 21:39	05:11 21:43 21:03	05:10 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
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15	08:25 16:45 16:45	07:41 17:40 17:40	06:42 06:32 18:29 20:21	05:36 21:10 21:44	05:09 21:44 21:37	05:08 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
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17	08:24 16:48 16:48	07:37 17:43 17:43	06:38 06:28 18:32 20:24	05:33 21:13 21:45	05:08 21:45 21:35	05:07 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
18	08:23 16:50 16:50	07:36 17:45 17:45	06:35 06:26 18:34 20:26	05:31 21:14 21:45	05:08 21:45 21:34	05:07 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
19	08:22 16:16-16:19/3 16:52	07:34 17:47 17:47	06:33 06:24 18:36 20:28	05:30 21:15 21:46	05:08 21:46 21:33	05:07 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
20	08:21 16:16-16:21/5 16:53	07:32 17:49 17:49	06:31 06:22 18:37 20:29	05:29 21:17 21:46	05:08 21:46 21:32	05:07 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
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23	08:17 16:17-16:26/9 16:58	07:25 17:54 17:54	06:24 06:15 18:43 20:34	05:25 21:21 21:47	05:09 21:47 21:28	05:08 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
24	08:16 16:18-16:29/11 17:00	07:23 17:56 17:56	06:22 06:13 18:44 20:36	05:24 21:22 21:47	05:09 21:47 21:27	05:08 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
25	08:15 16:20-16:23/3 17:02	07:21 17:58 17:58	06:19 06:11 18:46 20:38	05:22 21:23 21:47	05:08 21:47 21:25	05:07 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
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27	08:12 16:23-16:32/9 17:05	07:17 18:01 18:01	06:15 06:07 18:49 20:41	05:20 21:26 21:47	05:10 21:47 21:23	05:09 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
28	08:11 16:23-16:32/9 17:07	07:15 18:03 18:03	06:12 06:05 18:51 20:42	05:19 21:27 21:47	05:11 21:47 21:21	05:10 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
29	08:10 16:25-16:32/7 17:09	07:14 18:04 18:04	06:10 06:04 18:53 20:44	05:18 21:28 21:46	05:11 21:46 21:20	05:10 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
30	08:08 16:25-16:31/6 17:11	07:13 18:06 18:06	06:08 06:02 19:54 20:46	05:17 21:30 21:46	05:12 21:46 21:18	05:11 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
31	08:07 17:12 17:12	07:12 18:07 18:07	06:06 06:00 19:56 20:46	05:16 21:31 21:46	05:11 21:46 21:17	05:10 20:01 20:01	05:47 19:01 19:01	06:37 17:30 17:30	07:21 16:27-16:28/1 16:28	08:10 09:41-09:46/5 16:20	07:19 16:26-16:30/4 17:01	08:09 16:21 16:21
Sonnenscheinstunden 261 200 279 367 415 483 496 499 452 381 332 268 246												
Anzahl Minuten mit Schatten 261 200 279 367 415 483 496 499 452 381 332 268 246												

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 30 - (9974505) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (30)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:13	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:15	05:13	05:50	06:39	07:27	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:21
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:20	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:13	05:16	05:54	06:43	07:31	07:25	08:13
	16:32	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:54	16:19
6	08:30	07:57	07:02	06:52	05:51	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:14	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:19
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:47	07:35	07:28	08:15
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:49	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:01	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:18
10	08:29	07:50	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:31	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:46	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:10	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:35	05:37	05:09	05:24	06:08	06:58	07:46	07:40 16:00-16:05/5	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:09	05:25	06:10	06:59	07:48	07:42 16:00-16:07/7	08:24
	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:27	06:12	07:01	07:50	07:44 15:59-16:05/6	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:33	16:37	16:17
17	08:24	07:37	06:38	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45 15:59-16:04/5	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:18
18	08:23	07:36	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47 16:00-16:03/3	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:52	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:29	05:08	05:32	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:32	16:18
21	08:20	07:30	06:28	06:20	05:27	05:09	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:18	07:28	06:26	06:18	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:57	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:16	05:25	05:09	05:36	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:43	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16 16:26-16:29/3	07:23	06:22	06:13	05:24	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15 16:26-16:31/5	07:21	06:19	06:11	05:22	05:10	05:38	06:26	07:15	07:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	20:29	19:19	17:14	16:26	16:21
26	08:14 16:26-16:32/6	07:19	06:17	06:09	05:21	05:10	05:40	06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	17:12	16:25	16:22
27	08:12 16:27-16:34/7	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	17:10	16:24	16:22
28	08:11 16:27-16:32/5	07:15	06:13	06:06	05:19	05:11	05:43	06:31	07:20	07:11	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:13	17:08	16:24	16:23
29	08:10		07:10	06:04	05:18	05:12	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:46	21:20	20:21	19:10	17:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:11		19:54	20:46	21:30	21:46	21:18	20:18	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	26	0	0	0	0	0	0	0	0	0	26	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 31 - (9974506) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (31)
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 09:55-10:21/26 16:27	08:05 09:51-10:00/9 09:01-09:12/11 17:14 09:13-09:36/23	07:13 07:03 18:05 19:58	06:00 05:50	05:15	05:15
2	08:31 09:56-10:22/26 16:28	08:04 08:59-09:36/37 17:16	07:11 07:01 18:06 19:59	05:58 20:49	05:15 21:33	05:15
3	08:31 09:57-10:23/26 16:29	08:02 08:59-09:37/38 17:18 16:45-16:49/4	07:09 06:59 18:08 20:01	05:56 20:51	05:14 21:34	05:14
4	08:31 09:56-10:23/27 16:30	08:01 08:57-09:37/40 17:20 16:44-16:50/6	07:06 06:57 18:10 20:03	05:54 20:52	05:13 21:35	05:13
5	08:31 09:57-10:24/27 16:32	07:59 08:57-09:37/40 17:21 16:44-16:52/8	07:04 06:54 18:12 20:04	05:52 20:54	05:12 21:36	05:12
6	08:30 09:57-10:24/27 16:33	07:57 08:57-09:37/40 17:23 16:44-16:52/8	07:02 06:52 18:13 20:06	05:51 20:56	05:12 21:37	05:12
7	08:30 09:58-10:25/27 16:34	07:56 08:56-09:37/41 17:25 16:45-16:52/7	07:00 06:50 18:15 20:08	05:49 20:57	05:11 21:38	05:11
8	08:30 09:58-10:25/27 15:45-15:48/3 16:35	07:54 08:56-09:36/40 17:27 16:46-16:51/5	06:58 06:48 18:17 20:09	05:47 20:59	05:11 21:39	05:11
9	08:29 09:59-10:26/27 15:44-15:50/6 16:37	07:52 08:56-09:35/39 17:29	06:55 06:45 18:19 20:11	05:45 21:00	05:10 21:40	05:10
10	08:29 09:59-10:26/27 15:44-15:51/7 16:38	07:50 08:56-09:33/37 17:30 16:56-17:02/6	06:53 06:43 18:20 20:13	05:44 21:02	05:10 21:41	05:10
11	08:28 09:41-10:26/45 16:39	07:49 08:56-09:31/35 17:32 16:55-17:04/9	06:51 06:41 18:22 20:14	05:42 21:03	05:10 21:41	05:10
12	08:27 09:40-10:26/46 16:41	07:47 09:23-09:27/4 16:55-17:04/9 17:34 08:56-09:18/22	06:49 06:39 18:24 20:16	05:40 21:05	05:09 21:42	05:09
13	08:27 09:41-10:27/46 16:42	07:45 08:57-09:17/20 17:36 16:55-17:04/9	06:47 06:37 18:26 20:18	05:39 21:07	05:09 21:43	05:09
14	08:26 09:41-10:27/46 16:44	07:43 08:59-09:17/18 16:55-17:04/9 17:38 17:08-17:10/2	06:44 06:34 18:27 20:19	05:37 21:08	05:09 21:43	05:09
15	08:25 09:41-10:27/46 15:44-15:55/11 16:45	07:41 09:00-09:16/16 16:56-17:03/7 17:40 17:07-17:12/5	06:42 06:32 18:29 20:21	05:36 21:10	05:09 21:44	05:09
16	08:24 09:41-10:27/46 15:44-15:56/12 16:47	07:39 09:02-09:14/12 16:58-17:01/3 17:41 17:07-17:14/7	06:40 06:30 18:31 20:23	05:34 21:11	05:08 21:44	05:08
17	08:24 09:41-10:27/46 15:44-15:56/12 16:48	07:37 09:05-09:11/6 17:43 17:08-17:14/6	06:38 06:28 18:32 20:24	05:33 21:13	05:08 21:45	05:08
18	08:23 09:41-10:27/46 15:45-15:57/12 16:50	07:36 17:09-17:13/4 17:45	06:35 06:26 18:34 20:26	05:31 21:14	05:08 21:45	05:08
19	08:22 09:40-10:26/46 15:45-15:56/11 16:52	07:34 17:16-17:19/3 17:47	06:33 06:24 18:36 20:28	05:30 21:15	05:08 21:46	05:08
20	08:21 09:40-10:26/46 15:45-15:56/11 16:53	07:32 17:16-17:21/5 17:49	06:31 06:22 18:37 20:29	05:29 21:17	05:08 21:46	05:08
21	08:20 10:07-10:26/19 15:47-15:56/9 16:55	07:30 17:16-17:23/7 17:50	06:28 06:20 18:39 20:31	05:27 21:18	05:09 21:46	05:09
22	08:18 10:09-10:25/16 15:48-15:55/7 16:57	07:28 17:20-17:26/6 17:52	06:26 06:18 18:41 20:33	05:26 21:20	05:09 21:46	05:09
23	08:17 10:11-10:24/13 16:58	07:25 17:21-17:28/7 17:54	06:24 06:15 18:43 20:34	05:25 21:21	05:09 21:47	05:09
24	08:16 10:13-10:22/9 09:18-09:27/9 17:00	07:23 17:21-17:30/9 17:56	06:22 06:13 18:44 20:36	05:24 21:22	05:09 21:47	05:09
25	08:15 09:43-10:06/23 17:02	07:21 17:24-17:31/7 17:58	06:19 06:11 18:46 20:38	05:22 21:24	05:10 21:47	05:10
26	08:14 09:43-10:06/23 17:03	07:19 17:26-17:30/4 17:59	06:17 06:09 18:48 20:39	05:21 21:25	05:10 21:47	05:10
27	08:12 09:44-10:06/22 17:05	07:17 18:01	06:15 06:07 18:49 20:41	05:20 21:26	05:11 21:47	05:11
28	08:11 09:44-10:05/21 17:07	07:15 18:03	06:12 06:05 18:51 20:42	05:19 21:28	05:11 21:47	05:11
29	08:10 09:46-10:05/19 17:09	07:14 18:04	06:10 06:04 19:10 20:44	05:18 21:29	05:11 21:46	05:11
30	08:08 09:47-10:03/16 17:11	07:13 18:05	06:08 06:02 19:53 20:46	05:17 21:30	05:12 21:46	05:12
31	08:07 09:49-10:02/13 09:04-09:09/5 17:12	07:12 09:13-09:36/23 18:06	06:06 06:00 19:56 21:31	05:16 21:31	05:12 21:46	05:12
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	1405	690	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 31 - (9974506) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (31)
Voraussetzungen für Berechnung des Schattenwurfs

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

	July	August	September	Oktober		November		Dezember
1	05:13 21:46	05:48 21:15	06:37 20:14	07:25 19:06		07:18 08:26-09:03/37 17:01 16:26-16:31/5		08:08 09:23-10:08/45 16:21 15:25-15:34/9
2	05:13 21:46	05:50 21:13	06:39 20:12	07:27 19:03		07:19 08:26-09:04/38 16:59		08:09 09:42-10:09/27 15:27-15:34/7 16:21 09:24-09:41/17
3	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01		07:21 08:26-09:05/39 16:57 16:15-16:21/6		08:10 09:42-10:09/27 15:27-15:33/6 16:20 09:25-09:40/15
4	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59		07:23 08:26-09:06/40 16:55 16:15-16:22/7		08:12 09:43-10:10/27 15:30-15:33/3 16:19 09:27-09:40/13
5	05:16 21:44	05:54 21:08	06:43 20:05	07:31 18:57		07:25 08:27-09:07/40 16:54 16:14-16:22/8		08:13 09:43-10:10/27 16:19 09:28-09:39/11
6	05:16 21:44	05:56 21:07	06:45 20:03	07:33 18:54		07:26 08:27-09:07/40 16:52 16:13-16:21/8		08:14 09:43-10:10/27 16:19 09:29-09:38/9
7	05:17 21:43	05:57 21:05	06:46 20:01	07:35 18:52		07:28 08:27-09:07/40 16:50 16:14-16:20/6		08:15 09:44-10:11/27 16:18 09:32-09:38/6
8	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50		07:30 08:29-09:07/38 16:49 16:15-16:18/3		08:17 09:44-10:11/27 16:18
9	05:19 21:42	06:01 21:01	06:50 19:56	07:38 18:48		07:32 08:30-09:07/37 16:47		08:18 09:45-10:11/26 16:18
10	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:45		07:33 09:22-09:31/9 16:45 08:32-09:07/35		08:19 09:45-10:11/26 16:17
11	05:21 21:41	06:04 20:58	06:53 19:52	07:41 18:43		07:35 09:20-09:33/13 08:35-08:40/5 16:44 08:44-09:07/23		08:20 09:46-10:11/25 16:17
12	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41		07:37 09:19-09:35/16 16:42 08:45-09:07/22		08:21 09:46-10:11/25 16:17
13	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39		07:39 09:18-09:37/19 16:41 08:45-09:07/22		08:22 10:44-10:49/5 16:17 09:47-10:12/25
14	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37		07:40 09:17-09:38/21 16:39 08:46-09:06/20		08:23 10:44-10:51/7 16:17 09:47-10:12/25
15	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:35		07:42 09:17-09:39/22 16:38 08:48-09:06/18		08:24 10:43-10:52/9 16:17 09:48-10:13/25
16	05:27 21:36	06:12 20:48	07:01 19:40	07:50 17:56-18:02/6 18:32		07:44 09:16-09:39/23 16:37 08:48-09:04/16		08:25 10:43-10:54/11 16:17 09:49-10:13/24
17	05:28 21:35	06:13 20:46	07:02 19:38	07:51 17:54-18:02/8 18:30		07:45 09:16-09:39/23 16:35 08:50-09:03/13		08:26 10:44-10:55/11 16:17 09:49-10:14/25
18	05:29 21:34	06:15 20:44	07:04 19:35	07:53 17:52-18:00/8 18:28		07:47 09:47-09:56/9 08:52-09:01/9 16:34 09:16-09:40/24		08:26 10:43-10:55/12 16:18 09:49-10:13/24
19	05:30 21:33	06:16 20:42	07:06 19:33	07:55 17:52-17:58/6 18:26		07:49 09:45-09:58/13 16:33 09:16-09:41/25		08:27 10:44-10:56/12 16:18 09:50-10:14/24
20	05:32 21:32	06:18 20:40	07:07 19:31	07:57 17:48-17:55/7 18:24		07:50 09:44-10:00/16 15:23-15:30/7 16:32 09:16-09:41/25		08:28 10:44-10:57/13 16:18 09:51-10:15/24
21	05:33 21:31	06:19 20:38	07:09 19:29	07:58 17:47-17:53/6 18:22		07:52 09:43-10:02/19 15:23-15:32/9 16:30 09:17-09:42/25		08:28 10:44-10:57/13 16:19 09:51-10:15/24
22	05:34 21:29	06:21 20:36	07:10 19:26	08:00 17:46-17:51/5 18:20		07:54 09:17-10:02/45 15:22-15:32/10 16:29 15:50-15:53/3		08:29 10:45-10:58/13 16:19 09:52-10:16/24
23	05:36 21:28	06:23 20:34	07:12 19:24	08:02 17:46-17:49/3 18:18		07:55 09:17-10:03/46 15:22-15:33/11 16:28 15:49-15:55/6		08:29 10:45-10:58/13 16:20 09:52-10:16/24
24	05:37 21:27	06:24 20:31	07:14 19:22	08:04 17:39-17:44/5 18:16		07:57 09:18-10:04/46 15:22-15:34/12 16:27 15:49-15:55/6		08:30 10:47-10:59/12 16:20 09:53-10:17/24
25	05:38 21:25	06:26 20:29	07:15 19:19	08:33-08:42/9 17:14 16:38-16:45/7		07:59 09:19-10:05/46 15:21-15:33/12 16:26 15:49-15:53/4		08:30 10:47-10:59/12 16:21 09:53-10:17/24
26	05:40 21:24	06:27 20:27	07:17 19:17	08:31-08:44/13 16:27-16:32/5 18:20		08:00 09:19-10:05/46 15:22-15:34/12 16:25 15:49-15:53/4		08:30 10:47-10:59/12 16:22 09:53-10:17/24
27	05:41 21:23	06:29 20:25	07:18 19:15	08:29-08:46/17 16:25-16:33/8 17:10 16:37-16:41/4		08:02 09:20-10:06/46 15:23-15:35/12 16:24 15:50-15:52/2		08:31 10:48-10:59/11 16:22 09:54-10:18/24
28	05:42 21:21	06:31 20:23	07:20 19:12	08:27-08:46/19 16:24-16:34/10 17:08 16:38-16:39/1		08:03 09:20-10:06/46 16:23 15:22-15:34/12		08:31 10:49-10:59/10 16:23 09:54-10:18/24
29	05:44 21:20	06:32 20:21	07:22 19:10	08:26-08:47/21 17:06 16:24-16:34/10		08:05 09:21-10:07/46 16:23 15:24-15:34/10		08:31 10:50-10:58/8 16:24 09:54-10:19/25
30	05:45 21:18	06:34 20:18	07:23 19:08	07:14 08:51-08:58/7 16:24-16:34/10 17:04 08:26-08:48/22		08:06 09:22-10:08/46 16:22 15:25-15:35/10		08:31 10:51-10:58/7 16:25 09:54-10:19/25
31	05:47 21:17	06:35 20:16		07:16 08:26-09:01/35 17:02 16:25-16:33/8				08:31 10:54-10:57/3 16:26 09:55-10:20/25
Sonnenscheinstunden	499	452	381	332		268		246
Anzahl Minuten mit Schatten	0	0	0	266		1432		1089

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:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

KÖTTER Consulting Engineers GmbH & Co. KG
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388**SHADOW - Kalender pro WEA****Berechnung:** Gesamtbelastung **WEA: WEA 32 - (9974507) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (32)**
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:47	05:15 21:32	05:13 21:46	05:48 21:15	06:37 20:14	07:25 19:06	07:18 16:24-16:31/7	08:08 16:21
2	08:31 16:28	08:04 16:45-16:46/1 17:16	07:11 18:06	07:01 19:59	05:58 20:49	05:15 21:33	05:13 21:46	05:50 21:13	06:39 20:12	07:27 19:03	07:19 16:24-16:30/6	08:09 16:21
3	08:31 16:29	08:02 16:46-16:49/3 17:18	07:09 18:08	06:59 20:01	05:56 20:51	05:14 21:34	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:01	07:21 16:25-16:28/3	08:10 16:20
4	08:31 16:30	08:01 16:46-16:50/4 17:20	07:06 18:10	06:57 20:03	05:54 20:52	05:13 21:35	05:15 21:45	05:53 21:10	06:42 20:07	07:30 18:59	07:23 16:55	08:12 16:19
5	08:31 16:32	07:59 16:46-16:51/5 17:21	07:04 18:12	06:54 20:04	05:52 20:54	05:13 21:36	05:16 21:44	05:54 21:08	06:43 20:05	07:31 18:57	07:25 16:18-16:21/3	08:13 16:19
6	08:30 16:33	07:57 16:47-16:50/3 17:23	07:02 18:14	06:52 20:06	05:51 20:56	05:12 21:37	05:16 21:44	05:56 21:07	06:45 20:03	07:33 18:54	07:26 16:16-16:21/5	08:14 16:19
7	08:30 16:34	07:56 16:56-16:57/1 17:25	07:00 18:15	06:50 20:08	05:49 20:57	05:11 21:38	05:17 21:43	05:57 21:05	06:47 20:01	07:35 18:52	07:28 16:15-16:20/5	08:16 16:18
8	08:30 16:35	07:54 16:55-16:58/3 17:27	06:58 18:17	06:48 20:09	05:47 20:59	05:11 21:39	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	07:30 16:15-16:18/3	08:17 16:18
9	08:29 16:37	07:52 16:55-17:00/5 17:29	06:55 18:19	06:45 20:11	05:45 21:00	05:10 21:40	05:19 21:42	06:01 21:01	06:50 19:56	07:38 18:48	07:32 16:47	08:18 16:18
10	08:29 16:38	07:50 16:55-17:02/7 17:31	06:53 18:20	06:43 20:13	05:44 21:02	05:10 21:41	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:46	07:33 16:45	08:19 16:17
11	08:28 16:39	07:49 16:55-17:01/6 17:32	06:51 18:22	06:41 20:14	05:42 21:03	05:10 21:41	05:21 21:41	06:04 20:58	06:53 19:52	07:41 18:43	07:35 16:44	08:20 16:17
12	08:27 16:00-16:03/3 16:41	07:47 16:57-16:59/2 17:34	06:49 18:24	06:39 20:16	05:40 21:05	05:09 21:42	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:42	08:21 16:17
13	08:27 16:00-16:06/6 16:42	07:45 17:36	06:47 18:26	06:37 20:18	05:39 21:07	05:09 21:43	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:39 16:41	08:22 16:17
14	08:26 16:00-16:07/7 16:44	07:43 17:38	06:44 18:27	06:35 20:19	05:37 21:08	05:09 21:43	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37	07:40 16:39	08:23 16:17
15	08:25 15:59-16:07/8 16:45	07:41 17:40	06:42 18:29	06:32 20:21	05:36 21:10	05:09 21:44	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:35	07:42 16:38	08:24 16:17
16	08:24 15:59-16:08/9 16:47	07:39 17:41	06:40 18:31	06:30 20:23	05:34 21:11	05:08 21:44	05:27 21:36	06:12 20:48	07:01 19:40	07:50 18:33	07:44 16:37	08:25 16:17
17	08:24 16:00-16:09/9 16:48	07:37 17:43	06:38 18:32	06:28 20:24	05:33 21:13	05:08 21:45	05:28 21:35	06:13 20:46	07:02 19:38	07:52 18:30	07:45 16:35	08:26 16:17
18	08:23 16:00-16:09/9 16:50	07:36 17:45	06:35 18:34	06:26 20:26	05:31 21:14	05:08 21:45	05:29 21:34	06:15 20:44	07:04 19:36	07:53 18:28	07:47 16:34	08:26 16:18
19	08:22 15:59-16:09/10 16:52	07:34 17:47	06:33 18:36	06:24 20:28	05:30 21:15	05:08 21:46	05:30 21:33	06:16 20:42	07:06 19:33	07:55 18:26	07:49 16:33	08:27 16:18
20	08:21 16:00-16:09/9 16:53	07:32 17:49	06:31 18:37	06:22 20:29	05:29 21:17	05:08 21:46	05:32 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:50 15:38-15:43/5	08:28 16:18
21	08:20 16:01-16:09/8 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 21:18	05:09 21:46	05:33 21:31	06:19 20:38	07:09 19:29	07:58 18:22	07:52 15:37-15:45/8	08:28 16:19
22	08:19 16:03-16:08/5 16:57	07:28 17:52	06:26 18:41	06:18 20:33	05:26 21:20	05:09 21:46	05:34 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 15:36-15:45/9	08:29 16:19
23	08:17 16:58	07:25 17:54	06:24 18:43	06:16 20:34	05:25 21:21	05:09 21:47	05:36 21:28	06:23 20:34	07:12 19:24	08:02 18:18	07:55 15:37-15:46/9	08:29 16:20
24	08:16 17:00	07:23 17:56	06:22 18:44	06:13 20:36	05:24 21:22	05:09 21:47	05:37 21:27	06:24 20:31	07:14 19:22	08:04 18:16	07:57 15:37-15:46/9	08:30 16:20
25	08:15 17:02	07:21 17:58	06:19 18:46	06:11 20:38	05:22 21:24	05:10 21:47	05:38 21:25	06:26 20:29	07:15 19:19	07:05 17:14	07:59 15:37-15:46/9	08:30 16:21
26	08:14 17:03	07:19 17:59	06:17 18:48	06:09 20:39	05:21 21:25	05:10 21:47	05:40 21:24	06:27 20:27	07:17 19:17	07:07 17:12	08:00 15:37-15:46/9	08:30 16:22
27	08:12 17:05	07:17 18:01	06:15 18:49	06:07 20:41	05:20 21:26	05:10 21:47	05:41 21:23	06:29 20:25	07:18 19:15	07:09 17:10	08:02 15:38-15:47/9	08:31 16:24
28	08:11 17:07	07:15 18:03	06:13 18:51	06:06 20:43	05:19 21:28	05:11 21:47	05:43 21:21	06:31 20:23	07:20 19:13	07:11 17:08	08:03 15:39-15:46/7	08:31 16:23
29	08:10 17:09		07:10 19:53	06:04 20:44	05:18 21:29	05:11 21:46	05:44 21:20	06:32 20:21	07:22 19:10	07:12 17:06	08:05 15:40-15:46/6	08:31 16:24
30	08:08 17:11		07:08 19:54	06:02 20:46	05:17 21:30	05:12 21:46	05:45 21:18	06:34 20:18	07:23 19:08	07:14 17:04	16:26-16:30/4	08:31 16:25
31	08:07 17:12		07:06 19:56		05:16 21:31		05:47 21:17	06:35 20:16		07:16 17:02	16:25-16:31/6	08:31 16:26
Sonnenscheinstunden	261	279	367	415	483	496	499	452	381	332	268	246
Anzahl Minuten mit Schatten	83	40	0	0	0	0	0	0	0	10	115	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) Schattenanfang	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenanfang
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenanfang

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 33 - (9974508) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (33)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:47	05:15 21:32
2	08:31 16:28	08:04 17:16	07:11 18:06	07:01 19:59	05:58 20:49	05:15 21:33
3	08:31 16:29	08:02 17:18	07:09 18:08	06:59 20:01	05:56 20:51	05:14 21:34
4	08:31 16:30	08:01 17:19	07:06 18:10	06:57 20:03	05:54 20:52	05:13 21:35
5	08:31 16:31	07:59 17:21	07:04 18:12	06:54 20:04	05:52 20:25-20:26/1 20:54	05:12 21:36
6	08:30 16:33	07:57 17:23	07:02 18:13	06:52 20:06	05:50 20:25-20:27/2 20:56	05:12 21:37
7	08:30 16:34	07:56 17:25	07:00 18:15	06:50 20:08	05:49 20:24-20:28/4 20:57	05:11 21:38
8	08:30 16:35	07:54 17:27	06:58 18:17	06:48 20:09	05:47 20:23-20:30/7 20:59	05:11 21:39
9	08:29 16:37	07:52 17:29	06:55 18:19	06:45 20:11	05:45 20:21-20:31/10 21:00	05:10 21:40
10	08:29 16:38	07:51 17:30	06:53 18:20	06:43 20:13	05:44 20:21-20:33/12 21:02	05:10 21:41
11	08:28 16:39	07:49 17:32	06:51 18:22	06:41 20:14	05:42 20:20-20:34/14 21:03	05:09 21:41
12	08:27 16:41	07:47 17:34	06:49 18:24	06:39 20:16	05:40 20:20-20:36/16 21:05	05:09 21:42
13	08:27 16:42	07:45 17:36	06:47 18:26	06:37 20:18	05:39 20:19-20:35/16 21:07	05:09 21:43
14	08:26 16:44	07:43 17:38	06:44 18:27	06:34 19:52-19:53/1 20:19	05:37 20:19-20:36/17 21:08	05:09 21:43
15	08:25 16:45	07:41 17:40	06:42 18:29	06:32 19:52-19:54/2 20:21	05:36 20:19-20:35/16 21:10	05:08 21:44
16	08:24 16:47	07:39 17:41	06:40 18:31	06:30 19:53-19:56/3 20:23	05:34 20:19-20:36/17 21:11	05:08 21:44
17	08:24 16:48	07:37 17:43	06:38 18:32	06:28 20:24	05:33 20:20-20:36/16 21:13	05:08 21:45
18	08:23 16:50	07:36 17:45	06:35 18:34	06:26 20:26	05:31 20:19-20:35/16 21:14	05:08 21:45
19	08:22 16:52	07:34 17:47	06:33 18:36	06:24 20:28	05:30 20:20-20:34/14 21:16	05:08 21:46
20	08:21 16:53	07:32 17:49	06:31 18:37	06:22 20:29	05:29 20:21-20:34/13 21:17	05:08 21:46
21	08:20 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 20:22-20:33/11 21:18	05:09 21:46
22	08:19 16:57	07:28 17:52	06:26 18:41	06:18 20:33	05:26 20:24-20:32/8 21:20	05:09 21:46
23	08:17 16:58	07:25 17:54	06:24 18:43	06:15 20:34	05:25 20:26-20:31/5 21:21	05:09 21:47
24	08:16 17:00	07:23 17:56	06:22 18:44	06:13 20:36	05:23 21:22	05:09 21:47
25	08:15 17:02	07:21 17:58	06:19 18:46	06:11 20:38	05:22 21:24	05:10 21:47
26	08:14 17:03	07:19 17:59	06:17 18:48	06:09 20:39	05:21 21:25	05:10 21:47
27	08:12 17:05	07:17 18:01	06:15 18:49	06:07 20:41	05:20 21:26	05:10 21:47
28	08:11 17:07	07:15 18:03	06:12 18:51	06:05 20:43	05:19 21:28	05:11 21:47
29	08:10 17:09		07:10 19:53	06:03 20:44	05:18 21:29	05:11 21:47
30	08:08 17:10		07:08 19:54	06:02 20:46	05:17 21:30	05:12 21:46
31	08:07 17:12		07:06 19:56		05:16 21:31	
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	0	0	1	6	215	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
Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattenende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
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SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 33 - (9974508) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (33)

Voraussetzungen für Berechnung des Schattenwurfs

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	05:13 21:46	05:48 20:30-20:46/16 21:15	06:37 20:14	07:25 19:06	07:18 17:01	08:08 16:21
2	05:13 21:46	05:50 20:30-20:44/14 21:13	06:39 20:12	07:27 19:03	07:19 16:59	08:09 16:21
3	05:14 21:45	05:51 20:30-20:42/12 21:12	06:40 20:10	07:28 19:01	07:21 16:57	08:10 16:20
4	05:15 21:45	05:53 20:32-20:41/9 21:10	06:42 20:07	07:30 18:59	07:23 16:55	08:12 16:19
5	05:15 21:45	05:54 20:33-20:39/6 21:08	06:43 20:05	07:31 18:57	07:25 16:54	08:13 16:19
6	05:16 21:44	05:56 20:36-20:38/2 21:07	06:45 20:03	07:33 18:54	07:26 16:52	08:14 16:18
7	05:17 21:43	05:57 20:35-20:36/1 21:05	06:46 20:01	07:35 18:52	07:28 16:50	08:16 16:18
8	05:18 21:43	05:59 21:03	06:48 19:58	07:36 18:50	07:30 16:49	08:17 16:18
9	05:19 21:42	06:01 21:01	06:50 19:56	07:38 18:48	07:32 16:47	08:18 16:18
10	05:20 21:41	06:02 20:59	06:51 19:54	07:40 18:45	07:33 16:45	08:19 16:17
11	05:21 21:41	06:04 20:58	06:53 19:52	07:41 18:43	07:35 16:44	08:20 16:17
12	05:22 21:40	06:05 20:56	06:54 19:49	07:43 18:41	07:37 16:42	08:21 16:17
13	05:23 21:39	06:07 20:54	06:56 19:47	07:45 18:39	07:39 16:41	08:22 16:17
14	05:24 21:38	06:08 20:52	06:58 19:45	07:46 18:37	07:40 16:39	08:23 16:17
15	05:25 21:37	06:10 20:50	06:59 19:42	07:48 18:35	07:42 16:38	08:24 16:17
16	05:27 21:36	06:11 20:48	07:01 19:40	07:50 18:32	07:44 16:37	08:25 16:17
17	05:28 21:35	06:13 20:46	07:02 19:38	07:52 18:30	07:45 16:35	08:26 16:17
18	05:29 21:34	06:15 20:44	07:04 19:35	07:53 18:28	07:47 16:34	08:26 16:18
19	05:30 21:33	06:16 20:42	07:06 19:33	07:55 18:26	07:49 16:33	08:27 16:18
20	05:31 21:32	06:18 20:40	07:07 19:31	07:57 18:24	07:51 16:31	08:28 16:18
21	05:33 20:34-20:41/7 21:31	06:19 20:38	07:09 19:29	07:58 18:22	07:52 16:30	08:28 16:19
22	05:34 20:33-20:42/9 21:29	06:21 20:36	07:10 19:26	08:00 18:20	07:54 16:29	08:29 16:19
23	05:35 20:32-20:44/12 21:28	06:23 20:34	07:12 19:24	08:02 18:18	07:55 16:28	08:29 16:20
24	05:37 20:31-20:45/14 21:27	06:24 20:31	07:14 19:22	08:04 18:16	07:57 16:27	08:30 16:20
25	05:38 20:30-20:45/15 21:25	06:26 20:29	07:15 18:52-18:53/1 19:19	07:05 17:14	07:59 16:26	08:30 16:21
26	05:40 20:30-20:45/15 21:24	06:27 20:27	07:17 18:49-18:50/1 19:17	07:07 17:12	08:00 16:25	08:30 16:22
27	05:41 20:30-20:46/16 21:23	06:29 19:55-19:58/3 20:25	07:18 19:15	07:09 17:10	08:02 16:24	08:31 16:22
28	05:42 20:29-20:46/17 21:21	06:31 19:54-19:56/2 20:23	07:20 19:12	07:11 17:08	08:03 16:23	08:31 16:23
29	05:44 20:29-20:46/17 21:20	06:32 19:53-19:54/1 20:21	07:22 19:10	07:12 17:06	08:05 16:23	08:31 16:24
30	05:45 20:30-20:46/16 21:18	06:34 20:18	07:23 19:08	07:14 17:04	08:06 16:22	08:31 16:25
31	05:47 20:29-20:46/17 21:17	06:35 20:16	07:24 19:06	07:16 17:02	08:07 16:21	08:31 16:26
Sonnenscheinstunden	500	452	381	332	268	246
Anzahl Minuten mit Schatten	155	66	2	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 34 - (9974509) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (34)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31	08:05	07:13		07:03		06:00	19:44-20:02/18	05:15
	16:27	17:14	18:05		19:58		20:47		21:32
2	08:31	08:04	07:11		07:01		05:58	19:44-20:00/16	05:15
	16:28	17:16	18:06		19:59		20:49		21:33
3	08:31	08:02	07:09		06:59	19:32-19:35/3	05:56	19:45-19:59/14	05:14
	16:29	17:18	18:08		20:01		20:51		21:34
4	08:31	08:01	07:06		06:57	19:32-19:37/5	05:54	19:46-19:57/11	05:13
	16:30	17:19	18:10		20:03		20:52		21:35
5	08:31	07:59	07:04	17:45-17:46/1	06:54	19:33-19:39/6	05:52	19:50-19:55/5	05:12
	16:31	17:21	18:12		20:04		20:54		21:36
6	08:30	07:57	07:02	17:45-17:48/3	06:52	19:33-19:40/7	05:50		05:12
	16:33	17:23	18:13		20:06		20:56		21:37
7	08:30	07:56	07:00	17:46-17:50/4	06:50	19:40-19:41/1	05:49		05:11
	16:34	17:25	18:15		20:08		20:57		21:38
8	08:30	07:54	06:58	17:48-17:50/2	06:48		05:47		05:11
	16:35	17:27	18:17		20:09		20:59		21:39
9	08:29	07:52	06:55		06:45	19:44-19:45/1	05:45		05:10
	16:37	17:29	18:19		20:11		21:00		21:40
10	08:29	07:50	06:53		06:43	19:45-19:47/2	05:44		05:10
	16:38	17:30	18:20		20:13		21:02		21:41
11	08:28	07:49	06:51		06:41	19:46-19:48/2	05:42		05:09
	16:39	17:32	18:22		20:14		21:03		21:41
12	08:27	07:47	06:49		06:39		05:40		05:09
	16:41	17:34	18:24		20:16		21:05		21:42
13	08:27	07:45	06:47		06:37		05:39		05:09
	16:42	17:36	18:26		20:18		21:07		21:43
14	08:26	07:43	06:44		06:34		05:37		05:09
	16:44	17:38	18:27		20:19		21:08		21:43
15	08:25	07:41	06:42		06:32		05:36		05:08
	16:45	17:40	18:29		20:21		21:10		21:44
16	08:24	07:39	06:40		06:30	19:55-19:56/1	05:34		05:08
	16:47	17:41	18:31		20:23		21:11		21:44
17	08:24	07:37	06:38		06:28		05:33		05:08
	16:48	17:43	18:32		20:24		21:13		21:45
18	08:23	07:36	06:35		06:26		05:31		05:08
	16:50	17:45	18:34		20:26		21:14		21:45
19	08:22	07:34	06:33		06:24		05:30		05:08
	16:52	17:47	18:36		20:28		21:16		21:46
20	08:21	07:32	06:31		06:22	19:54-19:56/2	05:29		05:08
	16:53	17:49	18:37		20:29		21:17		21:46
21	08:20	07:30	06:28		06:20	19:49-20:00/11	05:27		05:09
	16:55	17:50	18:39		20:31		21:18		21:46
22	08:19	07:28	06:26		06:18	19:47-20:01/14	05:26		05:09
	16:57	17:52	18:41		20:33		21:20		21:46
23	08:17	07:25	06:24		06:15	20:06-20:07/1	05:25		05:09
	16:58	17:54	18:43		20:34	19:46-20:02/16	21:21		21:47
24	08:16	07:23	06:22		06:13	20:05-20:09/4	05:23		05:09
	17:00	17:56	18:44		20:36	19:45-20:03/18	21:22		21:47
25	08:15	07:21	06:19		06:11	20:05-20:10/5	05:22		05:10
	17:02	17:58	18:46		20:38	19:44-20:03/19	21:24		21:47
26	08:14	07:19	06:17		06:09	20:05-20:12/7	05:21		05:10
	17:03	17:59	18:48		20:39	19:43-20:03/20	21:25		21:47
27	08:12	07:17	06:15		06:07	20:06-20:13/7	05:20		05:10
	17:05	18:01	18:49		20:41	19:43-20:03/20	21:26		21:47
28	08:11	07:15	06:12		06:05	20:07-20:13/6	05:19		05:11
	17:07	18:03	18:51		20:43	19:43-20:03/20	21:28		21:47
29	08:10		07:10		06:03	19:43-20:02/19	05:18		05:11
	17:09		19:53		20:44		21:29		21:47
30	08:08		07:08		06:02	19:43-20:01/18	05:17		05:12
	17:10		19:54		20:46		21:30		21:46
31	08:07		07:06				05:16		
	17:12		19:56				21:31		
Sonnenscheinstunden	261	279	367		415		483		496
Anzahl Minuten mit Schatten	0	0	10		235		64		

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:
216094-04 WP Brilon-Madfeld

 Lizenzierter Anwender:
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 Berechnet:
 18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 34 - (9974509) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (34)

Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48			06:37	19:46-19:48/2	07:25		07:18	08:08	
	21:46	21:15			20:14		19:06		17:01	16:21	
2	05:13	05:50			06:39	19:43-19:45/2	07:27		07:19	08:09	
	21:46	21:13			20:12		19:03		16:59	16:21	
3	05:14	05:51			06:40	19:42-19:43/1	07:28		07:21	08:10	
	21:45	21:12			20:10		19:01		16:57	16:20	
4	05:15	05:53			06:42		07:30		07:23	08:12	
	21:45	21:10			20:07		18:59		16:55	16:19	
5	05:15	05:54			06:43	19:37-19:39/2	07:31		07:25	08:13	
	21:45	21:08			20:05		18:57		16:54	16:19	
6	05:16	05:56			06:45	19:29-19:36/7	07:33	18:23-18:27/4	07:26	08:14	
	21:44	21:07			20:03		18:54		16:52	16:18	
7	05:17	05:57			06:46	19:28-19:34/6	07:35	18:22-18:25/3	07:28	08:16	
	21:43	21:05			20:01		18:52		16:50	16:18	
8	05:18	05:59	19:58-20:06/8		06:48	19:26-19:31/5	07:36	18:20-18:22/2	07:30	08:17	
	21:43	21:03			19:58		18:50		16:48	16:18	
9	05:19	06:01	19:55-20:07/12		06:50	19:26-19:30/4	07:38		07:32	08:18	
	21:42	21:01			19:56		18:48		16:47	16:18	
10	05:20	06:02	19:54-20:09/15		06:51	19:26-19:27/1	07:40		07:33	08:19	
	21:41	20:59			19:54		18:45		16:45	16:17	
11	05:21	06:04	19:53-20:09/16		06:53		07:41		07:35	08:20	
	21:41	20:58			19:52		18:43		16:44	16:17	
12	05:22	06:05	19:52-20:10/18		06:54		07:43		07:37	08:21	
	21:40	20:56			19:49		18:41		16:42	16:17	
13	05:23	06:07	19:51-20:10/19		06:56		07:45		07:39	08:22	
	21:39	20:54			19:47		18:39		16:41	16:17	
14	05:24	06:08	19:51-20:11/20		06:58		07:46		07:40	08:23	
	21:38	20:52			19:45		18:37		16:39	16:17	
15	05:25	06:10	20:14-20:21/7		06:59		07:48		07:42	08:24	
	21:37	20:50	19:50-20:10/20		19:42		18:35		16:38	16:17	
16	05:27	06:11	20:12-20:19/7		07:01		07:50		07:44	08:25	
	21:36	20:48	19:50-20:10/20		19:40		18:32		16:37	16:17	
17	05:28	06:13	20:12-20:18/6		07:02		07:51		07:45	08:26	
	21:35	20:46	19:50-20:10/20		19:38		18:30		16:35	16:17	
18	05:29	06:15	20:11-20:16/5		07:04		07:53		07:47	08:26	
	21:34	20:44	19:50-20:09/19		19:35		18:28		16:34	16:18	
19	05:30	06:16	20:11-20:14/3		07:06		07:55		07:49	08:27	
	21:33	20:42	19:51-20:08/17		19:33		18:26		16:33	16:18	
20	05:31	06:18	20:10-20:12/2		07:07		07:57		07:51	08:28	
	21:32	20:40	19:51-20:07/16		19:31		18:24		16:31	16:18	
21	05:33	06:19	19:52-20:06/14		07:09		07:58		07:52	08:28	
	21:31	20:38			19:29		18:22		16:30	16:19	
22	05:34	06:21	19:54-20:04/10		07:10		08:00		07:54	08:29	
	21:29	20:36			19:26		18:20		16:29	16:19	
23	05:35	06:23			07:12		08:02		07:55	08:29	
	21:28	20:34			19:24		18:18		16:28	16:20	
24	05:37	06:24			07:14		08:04		07:57	08:30	
	21:27	20:31			19:22		18:16		16:27	16:20	
25	05:38	06:26			07:15		07:05		07:59	08:30	
	21:25	20:29			19:19		17:14		16:26	16:21	
26	05:40	06:27			07:17		07:07		08:00	08:30	
	21:24	20:27			19:17		17:12		16:25	16:22	
27	05:41	06:29	19:57-19:58/1		07:18		07:09		08:02	08:31	
	21:23	20:25			19:15		17:10		16:24	16:22	
28	05:42	06:31			07:20		07:11		08:03	08:31	
	21:21	20:23			19:12		17:08		16:23	16:23	
29	05:44	06:32			07:22		07:12		08:05	08:31	
	21:20	20:21			19:10		17:06		16:23	16:24	
30	05:45	06:34			07:23		07:14		08:06	08:31	
	21:18	20:18			19:08		17:04		16:22	16:25	
31	05:47	06:35					07:16			08:31	
	21:17	20:16					17:02			16:26	
Sonnenscheinstunden		500	452		381		332		268	246	0
Anzahl Minuten mit Schatten		0	275		30		9		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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 35 - (9974510) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (35)
Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 16:27	08:05 17:14	07:13 18:05	17:38-17:39/1 19:58	06:00 20:47	20:14-20:20/6 21:32
2	08:31 16:28	08:04 17:16	07:11 18:06	17:37-17:41/4 19:59	05:58 20:49	20:14-20:21/7 21:33
3	08:31 16:29	08:02 17:18	07:09 18:08	17:36-17:43/7 20:01	05:56 20:51	20:15-20:22/7 21:34
4	08:31 16:30	08:01 17:19	07:06 18:10	17:35-17:44/9 20:03	05:54 20:52	05:42-05:44/2 21:35
5	08:31 16:31	07:59 17:21	07:04 18:12	17:35-17:46/11 20:04	05:52 20:54	05:41-05:44/3 21:36
6	08:30 16:33	07:57 17:23	07:02 18:13	17:36-17:46/10 20:06	05:50 20:56	05:41-05:45/4 21:37
7	08:30 16:34	07:56 17:25	07:00 18:15	17:37-17:44/7 20:08	05:49 20:57	05:40-05:45/5 21:38
8	08:30 16:35	07:54 17:27	06:58 18:17	19:38-19:43/5 20:09	05:47 20:59	05:40-05:46/6 21:39
9	08:29 16:37	07:52 17:29	06:55 18:19	19:37-19:45/8 20:11	05:45 21:00	05:39-05:46/7 21:40
10	08:29 16:38	07:50 17:30	06:53 18:20	19:36-19:47/11 20:13	05:44 21:02	05:39-05:46/7 21:41
11	08:28 16:39	07:49 17:32	06:51 18:22	19:35-19:48/13 20:14	05:42 21:03	05:39-05:47/8 21:41
12	08:27 16:41	07:47 17:34	06:49 18:24	19:35-19:49/14 20:16	05:40 21:05	05:39-05:48/9 21:42
13	08:27 16:42	07:45 17:36	06:47 18:26	19:35-19:51/16 20:18	05:39 21:07	05:38-05:47/9 21:43
14	08:26 16:44	07:43 17:38	06:44 18:27	19:36-19:53/17 20:19	05:37 21:08	05:38-05:48/10 21:43
15	08:25 16:45	07:41 17:40	06:42 18:29	19:48-19:54/6 20:21	05:36 21:10	20:23-20:39/16 21:44
16	08:24 16:47	07:39 17:41	06:40 18:31	19:49-19:56/7 20:23	05:34 21:11	20:23-20:40/17 21:44
17	08:24 16:48	07:37 17:43	06:37 18:32	19:50-19:58/8 20:24	05:33 21:13	20:24-20:40/16 21:45
18	08:23 16:50	07:35 17:45	06:35 18:34	19:51-19:59/8 20:26	05:31 21:14	20:24-20:39/15 21:45
19	08:22 16:52	07:34 17:47	06:33 18:36	19:51-20:00/9 20:28	05:30 21:15	20:24-20:39/15 21:46
20	08:21 16:53	07:32 17:49	06:31 18:37	19:53-19:57/4 20:29	05:28 21:17	20:25-20:38/13 21:46
21	08:20 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 21:18	20:26-20:38/12 21:46
22	08:19 16:57	07:28 17:52	06:26 18:41	20:03-20:06/3 20:33	05:26 21:20	20:28-20:37/9 21:46
23	08:17 16:58	07:25 17:54	06:24 18:42	20:03-20:07/4 20:34	05:25 21:21	20:28-20:34/6 21:47
24	08:16 17:00	07:23 17:56	06:22 18:44	20:03-20:09/6 20:36	05:23 21:22	05:39-05:50/11 21:47
25	08:15 17:02	07:21 17:58	06:19 18:46	20:03-20:10/7 20:38	05:22 21:24	05:40-05:51/11 21:47
26	08:14 17:03	07:19 17:59	06:17 18:48	20:04-20:11/7 20:39	05:21 21:25	05:40-05:50/10 21:47
27	08:12 17:05	07:17 18:01	06:15 18:49	20:06-20:08/2 20:41	05:20 21:26	05:41-05:51/10 21:47
28	08:11 17:07	07:15 18:03	06:12 18:51	20:13-20:15/2 20:42	05:19 21:28	05:41-05:51/10 21:47
29	08:10 17:09		07:10 19:53	20:13-20:16/3 20:44	05:18 21:29	05:42-05:51/9 21:46
30	08:08 17:10		07:08 19:54	20:13-20:17/4 20:46	05:17 21:30	05:42-05:51/9 21:46
31	08:07 17:12		07:06 19:56		05:16 21:31	
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	0	0	49	172	205	402

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA:** WEA 35 - (9974510) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (35)
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:43-05:51/8	05:48	20:35-20:46/11	06:37	19:35-19:48/13	07:25		07:18		08:08
	21:46		21:15		20:14		19:06		17:01		16:21
2	05:13	05:43-05:51/8	05:50	20:35-20:44/9	06:39	19:34-19:45/11	07:26		07:19		08:09
	21:46		21:13		20:12		19:03		16:59		16:21
3	05:14	05:44-05:51/7	05:51	20:35-20:42/7	06:40	19:35-19:43/8	07:28		07:21		08:10
	21:45		21:12		20:10		19:01		16:57		16:20
4	05:15	05:45-05:51/6	05:53	20:37-20:41/4	06:42	19:35-19:40/5	07:30		07:23		08:12
	21:45		21:10		20:07		18:59		16:55		16:19
5	05:15	05:46-05:51/5	05:54	20:38-20:39/1	06:43	19:38-19:39/1	07:31		07:25		08:13
	21:45		21:08		20:05		18:57		16:53		16:19
6	05:16	05:46-05:51/5	05:56		06:45		07:33	18:14-18:19/5	07:26		08:14
	21:44		21:07		20:03		18:54		16:52		16:18
7	05:17	05:47-05:50/3	05:57		06:46		07:35	18:12-18:21/9	07:28		08:16
	21:43		21:05		20:01		18:52		16:50		16:18
8	05:18	05:48-05:50/2	05:59		06:48		07:36	18:10-18:21/11	07:30		08:17
	21:43		21:03		19:58		18:50		16:48		16:18
9	05:19	05:49-05:50/1	06:00		06:50		07:38	18:10-18:20/10	07:32		08:18
	21:42		21:01		19:56		18:48		16:47		16:17
10	05:20		06:02	20:24-20:31/7	06:51		07:40	18:10-18:18/8	07:33		08:19
	21:41		20:59		19:54		18:45		16:45		16:17
11	05:21		06:04	20:22-20:29/7	06:53		07:41	18:10-18:16/6	07:35		08:20
	21:41		20:58		19:52		18:43		16:44		16:17
12	05:22		06:05	20:21-20:27/6	06:54		07:43	18:10-18:13/3	07:37		08:21
	21:40		20:56		19:49		18:41		16:42		16:17
13	05:23		06:07	20:21-20:25/4	06:56		07:45		07:39		08:22
	21:39		20:54		19:47		18:39		16:41		16:17
14	05:24		06:08	20:20-20:23/3	06:58		07:46		07:40		08:23
	21:38		20:52		19:45		18:37		16:39		16:17
15	05:25		06:10	20:21-20:22/1	06:59		07:48		07:42		08:24
	21:37		20:50		19:42		18:35		16:38		16:17
16	05:27		06:11	20:12-20:16/4	07:01		07:50		07:44		08:25
	21:36		20:48		19:40		18:32		16:37		16:17
17	05:28		06:13	20:10-20:18/8	07:02		07:51		07:45		08:26
	21:35		20:46		19:38		18:30		16:35		16:17
18	05:29		06:15	20:08-20:16/8	07:04		07:53		07:47		08:26
	21:34		20:44		19:35		18:28		16:34		16:18
19	05:30		06:16	20:08-20:14/6	07:06		07:55		07:49		08:27
	21:33		20:42		19:33		18:26		16:33		16:18
20	05:31	20:41-20:43/2	06:18	20:08-20:12/4	07:07		07:57		07:50		08:28
	21:32		20:40		19:31		18:24		16:31		16:18
21	05:33	20:38-20:46/8	06:19	20:08-20:10/2	07:09		07:58		07:52		08:28
	21:31		20:38		19:29		18:22		16:30		16:19
22	05:34	20:37-20:47/10	06:21		07:10		08:00		07:54		08:29
	21:29		20:36		19:26		18:20		16:29		16:19
23	05:35	20:36-20:48/12	06:23	19:57-20:01/4	07:12		08:02		07:55		08:29
	21:28		20:34		19:24		18:18		16:28		16:20
24	05:37	20:35-20:49/14	06:24	19:54-20:03/9	07:14		08:04		07:57		08:30
	21:27		20:31		19:22		18:16		16:27		16:20
25	05:38	20:35-20:49/14	06:26	19:53-20:02/9	07:15		07:05		07:59		08:30
	21:25		20:29		19:19		17:14		16:26		16:21
26	05:40	20:34-20:49/15	06:27	19:52-19:59/7	07:17		07:07		08:00		08:30
	21:24		20:27		19:17		17:12		16:25		16:22
27	05:41	20:34-20:50/16	06:29	19:50-19:58/8	07:18		07:09		08:02		08:31
	21:23		20:25	19:42-19:44/2	19:15		17:10		16:24		16:22
28	05:42	20:34-20:50/16	06:31	19:49-19:56/7	07:20		07:11		08:03		08:31
	21:21		20:23	19:39-19:47/8	19:12		17:08		16:23		16:23
29	05:44	20:33-20:49/16	06:32	19:36-19:54/18	07:22		07:12		08:05		08:31
	21:20		20:21		19:10		17:06		16:23		16:24
30	05:45	20:34-20:48/14	06:34	19:36-19:52/16	07:23		07:14		08:06		08:31
	21:18		20:18		19:08		17:04		16:22		16:25
31	05:47	20:34-20:47/13	06:35	19:35-19:49/14			07:16				08:31
	21:17		20:16				17:02				16:26
Sonnenscheinstunden	500		452		381		332		268		246
Anzahl Minuten mit Schatten	195		194		38		52		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:
216094-04 WP Brilon-Madfeld

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18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA**: WEA 36 - (9974511) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (36)
Voraussetzungen für Berechnung des Schattenwurfs

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

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Anzahl Minuten mit Schatten 0 279 367 415 483 496 500 452 381 332 268 246																																																																																												

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung **WEA: WEA 39 - (9974513) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (39)**
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:04-20:19/15	05:15 20:47	05:13 21:32	05:48 21:46	06:37 20:14	07:25 19:56	07:18 17:01	08:08 16:21
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3	08:31 16:29	08:02 17:18	07:09 18:08	06:59 20:01	05:56 20:03-20:19/16	05:14 20:51	05:14 21:45	05:51 21:12	06:40 20:10	07:28 19:51	07:21 16:57	08:10 16:20
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Sonnenscheinstunden 261 279 367 415 483 496 500 452 381 332 268 246												
Anzahl Minuten mit Schatten 0 0 0 38 110 0 0 150 0 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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 40 - WEA L-02 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (40)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember	
1	08:31 16:27	08:05 17:14	07:13 18:05	07:03 19:58	06:00 20:47	05:15 21:32	05:13 21:46	05:48 21:15	20:26-20:34/8	06:37 20:14	07:25 19:06	07:18 17:01	08:08 16:21
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7	08:30 16:34	07:56 17:25	07:00 18:15	06:50 20:08	05:49 20:57	20:12-20:26/14 21:38	05:11 21:43	05:57 21:05	20:22-20:35/13	06:46 20:01	07:35 18:52	07:28 16:50	08:16 16:18
8	08:30 16:35	07:54 17:27	06:58 18:17	06:48 20:09	05:47 20:59	20:13-20:26/13 21:39	05:11 21:43	05:59 21:03	20:23-20:35/12	06:48 19:58	07:36 18:50	07:30 16:48	08:17 16:18
9	08:29 16:37	07:52 17:29	06:55 18:19	06:45 20:11	05:45 21:00	20:13-20:25/12 21:40	05:10 21:42	06:00 21:01	20:23-20:32/9	06:50 19:56	07:38 18:48	07:32 16:47	08:18 16:17
10	08:29 16:38	07:50 17:30	06:53 18:20	06:43 20:13	05:44 21:02	20:14-20:25/11 21:41	05:10 21:42	06:02 20:59	20:25-20:31/6	06:51 19:54	07:40 18:45	07:33 16:45	08:19 16:17
11	08:28 16:39	07:49 17:32	06:51 18:22	06:41 20:14	05:42 21:03	20:14-20:24/10 21:41	05:09 21:41	06:04 21:08	20:27-20:29/2	06:53 19:52	07:41 18:43	07:35 16:44	08:20 16:17
12	08:27 16:41	07:47 17:34	06:49 18:24	06:39 20:16	05:40 21:05	20:16-20:23/7 21:42	05:09 21:40	06:05 20:56		06:54 19:49	07:43 18:41	07:37 16:42	08:21 16:17
13	08:27 16:42	07:45 17:36	06:47 18:26	06:37 20:17	05:39 21:07	20:18-20:20/2 21:43	05:09 21:39	06:07 20:54		06:56 19:47	07:45 18:39	07:49 16:41	08:22 16:19
14	08:26 16:44	07:43 17:38	06:44 18:27	06:34 20:19	05:37 21:08		05:09 21:43	06:08 20:52		06:58 19:45	07:46 18:37	07:40 16:39	08:23 16:17
15	08:25 16:45	07:41 17:40	06:42 18:29	06:32 20:21	05:36 21:10		05:08 21:44	06:10 21:37		06:59 19:42	07:48 18:35	07:42 16:38	08:24 16:17
16	08:24 16:47	07:39 17:41	06:40 18:31	06:30 20:23	05:34 21:11		05:08 21:44	06:11 21:36		07:01 19:40	07:51 18:32	07:44 16:37	08:25 16:17
17	08:24 16:48	07:37 17:43	06:37 18:32	06:28 20:24	05:33 21:13		05:08 21:45	06:13 21:35		07:02 19:38	07:51 18:30	07:45 16:35	08:26 16:17
18	08:23 16:50	07:36 17:45	06:35 18:34	06:26 20:26	05:31 21:14		05:09 21:44	06:15 20:44		07:04 19:35	07:53 18:28	07:47 16:34	08:26 16:18
19	08:22 16:52	07:34 17:47	06:33 18:36	06:24 20:28	05:30 21:16		05:08 21:46	06:16 20:42		07:06 19:33	07:55 18:26	07:49 16:33	08:27 16:18
20	08:21 16:53	07:32 17:49	06:31 18:37	06:22 20:29	05:28 21:17		05:08 21:46	06:18 20:40		07:07 19:31	07:57 18:21	07:51 16:31	08:28 16:19
21	08:20 16:55	07:30 17:50	06:28 18:39	06:20 20:31	05:27 21:18		05:08 21:46	06:19 21:31		07:09 19:29	07:58 18:22	07:52 16:30	08:28 16:19
22	08:19 16:56	07:28 17:52	06:26 18:41	06:17 20:33	05:26 21:20		05:09 21:46	06:21 20:36		07:10 19:26	08:00 18:20	07:54 16:29	08:29 16:19
23	08:17 16:58	07:25 17:54	06:25 18:42	06:15 20:34	05:25 21:21		05:09 21:47	06:23 20:34		07:12 19:24	08:02 18:18	07:55 16:28	08:29 16:20
24	08:16 17:00	07:23 17:56	06:22 18:44	06:13 20:36	05:23 21:22		05:09 21:47	06:24 20:37		07:14 19:22	08:04 18:16	07:57 16:27	08:30 16:20
25	08:15 17:02	07:21 17:58	06:19 18:46	06:11 20:38	05:22 21:24		05:09 21:47	06:26 20:29		07:15 19:19	07:05 17:04	07:59 16:26	08:30 16:21
26	08:14 17:03	07:19 17:59	06:17 18:48	06:09 20:39	05:21 21:25		05:10 21:47	06:27 20:27		07:17 19:17	07:07 17:12	08:00 16:25	08:31 16:22
27	08:12 17:05	07:17 18:01	06:15 18:49	06:07 20:41	05:20 21:26		05:10 21:47	06:29 20:25		07:18 19:15	07:09 17:10	08:02 16:24	08:31 16:24
28	08:11 17:07	07:15 18:03	06:12 18:51	06:05 20:43	05:19 21:28		05:11 21:47	06:24 21:21		07:20 19:12	07:11 17:08	08:03 16:23	08:31 16:23
29	08:10 17:09	07:10 18:03	06:10 18:50	06:03 20:44	05:18 21:29		05:11 21:47	06:44 20:21		07:22 19:10	07:12 17:06	08:05 16:23	08:31 16:24
30	08:08 17:10	07:08 18:04	06:08 18:54	06:02 20:46	05:17 21:30		05:12 21:46	06:45 21:18		07:23 19:08	07:14 17:04	08:06 16:22	08:31 16:25
31	08:07 17:12	07:06 18:01	06:06 18:56		05:16 21:31		05:11 21:17	06:47 20:27-20:32/5	06:35	15:16	07:16		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452		381	332	268	0
Anzahl Minuten mit Schatten	0	0	0	0	114	0	5	113		0	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:
216094-04 WP Brilon-Madfeld

 Lizenzierter Anwender:
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 +49 5971 9710-31
 Schaer / t.schaer@koetter-consulting.com
 Berechnet:
 18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 41 - WEA L-03 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (41)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:51	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:42	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:04	21:41	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:36	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:28	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:47	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:26	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:40	06:27	07:17	08:07	08:00	08:31
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:22
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:31	07:20	08:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA 42 - WEA L-04 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (42)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:44	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:51	06:53	06:43	05:44	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:42	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:04	21:42	21:41	20:58	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:47	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:09	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:40	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:45	21:36	20:48	19:40	18:32	16:37	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:52	07:46	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:36	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:06	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:28	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:47	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:43	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:14	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:23	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:26	20:29	19:19	18:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:40	06:27	07:17	08:07	08:00	08:31
	17:03	17:59	18:48	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:22
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	08:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:31	07:20	08:11	08:03	08:31
	17:07	18:03	18:51	20:43	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:23	16:24
30	08:08		07:08	06:02	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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) Schattende/Minuten mit Schatten
Sonnenuntergang (SS:MM) Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA N03 - NORDEX N131/3300 DE 3300 131.0 I-! NH: 164,0 m (Ges:229,5 m) (58)

Voraussetzungen für Berechnung des Schattenwurfs

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	08:31 14:58-15:30/32 13:01-13:44/43	08:05 15:32-16:08/36	07:13 07:41-07:58/17	07:03	06:00	05:15
	16:27 13:57-14:15/18 10:38-11:09/31	17:14	18:05 16:42-17:09/27	19:58	20:47	21:32
2	08:31 14:59-15:31/32 13:01-13:45/44	08:04 15:32-16:07/35	07:11 07:41-07:58/17	07:01	05:58	05:15
	16:28 13:58-14:15/17 10:39-11:09/30	17:16	18:06 16:42-17:09/27	19:59	20:49	21:33
3	08:31 14:58-15:31/33 13:01-13:44/43	08:02 15:32-16:08/36	07:09 07:40-07:58/18	06:59	05:56	05:14
	16:29 13:59-14:14/15 10:39-11:09/30	17:18	18:08 16:43-17:09/26	20:01	20:51	21:34
4	08:31 14:59-15:33/34 13:02-13:45/43	08:01 15:32-16:07/35	07:06 07:40-07:57/17	06:57	05:54	05:13
	16:30 14:00-14:14/14 10:40-11:09/29	17:19	18:10 16:42-17:07/25	20:03	20:52	21:35
5	08:31 14:59-15:34/35 13:03-13:46/43	07:59 15:32-16:07/35	07:04 07:40-07:57/17	06:54	05:52	05:12
	16:31 14:02-14:14/12 10:41-11:10/29	17:21	18:12 16:43-17:06/23	20:04	20:54	21:36
6	08:30 14:59-15:34/35 13:03-13:46/43	07:57 16:28-16:38/10	07:02 07:41-07:56/15	06:52	05:50	05:12
	16:33 14:04-14:12/8 10:41-11:09/28	17:23 15:32-16:06/34	18:13 16:44-17:05/21	20:06	20:55	21:37
7	08:30 14:59-15:36/37 13:05-13:46/41	07:56 16:27-16:41/14	07:00 07:42-07:55/13	06:50	05:49	05:11
	16:34 14:08-14:10/2 10:42-11:10/28	17:25 15:33-16:07/34	18:15 16:46-17:04/18	20:08	20:57	21:38
8	08:29 14:59-15:36/37 10:43-11:09/26	07:54 16:26-16:43/17	06:58 07:44-07:53/9	06:48	05:47	05:11
	16:35 13:05-13:46/41	17:27 15:34-16:06/32	18:17 16:48-17:00/12	20:09	20:59	21:39
9	08:29 15:00-15:38/38 10:44-11:10/26	07:52 16:24-16:44/20	06:55 16:53-16:55/2	06:45	05:45	05:10
	16:37 13:06-13:47/41	17:29 15:34-16:06/32	18:19	20:11	21:00	21:40
10	08:29 15:00-15:38/38 10:45-11:09/24	07:50 16:24-16:44/20	06:53	06:43	05:44	05:10
	16:38 13:07-13:46/39	17:30 15:35-16:05/30	18:20	20:13	21:02	21:41
11	08:28 15:00-15:39/39 10:46-11:09/23	07:49 16:23-16:45/22	06:51	06:41	05:42	05:09
	16:39 13:07-13:46/39	17:32 15:35-16:04/29	18:22	20:14	21:03	21:41
12	08:27 15:00-15:39/39 10:47-11:08/21	07:47 16:22-16:45/23	06:49	06:39	05:40	05:09
	16:41 13:08-13:46/38	17:34 15:36-16:03/27	18:24	20:16	21:05	21:42
13	08:27 15:00-15:40/40 10:49-11:08/19	07:45 16:22-16:45/23	06:46	06:37	05:39	05:09
	16:42 13:08-13:46/38	17:36 15:38-16:02/24	18:25	20:18	21:06	21:43
14	08:26 15:01-15:41/40 10:50-11:08/18	07:43 16:22-16:45/23	06:44	06:34	05:37	05:09
	16:44 13:10-13:46/36	17:38 15:39-16:01/22	18:27	20:19	21:08	21:43
15	08:25 15:01-15:42/41 10:52-11:06/14	07:41 16:22-16:45/23	06:42	06:32	05:36	05:08
	16:45 13:11-13:46/35	17:40 15:41-15:59/18	18:29	20:21	21:10	21:44
16	08:24 15:02-15:43/41 10:55-11:04/9	07:39 16:22-16:45/23	06:40	06:30	05:34	05:08
	16:47 13:12-13:46/34	17:41 15:45-15:55/10	18:31	20:23	21:11	21:44
17	08:23 15:02-15:43/41	07:37 16:23-16:44/21	06:37	06:28	05:33	05:08
	16:48 13:14-13:45/31	17:43	18:32	20:24	21:12	21:45
18	08:23 15:47-15:58/8 13:15-13:45/30	07:35 16:24-16:44/20	06:35	06:26	05:31	05:08
	16:50 15:01-15:43/42	17:45	18:34	20:26	21:14	21:45
19	08:22 15:45-15:58/13 13:16-13:43/27	07:33 16:25-16:43/18	06:33	06:24	05:30	05:08
	16:52 15:02-15:43/41	17:47	18:36	20:28	21:15	21:46
20	08:21 15:03-15:59/56	07:31 16:51-17:02/11	06:31	06:22	05:28	05:08
	16:53 13:18-13:42/24	17:49 16:26-16:41/15	18:37	20:29	21:17	21:46
21	08:20 15:03-16:01/58	07:29 16:48-17:04/16	06:28	06:20	05:27	05:09
	16:55 13:20-13:41/21	17:50 16:28-16:39/11	18:39	20:31	21:18	21:46
22	08:18 15:04-16:03/59	07:27 16:46-17:06/20	06:26	06:17	05:26	05:09
	16:56 13:23-13:39/16	17:52	18:41	20:32	21:20	21:46
23	08:17 15:04-16:03/59	07:25 16:45-17:07/22	06:24	06:15	05:25	05:09
	16:58 13:26-13:36/10	17:54	18:42	20:34	21:21	21:47
24	08:16 15:05-16:04/59	07:23 16:44-17:08/24	06:22	06:13	05:23	05:09
	17:00	17:56	18:44	20:36	21:22	21:47
25	08:15 15:07-16:05/58	07:21 16:44-17:09/25	06:19	06:11	05:22	05:10
	17:02	17:58	18:46	20:37	21:24	21:47
26	08:14 15:07-16:06/59	07:19 07:45-07:55/10	06:17	06:09	05:21	05:10
	17:03	17:59 16:42-17:09/27	18:47	20:39	21:25	21:47
27	08:12 15:09-16:07/58	07:17 07:43-07:56/13	06:15	06:07	05:20	05:10
	17:05	18:01 16:42-17:09/27	18:49	20:41	21:26	21:47
28	08:11 15:09-16:07/58	07:15 07:42-07:57/15	06:12	06:05	05:19	05:11
	17:07	18:03 16:42-17:09/27	18:51	20:42	21:27	21:47
29	08:10 15:12-16:08/56		07:10	06:03	05:18	05:11
	17:09		19:52	20:44	21:29	21:46
30	08:08 15:13-16:07/54		07:08	06:02	05:17	05:12
	17:10		19:54	20:46	21:30	21:46
31	08:07 15:28-16:08/40		07:06		05:16	
	17:12 15:17-15:25/8		19:56		21:31	
Sonnenscheinstunden	261	279	367	415	483	496
Anzahl Minuten mit Schatten	2689	1009	304	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA N03 - NORDEX N131/3300 DE 3300 131.0 I-! NH: 164,0 m (Ges:229,5 m) (58)
Voraussetzungen für Berechnung des Schattenwurfs

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	05:13	05:48	06:37	07:25	07:17 15:53-16:14/21	08:07 14:42-15:21/39 10:28-10:51/23
	21:46	21:15	20:14	19:06	17:01 15:04-15:35/31	16:21 12:49-13:28/39
2	05:13	05:50	06:38	07:26	07:19 15:54-16:13/19	08:09 14:43-15:21/38 10:28-10:52/24
	21:46	21:13	20:12	19:03	16:59 15:04-15:36/32	16:21 12:50-13:30/40
3	05:14	05:51	06:40	07:28	07:21 15:55-16:12/17	08:10 14:43-15:21/38 10:27-10:53/26
	21:45	21:12	20:10	19:01	16:57 15:03-15:36/33	16:20 12:49-13:30/41
4	05:15	05:53	06:42	07:30	07:23 15:57-16:11/14	08:12 14:43-15:20/37 10:28-10:54/26
	21:45	21:10	20:07	18:59	16:55 15:03-15:37/34	16:19 12:49-13:30/41
5	05:15	05:54	06:43	07:31 08:22-08:27/5	07:25 15:58-16:08/10	08:13 14:45-15:21/36 10:27-10:55/28
	21:44	21:08	20:05	18:57 17:26-17:36/10	16:53 15:03-15:37/34	16:19 12:50-13:31/41
6	05:16	05:56	06:45	07:33 08:19-08:30/11	07:26 15:02-15:36/34	08:14 14:45-15:20/35 12:49-13:32/43
	21:44	21:07	20:03	18:54 17:23-17:39/16	16:52	16:18 13:50-13:58/8 10:27-10:55/28
7	05:17	05:57	06:46	07:35 08:17-08:31/14	07:28 15:02-15:37/35	08:15 14:45-15:20/35 12:49-13:32/43
	21:43	21:05	20:01	18:52 17:21-17:40/19	16:50	16:18 13:49-14:00/11 10:28-10:57/29
8	05:18	05:59	06:48	07:36 08:15-08:31/16	07:30 15:02-15:38/36	08:17 14:47-15:21/34 12:50-13:33/43
	21:43	21:03	19:58	18:50 17:19-17:41/22	16:48	16:18 13:49-14:02/13 10:28-10:57/29
9	05:19	06:00	06:50	07:38 08:15-08:32/17	07:32 15:02-15:38/36	08:18 14:47-15:20/33 12:50-13:34/44
	21:42	21:01	19:56	18:48 17:18-17:42/24	16:47	16:17 13:48-14:03/15 10:28-10:58/30
10	05:20	06:02	06:51	07:40 08:15-08:32/17	07:33 15:02-15:39/37	08:19 14:48-15:20/32 12:51-13:34/43
	21:41	20:59	19:54	18:45 17:17-17:42/25	16:45	16:17 13:47-14:04/17 10:28-10:58/30
11	05:21	06:04	06:53	07:41 08:15-08:32/17	07:35 14:58-15:39/41	08:20 14:48-15:20/32 12:51-13:34/43
	21:41	20:57	19:51	18:43 17:16-17:42/26	16:44 14:48-14:56/8	16:17 13:47-14:05/18 10:28-10:59/31
12	05:22	06:05	06:54	07:43 08:14-08:31/17	07:37 14:45-15:39/54	08:21 14:49-15:20/31 12:51-13:35/44
	21:40	20:56	19:49	18:41 17:15-17:42/27	16:42	16:17 13:47-14:06/19 10:28-10:59/31
13	05:23	06:07	06:56	07:45 08:14-08:31/17	07:39 14:43-15:39/56	08:22 14:50-15:19/29 12:51-13:35/44
	21:39	20:54	19:47	18:39 17:15-17:42/27	16:41	16:17 13:47-14:07/20 10:29-11:00/31
14	05:24	06:08	06:58	07:46 08:15-08:30/15	07:40 14:42-15:40/58	08:23 14:51-15:19/28 12:52-13:36/44
	21:38	20:52	19:45	18:37 17:15-17:42/27	16:39	16:17 13:47-14:08/21 10:29-11:00/31
15	05:25	06:10	06:59	07:48 08:16-08:28/12	07:42 14:40-15:39/59	08:24 14:51-15:19/28 12:52-13:37/45
	21:37	20:50	19:42	18:35 17:14-17:41/27	16:38	16:17 13:47-14:09/22 10:29-11:01/32
16	05:27	06:11	07:01	07:50 08:18-08:25/7	07:44 14:40-15:39/59	08:25 14:52-15:19/27 12:53-13:37/44
	21:36	20:48	19:40	18:32 17:15-17:41/26	16:37	16:17 13:48-14:09/21 10:30-11:02/32
17	05:28	06:13	07:02	07:51 17:15-17:40/25	07:45 14:40-15:38/58	08:25 14:53-15:19/26 12:54-13:38/44
	21:35	20:46	19:38	18:30	16:35	16:17 13:48-14:10/22 10:31-11:03/32
18	05:29	06:15	07:04	07:53 17:16-17:39/23	07:47 14:39-15:38/59	08:26 14:53-15:18/25 12:53-13:38/45
	21:34	20:44	19:35	18:28	16:34	16:18 13:48-14:10/22 10:30-11:02/32
19	05:30	06:16	07:05	07:55 17:17-17:38/21	07:49 14:39-15:38/59	08:27 15:15-15:18/3 13:49-14:11/22 10:31-11:03/32
	21:33	20:42	19:33	18:26	16:33 13:01-13:11/10	16:18 14:54-15:14/20 12:54-13:39/45
20	05:31	06:18	07:07	07:57 17:17-17:36/19	07:50 14:39-15:38/59	08:28 15:17-15:18/1 13:49-14:12/23 10:32-11:04/32
	21:32	20:40	19:31	18:24 17:02-17:07/5	16:31 12:58-13:14/16	16:18 14:55-15:15/20 12:55-13:39/44
21	05:33	06:19	07:09	07:58 17:19-17:34/15	07:52 14:38-15:36/58	08:28 14:55-15:15/20 12:55-13:39/44
	21:31	20:38	19:28	18:22 16:58-17:10/12	16:30 12:55-13:16/21	16:19 13:49-14:12/23 10:32-11:04/32
22	05:34	06:21	07:10	08:00 17:22-17:31/9	07:54 14:39-15:35/56	08:29 14:56-15:16/20 12:56-13:40/44
	21:29	20:36	19:26	18:20 16:56-17:12/16	16:29 12:54-13:18/24	16:19 14:50-14:13/23 10:33-11:05/32
23	05:35	06:23	07:12	08:02 16:55-17:13/18	07:55 15:22-15:35/13 12:53-13:20/27	08:29 14:56-15:16/20 12:56-13:40/44
	21:28	20:33	19:24	18:18	16:28 14:39-15:20/41	16:20 13:50-14:13/23 10:33-11:05/32
24	05:37	06:24	07:13	08:03 16:54-17:14/20	07:57 15:24-15:33/9 12:52-13:22/30	08:30 15:17-15:20/3 13:51-14:13/22 10:33-11:05/32
	21:27	20:31	19:22	18:16	16:27 14:39-15:21/42	16:20 14:56-15:16/20 12:56-13:40/44
25	05:38	06:26	07:15	07:05 15:53-16:15/22	07:58 14:39-15:20/41	08:30 15:18-15:22/4 13:52-14:14/22 10:34-11:06/32
	21:25	20:29	19:19	17:14	16:26 12:51-13:22/31	16:21 14:57-15:17/20 12:57-13:42/45
26	05:40	06:27	07:17	07:07 15:53-16:16/23	08:00 14:40-15:21/41 10:33-10:42/9	08:30 14:57-15:23/26 12:57-13:42/45
	21:24	20:27	19:17	17:12 15:14-15:27/13	16:25 12:50-13:24/34	16:22 13:52-14:14/22 10:34-11:07/32
27	05:41	06:29	07:18	07:09 15:52-16:15/23	08:02 14:40-15:21/41 10:31-10:45/14	08:31 14:57-15:24/27 12:58-13:42/44
	21:23	20:25	19:15	17:10 15:10-15:29/19	16:24 12:50-13:25/35	16:22 13:53-14:14/21 10:35-11:07/32
28	05:42	06:31	07:20	07:10 15:52-16:15/23	08:03 14:40-15:20/40 10:29-10:47/18	08:31 14:57-15:25/28 12:58-13:42/44
	21:21	20:23	19:12	17:08 15:08-15:31/23	16:23 12:49-13:25/36	16:23 13:53-14:15/22 10:35-11:07/32
29	05:44	06:32	07:22	07:12 15:52-16:15/23	08:05 14:41-15:21/40 10:29-10:48/19	08:31 14:57-15:26/29 12:59-13:43/44
	21:20	20:21	19:10	17:06 15:07-15:32/25	16:23 12:50-13:27/37	16:24 13:54-14:15/21 10:36-11:07/31
30	05:45	06:34	07:23	07:14 15:52-16:15/23	08:06 14:42-15:21/39 10:29-10:50/21	08:31 14:58-15:27/29 12:59-13:43/44
	21:18	20:18	19:08	17:04 15:06-15:33/27	16:22 12:50-13:28/38	16:25 13:55-14:15/20 10:36-11:08/32
31	05:47	06:35		07:16 15:53-16:14/21		08:31 14:58-15:28/30 13:00-13:44/44
	21:17	20:16		17:02 15:05-15:34/29		16:26 13:56-14:15/19 10:37-11:08/31
Sonnenscheinstunden	499	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	918	1874	3701

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:

216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:

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Schaer / t.schaer@koetter-consulting.com

Berechnet:

18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA-ZB01 - ENERCON E-138 EP3 E2 4200 138.3 IO! NH: 160,0 m (Ges:229,1 m) (61)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00 19:34-20:10/36	05:15	05:12	05:48 19:45-20:18/33	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01	05:58 19:33-20:09/36	05:14	05:13	05:50 19:44-20:18/34	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56 19:33-20:09/36	05:14	05:14	05:51 19:43-20:18/35	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54 19:32-20:09/37	05:13	05:15	05:53 19:43-20:19/36	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52 19:33-20:10/37	05:12	05:15	05:54 19:42-20:19/37	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50 19:32-20:09/37	05:12	05:16	05:56 19:42-20:19/37	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49 19:32-20:09/37	05:11	05:17	05:57 19:42-20:19/37	06:46	07:35	07:28	08:18
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47 19:33-20:09/36	05:11	05:18	05:59 19:42-20:19/37	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45 19:33-20:08/35	05:10	05:19	06:00 19:42-20:19/37	06:50	07:38	07:32	08:18
	16:37	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:44 19:33-20:09/36	05:10	05:20	06:02 19:42-20:19/37	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	21:01	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42 19:33-20:08/35	05:09	05:21	06:04 19:42-20:18/36	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	21:01	19:52	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40 19:34-20:08/34	05:09	05:22	06:05 19:41-20:17/36	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	21:01	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37	05:39 19:34-20:07/33	05:09	05:23	06:07 19:42-20:17/35	06:56	07:45	07:39	08:22
	16:42	17:36	18:26	20:18	21:07	21:43	21:39	21:04	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37 19:35-20:06/31	05:09	05:24	06:08 19:42-20:16/34	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	21:02	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36 19:35-20:05/30	05:08	05:25	06:10 19:43-20:15/32	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	21:03	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34 19:37-20:05/28	05:08	05:26	06:11 19:43-20:14/31	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	21:04	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33 19:38-20:04/26	05:08	05:28	06:13 19:44-20:13/29	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	21:04	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31 19:38-20:03/25	05:08	05:29	06:15 19:45-20:11/26	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	21:04	19:35	18:28	16:34	16:18
19	08:22	07:34	06:33	06:24	05:30 19:40-20:02/22	05:08	05:30	06:16 19:47-20:10/23	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	21:02	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28 19:41-20:01/20	05:08	05:31	06:18 19:48-20:07/19	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	21:04	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:20 19:50-19:57/7	05:27 19:43-19:59/16	05:08	05:33 19:56-20:06/10	06:19 19:51-20:05/14	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	21:03	19:29	18:22	16:30	16:19
22	08:19	07:27	06:26	06:17 19:46-20:01/15	05:26 19:45-19:58/13	05:09	05:34 19:54-20:08/14	06:21 19:55-19:59/4	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	21:02	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15 19:43-20:03/20	05:25 19:48-19:54/6	05:09	05:35 19:52-20:10/18	06:23	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	21:03	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13 19:41-20:05/24	05:23	05:09	05:37 19:51-20:12/21	06:24	07:13	08:03	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	21:03	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11 19:39-20:06/27	05:22	05:09	05:38 19:50-20:13/23	06:26	07:15	07:05	07:59	08:30
	17:02	17:58	18:46	20:38	21:24	21:47	21:25	21:02	19:19	17:14	16:26	16:21
26	08:14	07:19	06:17	06:09 19:38-20:07/29	05:21	05:10	05:40 19:48-20:13/25	06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	21:02	19:17	17:12	16:25	16:22
27	08:12	07:17	06:15	06:07 19:36-20:07/31	05:20	05:10	05:41 19:48-20:15/27	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	21:02	19:15	17:10	16:24	16:22
28	08:11	07:15	06:12	06:05 19:35-20:08/33	05:19	05:11	05:42 19:47-20:16/29	06:30	07:20	07:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	21:02	19:12	17:08	16:23	16:23
29	08:10		07:10	06:03 19:34-20:08/34	05:18	05:11	05:44 19:46-20:16/30	06:32	07:22	07:12	08:05	08:31
	17:09		18:53	20:44	21:29	21:46	21:20	21:02	19:10	17:06	16:23	16:24
30	08:08		07:08	06:01 19:34-20:08/34	05:17	05:12	05:45 19:46-20:17/31	06:34	07:23	07:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	21:08	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47 19:45-20:17/32	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	21:06		17:02		16:26
Sonnenscheinstunden												
Anzahl Minuten mit Schatten												
	261	279	367	415	483	496	500	452	381	332	268	246

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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
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DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA-ZB02 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (62)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45	05:45	05:10	05:19	06:00	06:50	07:38	07:32	08:18
	16:36	17:29	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:51	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39	05:40	05:09	05:22	06:05	06:54	07:43	07:37	08:21
	16:41	17:34	18:24	20:16	21:05	21:42	21:40	20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:25	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:08	05:24	06:08	06:58	07:46	07:40	08:23
	16:44	17:38	18:27	20:19	21:08	21:43	21:38	20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:17
19	08:22	07:34	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:16	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:29	18:22	16:30	16:19
22	08:19	07:27	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:22	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:34	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13	05:23	05:09	05:37	06:24	07:13	08:04	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	07:05	07:59	08:30
	17:02	17:57	18:46	20:38	21:24	21:47	21:25	20:29	19:19	17:14	16:26	16:21
26	08:14	07:19	06:17	06:09	05:21	05:10	05:39	06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	17:12	16:25	16:21
27	08:12	07:17	06:15	06:07	05:20	05:10	05:41	06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	17:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	07:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	17:08	16:23	16:23
29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	07:12	08:05	08:31
	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	17:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	07:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	17:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA-ZB03 - ENERCON E-138 EP3 E2 4200 138.3 IO! NH: 160,0 m (Ges:229,1 m) (63)
Voraussetzungen für Berechnung des Schattenwurfs

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		[Juli		[August	[September	[Oktober	[November	[Dezember
1	08:31	08:05	07:13	07:03		06:00 18:34-19:32/58		05:15 18:35-19:33/58		05:12 18:45-19:38/53		05:48 18:40-19:46/66	06:37 07:25	07:18	08:08	
	16:27	17:14	18:05	19:58		20:47		21:32		21:46		21:15	20:14	19:06	17:01	16:21
2	08:31	08:04	07:11	07:01		05:58 18:33-19:32/59		05:14 18:36-19:34/58		05:13 18:44-19:38/54		05:50 18:40-19:45/65	06:38 07:26	07:19	08:09	
	16:28	17:16	18:06	19:59		20:49		21:33		21:46		21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59		05:56 18:32-19:33/61		05:14 18:36-19:34/58		05:14 18:44-19:38/54		05:51 18:39-19:44/65	06:40 07:28	07:21	08:10	
	16:29	17:18	18:08	20:01		20:51		21:34		21:45		21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57		05:54 18:31-19:33/62		05:13 18:36-19:33/57		05:15 18:45-19:39/54		05:53 18:40-19:45/65	06:42 07:30	07:23	08:12	
	16:30	17:19	18:10	20:03		20:52		21:35		21:45		21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54		05:52 18:31-19:34/63		05:12 18:37-19:34/57		05:15 18:44-19:39/55		05:54 18:40-19:44/64	06:43 07:31	07:25	08:13	
	16:31	17:21	18:12	20:04		20:54		21:36		21:44		21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52		05:50 18:31-19:34/63		05:12 18:37-19:33/56		05:16 18:44-19:39/55		05:56 18:40-19:44/64	06:45 07:33	07:26	08:14	
	16:33	17:23	18:13	20:06		20:55		21:37		21:44		21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50		05:49 18:30-19:34/64		05:11 18:38-19:33/55		05:17 18:44-19:40/56		05:57 18:40-19:43/63	06:46 07:35	07:28	08:15	
	16:34	17:25	18:15	20:08		20:57		21:38		21:43		21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48		05:47 18:30-19:35/65		05:11 18:39-19:34/55		05:18 18:44-19:40/56		05:59 18:41-19:43/62	06:48 07:36	07:30	08:17	
	16:35	17:27	18:17	20:09		20:59		21:39		21:43		21:03	19:58	18:50	16:48	16:18
9	08:29	07:52	06:55	06:45		05:45 18:30-19:34/64		05:10 18:39-19:34/54		05:19 18:44-19:41/57		06:00 18:41-19:42/61	06:50 07:38	07:32	08:18	
	16:36	17:29	18:19	20:11		21:00		21:40		21:42		21:01	19:56	18:48	16:47	16:17
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	16:38	17:30	18:20	20:13		21:02		21:41		21:41		20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41		05:42 18:29-19:35/66		05:09 18:41-19:34/53		05:21 18:44-19:42/58		06:04 18:42-19:41/59	06:53 07:41	07:35	08:20	
	16:39	17:32	18:22	20:14		21:03		21:41		21:41		20:57	19:51	18:43	16:44	16:17
12	08:27	07:47	06:49	06:39		05:40 18:30-19:35/65		05:09 18:40-19:33/53		05:22 18:43-19:42/59		06:05 18:42-19:39/57	06:54 07:43	07:37	08:21	
	16:41	17:34	18:24	20:16		21:05		21:42		21:40		20:56	19:49	18:41	16:42	16:17
13	08:27	07:45	06:46	06:37		05:39 18:29-19:35/66		05:09 18:41-19:33/52		05:23 18:43-19:42/59		06:07 18:43-19:39/56	06:56 07:45	07:39	08:22	
	16:42	17:36	18:25	20:18		21:07		21:43		21:39		20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34		05:37 18:30-19:35/65		05:09 18:41-19:33/52		05:24 18:43-19:43/60		06:08 18:43-19:37/54	06:58 07:46	07:40	08:23	
	16:44	17:38	18:27	20:19		21:08		21:43		21:38		20:52	19:45	18:37	16:39	16:17
15	08:25	07:41	06:42	06:32		05:36 18:29-19:35/66		05:08 18:42-19:34/52		05:25 18:43-19:43/60		06:10 18:44-19:37/53	06:59 07:48	07:42	08:24	
	16:45	17:39	18:29	20:21		21:10		21:44		21:37		20:50	19:42	18:35	16:38	16:17
16	08:24	07:39	06:40	06:30		05:34 18:30-19:35/65		05:08 18:42-19:34/52		05:26 18:42-19:43/61		06:11 18:44-19:35/51	07:01 07:50	07:44	08:25	
	16:47	17:41	18:31	20:23		21:11		21:44		21:36		20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28		05:33 18:30-19:35/65		05:08 18:43-19:34/51		05:28 18:42-19:43/61		06:13 18:46-19:34/48	07:02 07:51	07:45	08:26	
	16:48	17:43	18:32	20:24		21:13		21:45		21:35		20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26		05:31 18:30-19:35/65		05:08 18:43-19:34/51		05:29 18:41-19:44/63		06:15 18:46-19:32/46	07:04 07:53	07:47	08:26	
	16:50	17:45	18:34	20:26		21:14		21:45		21:34		20:44	19:35	18:28	16:34	16:18
19	08:22	07:33	06:33	06:24 18:57-19:14/17		05:30 18:30-19:35/65		05:08 18:43-19:34/51		05:30 18:42-19:45/63		06:16 18:48-19:31/43	07:05 07:55	07:49	08:27	
	16:51	17:47	18:36	20:28		21:15		21:46		21:33		20:42	19:33	18:26	16:33	16:18
20	08:21	07:31	06:31	06:22 18:52-19:18/26		05:28 18:31-19:35/64		05:08 18:43-19:34/51		05:31 18:42-19:45/63		06:18 18:49-19:29/40	07:07 07:57	07:50	08:28	
	16:53	17:49	18:37	20:29		21:17		21:46		21:32		20:40	19:31	18:24	16:31	16:18
21	08:20	07:29	06:28	06:19 18:49-19:20/31		05:27 18:31-19:35/64		05:08 18:43-19:34/51		05:33 18:41-19:45/64		06:19 18:51-19:27/36	07:09 07:58	07:52	08:28	
	16:55	17:50	18:39	20:31		21:18		21:46		21:31		20:38	19:28	18:22	16:30	16:19
22	08:18	07:27	06:26	06:17 18:46-19:22/36		05:26 18:32-19:35/63		05:09 18:44-19:35/51		05:34 18:41-19:45/64		06:21 18:53-19:24/31	07:10 08:00	07:54	08:29	
	16:56	17:52	18:41	20:33		21:20		21:46		21:29		20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15 18:44-19:24/40		05:25 18:31-19:34/63		05:09 18:44-19:35/51		05:35 18:40-19:45/65		06:23 18:56-19:21/25	07:12 08:02	07:55	08:29	
	16:58	17:54	18:42	20:34		21:21		21:47		21:28		20:33	19:24	18:18	16:28	16:20
24	08:16	07:23	06:22	06:13 18:42-19:26/44		05:23 18:31-19:34/63		05:09 18:44-19:35/51		05:37 18:41-19:46/65		06:24 19:00-19:16/16	07:13 08:03	07:57	08:30	
	17:00	17:56	18:44	20:36		21:22		21:47		21:27		20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11 18:40-19:27/47		05:22 18:32-19:34/62		05:09 18:45-19:36/51		05:38 18:40-19:45/65		06:26	07:15	07:05	07:59	08:30
	17:02	17:58	18:46	20:37		21:24		21:47		21:25		20:29	19:19	17:14	16:26	16:21
26	08:14	07:19	06:17	06:09 18:39-19:28/49		05:21 18:32-19:34/62		05:10 18:44-19:36/52		05:39 18:40-19:45/65		06:27	07:17	07:07	08:00	08:30
	17:03	17:59	18:47	20:39		21:25		21:47		21:24		20:27	19:17	17:12	16:25	16:21
27	08:12	07:17	06:15	06:07 18:37-19:29/52		05:20 18:33-19:34/61		05:10 18:44-19:36/52		05:41 18:41-19:46/65		06:29	07:18	07:09	08:02	08:31
	17:05	18:01	18:49	20:41		21:26		21:47		21:23		20:25	19:15	17:10	16:24	16:22
28	08:11	07:15	06:12	06:05 18:36-19:30/54		05:19 18:34-19:35/61		05:11 18:45-19:36/51		05:42 18:40-19:45/65		06:30	07:20	07:10	08:03	08:31
	17:07	18:03	18:51	20:42		21:28		21:47		21:21		20:23	19:12	17:08	16:23	16:23
29	08:10		07:10	06:03 18:35-19:30/55		05:18 18:34-19:34/60		05:11 18:44-19:36/52		05:44 18:40-19:45/65		06:32	07:22	07:12	08:04	08:31
	17:09		17:52	20:44		21:29		21:46		21:20		20:21	19:10	17:06	16:23	16:24
30	08:08		07:08	06:01 18:34-19:31/57		05:17 18:34-19:34/60		05:12 18:45-19:37/52		05:45 18:40-19:46/66		06:34	07:23	07:14	08:06	08:31
	17:10		17:54	20:46		21:30		21:46		21:18		20:18	19:08	17:04	16:22	16:25
31	08:07		07:06			05:16 18:35-19:34/59				05:47 18:40-19:45/65		06:35		07:16		08:31
	17:12		17:56			21:31		21:47		21:17		20:16		17:02		16:26
Sonneneinstrahlung																
Anzahl Minuten mit Schatten	261	279	367	415	508	483	496	593	1872	452	1250	381	332	268	246	

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) Schattende/Minuten mit Schatten
	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattende/Minuten mit Schatten

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA-ZB04 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (64)
Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	16:53	16:19
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	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
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	16:36	17:28	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:41	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:04	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:57	19:51	18:43	16:44	16:17
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13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
	16:42	17:36	18:25	20:18	21:07	21:43	21:39	20:54	19:47	18:39	16:41	16:17
14	08:26	07:43	06:44	06:34	05:37	05:08	05:24	06:08	06:57	07:46	07:40	08:23
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15	08:25	07:41	06:42	06:32	05:36	05:08	05:25	06:10	06:59	07:48	07:42	08:24
	16:45	17:39	18:29	20:21	21:10	21:44	21:37	20:50	19:42	18:34	16:38	16:17
16	08:24	07:39	06:40	06:30	05:34	05:08	05:26	06:11	07:01	07:50	07:44	08:25
	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
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	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
18	08:23	07:35	06:35	06:26	05:31	05:08	05:29	06:15	07:04	07:53	07:47	08:26
	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:18
19	08:22	07:33	06:33	06:24	05:30	05:08	05:30	06:16	07:05	07:55	07:49	08:27
	16:51	17:47	18:36	20:28	21:15	21:46	21:33	20:42	19:33	18:26	16:33	16:18
20	08:21	07:31	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:50	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:29	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:28	18:22	16:30	16:19
22	08:18	07:27	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
	16:56	17:52	18:41	20:33	21:20	21:46	21:29	20:36	19:26	18:20	16:29	16:19
23	08:17	07:25	06:24	06:15	05:25	05:09	05:35	06:22	07:12	08:02	07:55	08:29
	16:58	17:54	18:42	20:34	21:21	21:47	21:28	20:33	19:24	18:18	16:28	16:20
24	08:16	07:23	06:21	06:13	05:23	05:09	05:37	06:24	07:13	08:03	07:57	08:30
	17:00	17:56	18:44	20:36	21:22	21:47	21:27	20:31	19:22	18:16	16:27	16:20
25	08:15	07:21	06:19	06:11	05:22	05:09	05:38	06:26	07:15	08:05	07:59	08:30
	17:02	17:57	18:46	20:37	21:24	21:47	21:25	20:29	19:19	18:14	16:26	16:21
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
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29	08:10		07:10	06:03	05:18	05:11	05:44	06:32	07:22	08:12	08:05	08:31
	17:09		19:52	20:44	21:29	21:46	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	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:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

SHADOW - Kalender pro WEA

Berechnung: Gesamtbelastung WEA: WEA-ZB05 - ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1 m) (65)

Voraussetzungen für Berechnung des Schattenwurfs

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	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:03	06:00	05:15	05:12	05:48	06:37	07:25	07:18	08:08
	16:27	17:14	18:05	19:58	20:47	21:32	21:46	21:15	20:14	19:06	17:00	16:21
2	08:31	08:04	07:11	07:01	05:58	05:14	05:13	05:50	06:38	07:26	07:19	08:09
	16:28	17:16	18:06	19:59	20:49	21:33	21:46	21:13	20:12	19:03	16:59	16:20
3	08:31	08:02	07:09	06:59	05:56	05:14	05:14	05:51	06:40	07:28	07:21	08:10
	16:29	17:18	18:08	20:01	20:51	21:34	21:45	21:12	20:10	19:01	16:57	16:20
4	08:31	08:01	07:06	06:57	05:54	05:13	05:15	05:53	06:42	07:30	07:23	08:12
	16:30	17:19	18:10	20:03	20:52	21:35	21:45	21:10	20:07	18:59	16:55	16:19
5	08:31	07:59	07:04	06:54	05:52	05:12	05:15	05:54	06:43	07:31	07:25	08:13
	16:31	17:21	18:12	20:04	20:54	21:36	21:45	21:08	20:05	18:57	16:53	16:19
6	08:30	07:57	07:02	06:52	05:50	05:12	05:16	05:56	06:45	07:33	07:26	08:14
	16:33	17:23	18:13	20:06	20:56	21:37	21:44	21:07	20:03	18:54	16:52	16:18
7	08:30	07:56	07:00	06:50	05:49	05:11	05:17	05:57	06:46	07:35	07:28	08:16
	16:34	17:25	18:15	20:08	20:57	21:38	21:43	21:05	20:01	18:52	16:50	16:18
8	08:30	07:54	06:58	06:48	05:47	05:11	05:18	05:59	06:48	07:36	07:30	08:17
	16:35	17:27	18:17	20:09	20:59	21:39	21:43	21:03	19:58	18:50	16:48	16:18
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	16:36	17:28	18:19	20:11	21:00	21:40	21:42	21:01	19:56	18:48	16:47	16:17
10	08:29	07:50	06:53	06:43	05:43	05:10	05:20	06:02	06:51	07:40	07:33	08:19
	16:38	17:30	18:20	20:13	21:02	21:41	21:42	20:59	19:54	18:45	16:45	16:17
11	08:28	07:49	06:51	06:41	05:42	05:09	05:21	06:03	06:53	07:41	07:35	08:20
	16:39	17:32	18:22	20:14	21:03	21:41	21:41	20:58	19:51	18:43	16:44	16:17
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13	08:27	07:45	06:46	06:37	05:39	05:09	05:23	06:07	06:56	07:45	07:39	08:22
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14	08:26	07:43	06:44	06:34	05:37	05:08	05:24	06:08	06:57	07:46	07:40	08:23
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15	08:25	07:41	06:42	06:32	05:35	05:08	05:25	06:10	06:59	07:48	07:42	08:24
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	16:47	17:41	18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:32	16:36	16:17
17	08:24	07:37	06:37	06:28	05:33	05:08	05:28	06:13	07:02	07:51	07:45	08:26
	16:48	17:43	18:32	20:24	21:13	21:45	21:35	20:46	19:38	18:30	16:35	16:17
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	16:50	17:45	18:34	20:26	21:14	21:45	21:34	20:44	19:35	18:28	16:34	16:17
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20	08:21	07:32	06:31	06:22	05:28	05:08	05:31	06:18	07:07	07:57	07:51	08:28
	16:53	17:49	18:37	20:29	21:17	21:46	21:32	20:40	19:31	18:24	16:31	16:18
21	08:20	07:30	06:28	06:19	05:27	05:08	05:33	06:19	07:09	07:58	07:52	08:28
	16:55	17:50	18:39	20:31	21:18	21:46	21:31	20:38	19:28	18:22	16:30	16:19
22	08:19	07:27	06:26	06:17	05:26	05:09	05:34	06:21	07:10	08:00	07:54	08:29
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	17:03	17:59	18:47	20:39	21:25	21:47	21:24	20:27	19:17	18:12	16:25	16:21
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	17:05	18:01	18:49	20:41	21:26	21:47	21:23	20:25	19:15	18:10	16:24	16:22
28	08:11	07:15	06:12	06:05	05:19	05:11	05:42	06:30	07:20	08:10	08:03	08:31
	17:07	18:03	18:51	20:42	21:28	21:47	21:21	20:23	19:12	18:08	16:23	16:23
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	17:09		19:53	20:44	21:29	21:47	21:20	20:21	19:10	18:06	16:22	16:24
30	08:08		07:08	06:01	05:17	05:12	05:45	06:34	07:23	08:14	08:06	08:31
	17:10		19:54	20:46	21:30	21:46	21:18	20:18	19:08	18:04	16:22	16:25
31	08:07		07:06		05:16		05:47	06:35		07:16		08:31
	17:12		19:56		21:31		21:17	20:16		17:02		16:26
Sonnenscheinstunden	261	279	367	415	483	496	500	452	381	332	268	246
Anzahl Minuten mit Schatten	0	0	0	0	0	0	0	0	0	0	0	0

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

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Sonnenuntergang (SS:MM) Zeitpunkt (SS:MM) Schattenanfang-Zeitpunkt (SS:MM) Schattenende/Minuten mit Schatten

Anlage A6: SHADOW-Grafischer Kalender pro WEA mit Darstellung der Beschattungszeiten je WEA an den Immissionsorten über das ganze Jahr

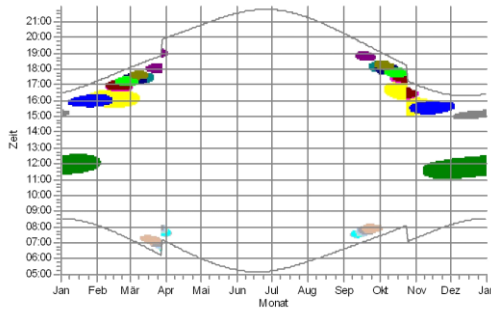
Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
KÖTTER Consulting Engineers GmbH & Co. KG
Bonifatiusstr. 400
DE-48432 Rheine
+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:28/3.4.388

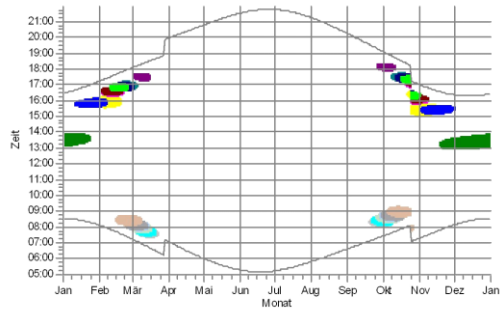
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

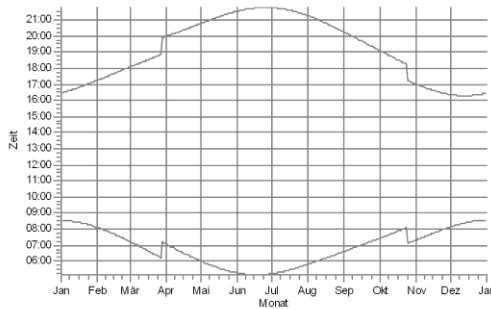
WEA 01: NORDEX N149/5.X 5700 149.0 IO! NH: 125.0 m (Ges:199,5 m) (8)



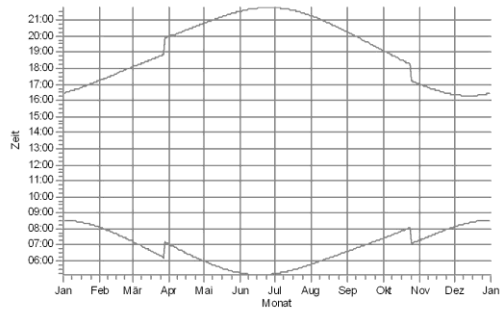
WEA 02: NORDEX N163/5.X 5700 163.0 IO! NH: 164.0 m (Ges:245,5 m) (9)



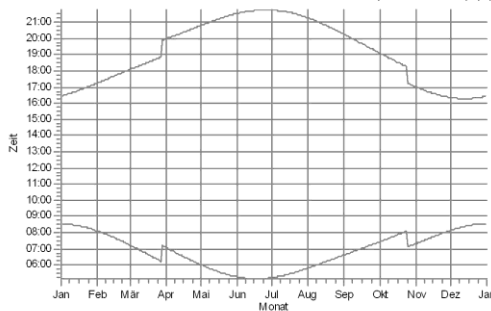
WEA 01: ENERCON E-82 E2 2300 82.0 IO! NH: 138.4 m (Ges:179,4 m) (1)



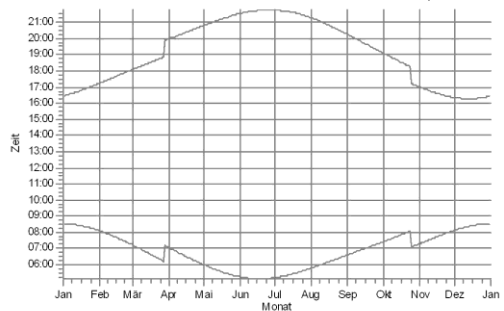
WEA 01: ENERCON E-138 EP3 E2 4200 138.3 IO! NH: 160.0 m (Ges:229,1



WEA 02: ENERCON E-82 E2 2300 82.0 IO! NH: 138.4 m (Ges:179,4 m) (2)



WEA 02: ENERCON E-138 EP3 E2 4200 138.3 IO! NH: 160.0 m (Ges:229,1



Schattenrezeptoren

SR-01: SR-01, Radlinghauser Str. 4, 59929 Brilon	SR-07: SR-07, Radlinghauser Str. 1, 59929 Brilon	SR-13: SR-13, Am Ruhberg 10, 59929 Brilon
SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon	SR-08: SR-08, Almer Str. 26, 59929 Brilon	SR-14: SR-14, Radlinghauser Str. 15, 59929 Brilon
SR-03: SR-03, Almer Str. 41, 59929 Brilon	SR-09: SR-09, Almer Str. 24, 59929 Brilon	SR-15: SR-15, Radlinghauser Str. 11, 59929 Brilon
SR-04: SR-04, Lohweg 1, 59929 Brilon	SR-10: SR-10, Almer Str. 29, 59929 Brilon	SR-16: SR-16, Radlinghauser Str. 15, 59929 Brilon
SR-05: SR-05, Almer Str. 39, 59929 Brilon	SR-11: SR-11, Stammelstraße 22, 59929 Brilon	SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon
SR-06: SR-06, Radlinghauser Str. 3, 59929 Brilon	SR-12: SR-12, Am Ruhberg 16, 59929 Brilon	

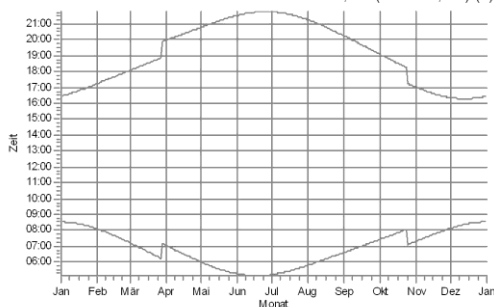
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Berechnet:
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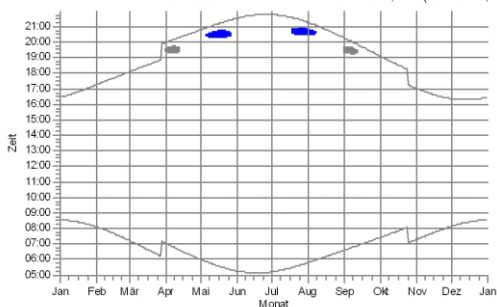
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

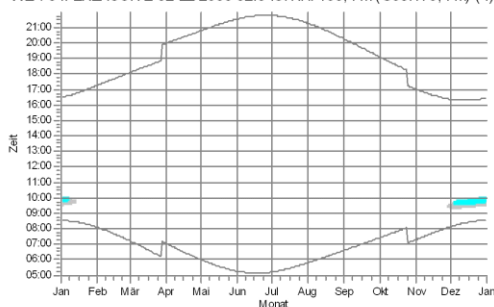
WEA 03: ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (3)



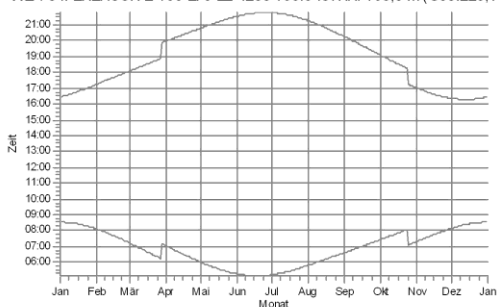
WEA 03: ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1



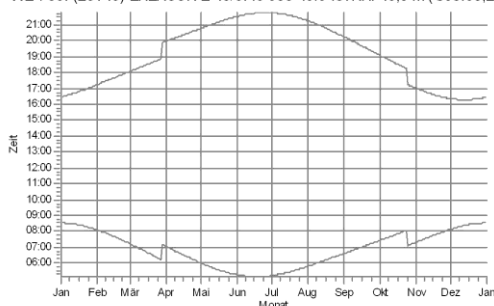
WEA 04: ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (4)



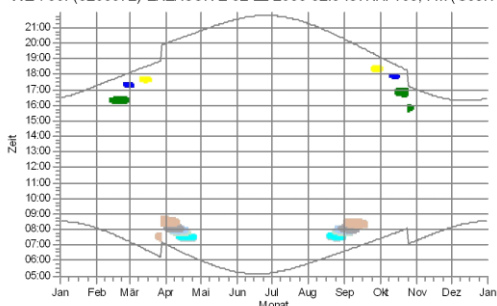
WEA 04: ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:229,1



WEA 05: (28143) ENERCON E-40/5.40 500 40.3 !O! NH: 48,0 m (Ges:68,2



WEA 06: (0260972) ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:17



Schattenrezeptoren

SR-01: SR-01, Radlinghauser Str. 4, 59929 Brilon	SR-12: SR-12, Am Ruhberg 16, 59929 Brilon	SR-16: SR-16, Radlinghauser Str. 15, 59929 Brilon
SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon	SR-13: SR-13, Am Ruhberg 10, 59929 Brilon	SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon
SR-03: SR-03, Almer Str. 41, 59929 Brilon	SR-14: SR-14, Radlinghauser Str. 15, 59929 Brilon	
SR-04: SR-04, Lohweg 1, 59929 Brilon	SR-15: SR-15, Radlinghauser Str. 11, 59929 Brilon	

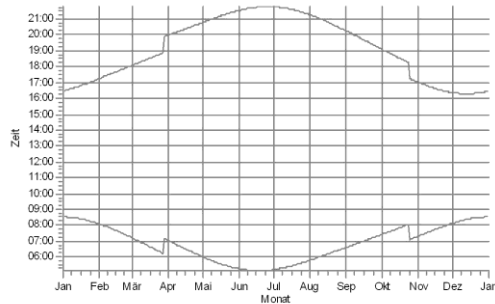
Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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+49 5971 9710-31
Schaer / t.schaer@koetter-consulting.com
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18.09.2020 10:28/3.4.388

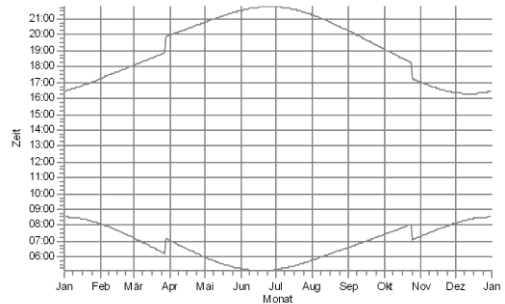
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

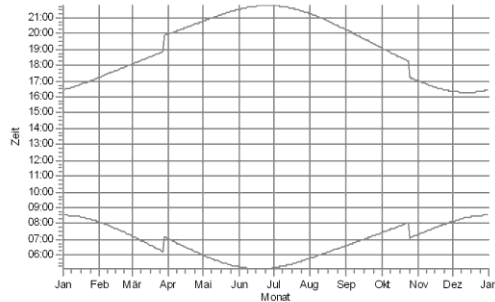
WEA 07: (8251110) NORDEX N29-250 250-45 29.7 !:NH: 50,0 m (Ges:64



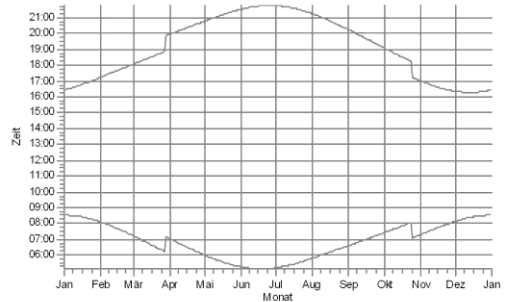
WEA 08: (8251176) NORDEX N29-250 250-45 29.7 !:NH: 50,0 m (Ges:64



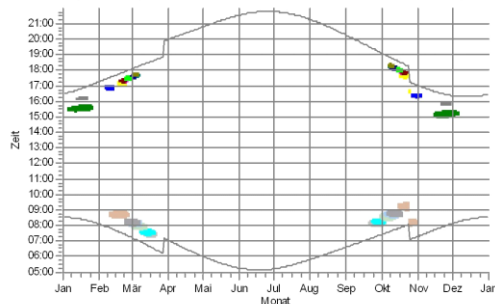
WEA 09: (9111291) DEWIND D6/64-1,25MW 1250 64.0 !:NH: 91,5 m (Ge



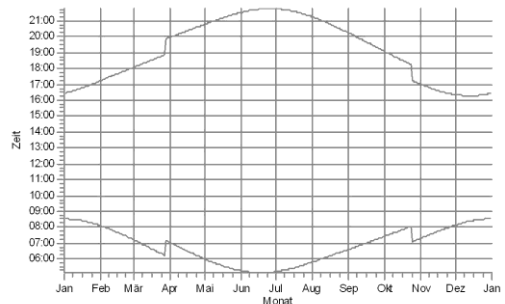
WEA 11: (9138727) FUHLÄNDER FL-MD77 1500 77.0 !:NH: 100,0 m (Ge



WEA 12: (9139150) ENERCON E-66/20.70 2000 70.0 !:NH: 98,0 m (Ges:1



WEA 13: (9140523) FUHLÄNDER FL-MD77 1500 77.0 !:NH: 100,0 m (Ge



Schattenrezeptoren

SR-01: SR-01, Radlinghauser Str. 4, 59929 Brilon	SR-07: SR-07, Radlinghauser Str. 1, 59929 Brilon	SR-14: SR-14, Radlinghauser Str. 15, 59929 Brilon
SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon	SR-08: SR-08, Almer Str. 26, 59929 Brilon	SR-15: SR-15, Radlinghauser Str. 11, 59929 Brilon
SR-03: SR-03, Almer Str. 41, 59929 Brilon	SR-09: SR-09, Almer Str. 24, 59929 Brilon	SR-16: SR-16, Radlinghauser Str. 15, 59929 Brilon
SR-04: SR-04, Lohweg 1, 59929 Brilon	SR-10: SR-10, Almer Str. 29, 59929 Brilon	SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon
SR-05: SR-05, Almer Str. 39, 59929 Brilon	SR-12: SR-12, Am Ruhberg 16, 59929 Brilon	
SR-06: SR-06, Radlinghauser Str. 3, 59929 Brilon	SR-13: SR-13, Am Ruhberg 10, 59929 Brilon	

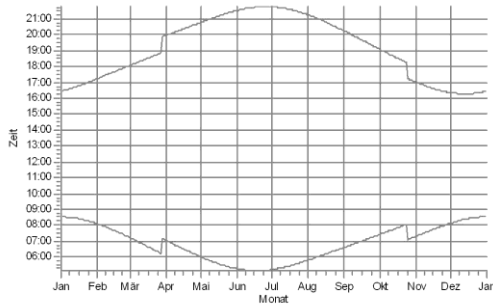
Projekt:
216094-04 WP Brilon-Madfeld

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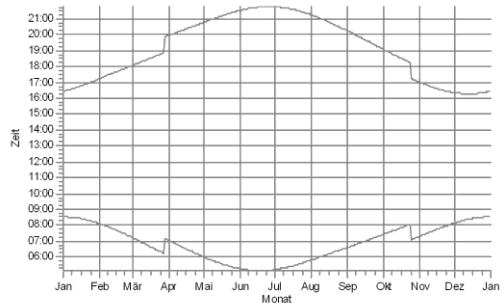
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

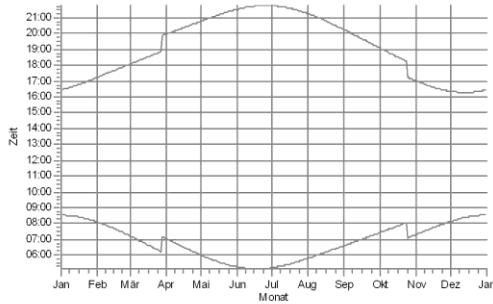
WEA 14: (9140539) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



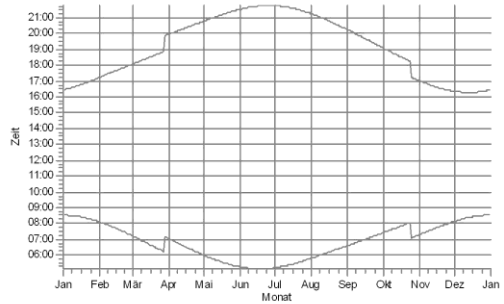
WEA 15: (9140540) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



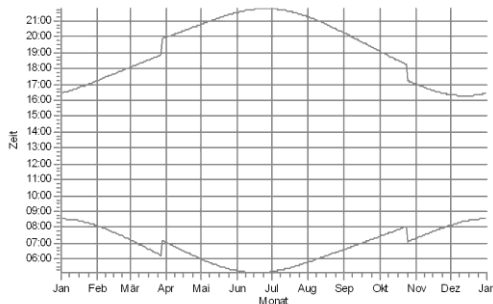
WEA 16: (9140541) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



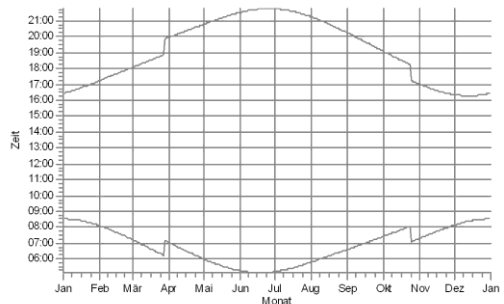
WEA 17: (9140543) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



WEA 18: (9140544) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



WEA 19: (9140545) ENERCON E-82 2000 82.0 !0! NH: 98,3 m (Ges:139,3 m)



Schattenrezeptoren

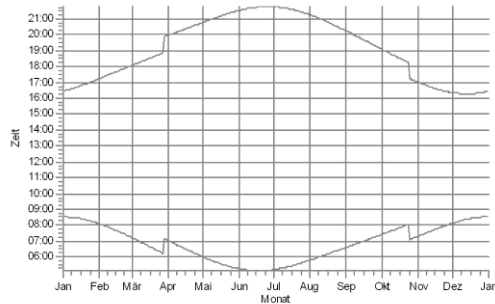
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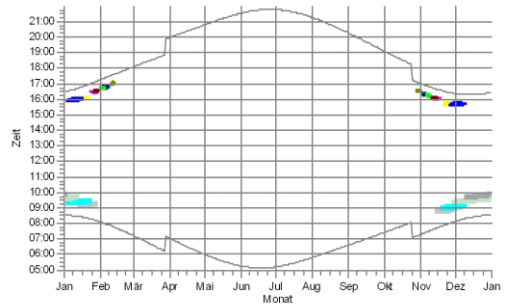
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

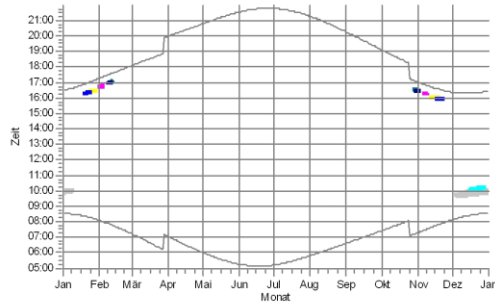
WEA 20: (9140546) ENERCON E-48 800 48.0 !O! NH: 75,6 m (Ges:99,6 m)



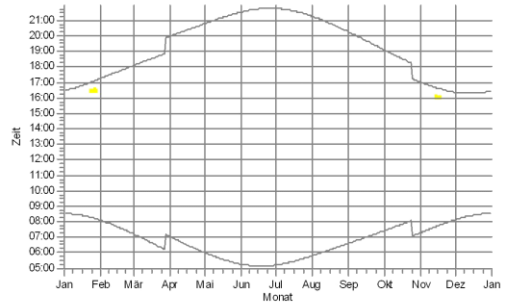
WEA 28: (9974503) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:1



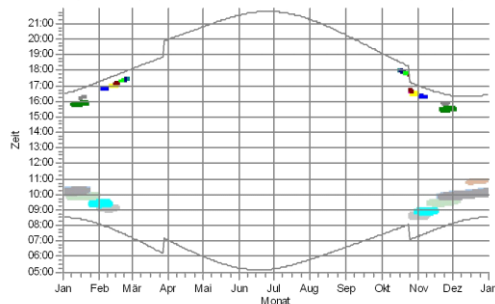
WEA 29: (9974504) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:1



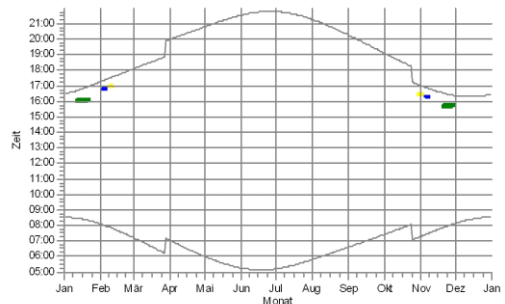
WEA 30: (9974505) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:1



WEA 31: (9974506) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:1



WEA 32: (9974507) ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:1



Schattenrezeptoren

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SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon	SR-08: SR-08, Almer Str. 26, 59929 Brilon	SR-15: SR-15, Radlinghauser Str. 11, 59929 Brilon
SR-03: SR-03, Almer Str. 41, 59929 Brilon	SR-09: SR-09, Almer Str. 24, 59929 Brilon	SR-16: SR-16, Radlinghauser Str. 15, 59929 Brilon
SR-04: SR-04, Lohweg 1, 59929 Brilon	SR-10: SR-10, Almer Str. 29, 59929 Brilon	SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon
SR-05: SR-05, Almer Str. 39, 59929 Brilon	SR-12: SR-12, Am Ruhberg 16, 59929 Brilon	
SR-06: SR-06, Radlinghauser Str. 3, 59929 Brilon	SR-13: SR-13, Am Ruhberg 10, 59929 Brilon	

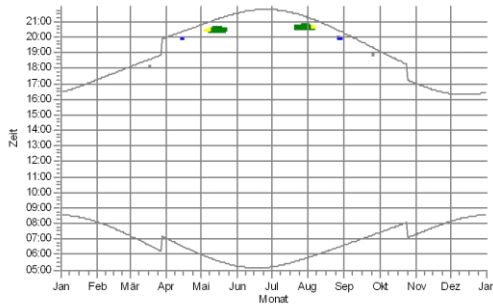
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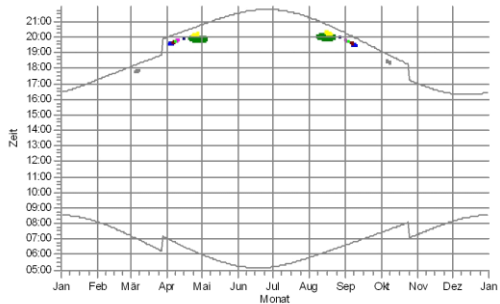
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

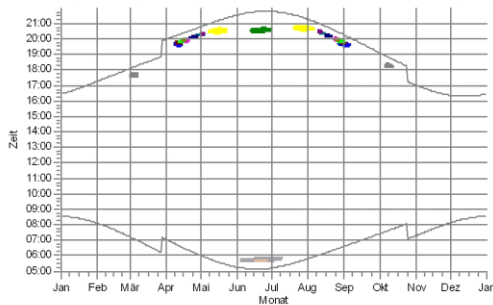
WEA 33: (9974508) ENERCON E-66/20.70 2000 70.0 !:NH: 98,0 m (Ges:1



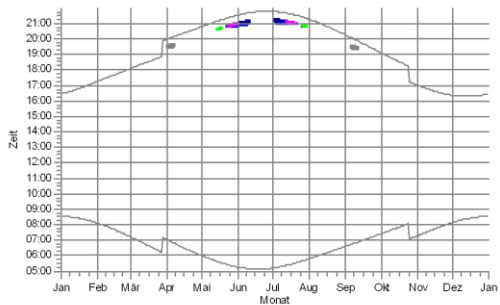
WEA 34: (9974509) ENERCON E-66/20.70 2000 70.0 !:NH: 98,0 m (Ges:1



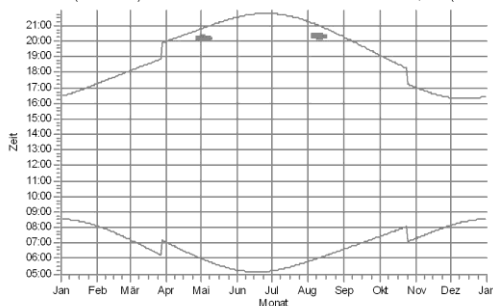
WEA 35: (9974510) ENERCON E-66/20.70 2000 70.0 !:NH: 98,0 m (Ges:1



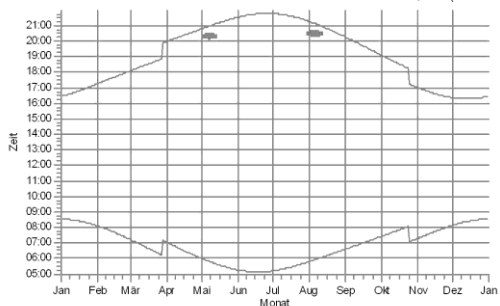
WEA 36: (9974511) ENERCON E-66/20.70 2000 70.0 !:NH: 98,0 m (Ges:1



WEA 39: (9974513) ENERCON E-82 E2 2300 82.0 !:NH: 138,4 m (Ges:17



WEA 40: WEA L-02 ENERCON E-82 E2 2300 82.0 !:NH: 138,4 m (Ges:17



Schattenrezeptoren

SR-01: SR-01, Radlinghauser Str. 4, 59929 Brilon	SR-07: SR-07, Radlinghauser Str. 1, 59929 Brilon	SR-13: SR-13, Am Ruhberg 10, 59929 Brilon
SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon	SR-08: SR-08, Almer Str. 26, 59929 Brilon	SR-14: SR-14, Radlinghauser Str. 15, 59929 Brilon
SR-03: SR-03, Almer Str. 41, 59929 Brilon	SR-09: SR-09, Almer Str. 24, 59929 Brilon	SR-15: SR-15, Radlinghauser Str. 11, 59929 Brilon
SR-04: SR-04, Lohweg 1, 59929 Brilon	SR-10: SR-10, Almer Str. 29, 59929 Brilon	SR-16: SR-16, Radlinghauser Str. 15, 59929 Brilon
SR-05: SR-05, Almer Str. 39, 59929 Brilon	SR-11: SR-11, Stempelstraße 22, 59929 Brilon	SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon
SR-06: SR-06, Radlinghauser Str. 3, 59929 Brilon	SR-12: SR-12, Am Ruhberg 16, 59929 Brilon	

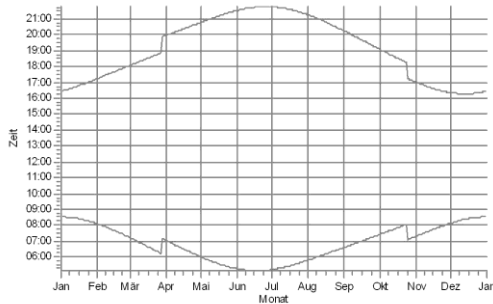
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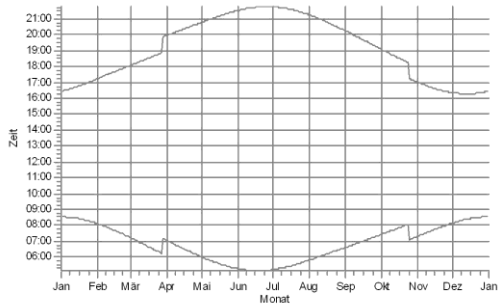
SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung

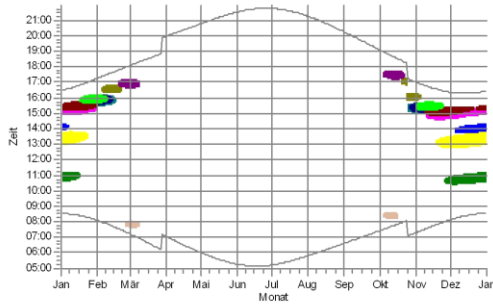
WEA 41: WEA L-03 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:17



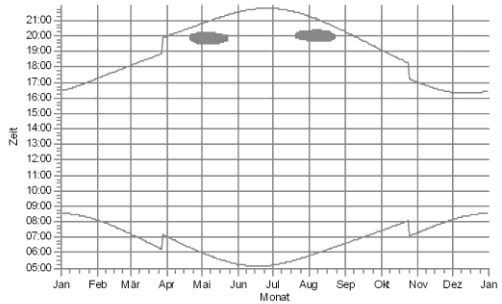
WEA 42: WEA L-04 ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:17



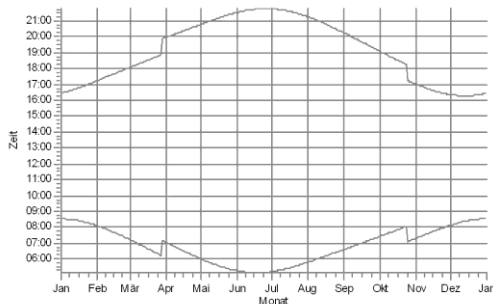
WEA N03: NORDEX N131/3300 DE 3300 131.0 !-! NH: 164,0 m (Ges:229,5



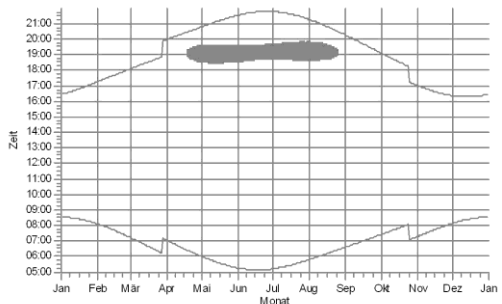
WEA-ZB01: ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:225



WEA-ZB02: ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:225



WEA-ZB03: ENERCON E-138 EP3 E2 4200 138.3 !O! NH: 160,0 m (Ges:225



Schattenrezeptoren

 SR-01: SR-01, Radlinghauser Str. 4, 59929 Brilon
 SR-02: SR-02, Radlinghauser Str. 7, 59929 Brilon
 SR-03: SR-03, Almer Str. 41, 59929 Brilon
 SR-04: SR-04, Lohweg 1, 59929 Brilon

 SR-05: SR-05, Almer Str. 39, 59929 Brilon
 SR-06: SR-06, Radlinghauser Str. 3, 59929 Brilon
 SR-07: SR-07, Radlinghauser Str. 1, 59929 Brilon
 SR-08: SR-08, Almer Str. 26, 59929 Brilon

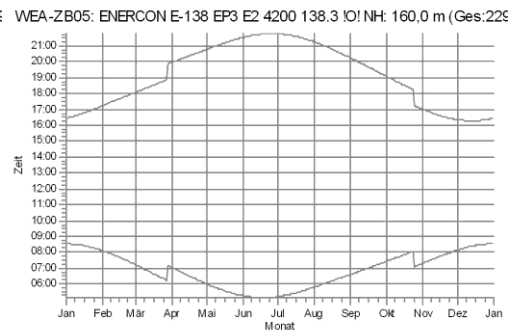
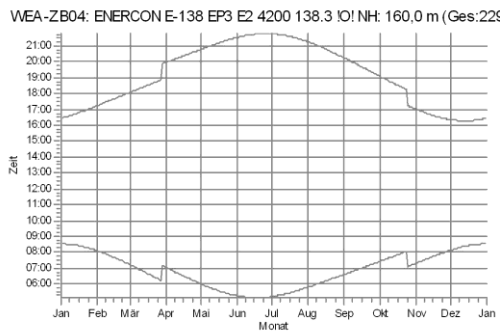
 SR-09: SR-09, Almer Str. 24, 59929 Brilon
 SR-10: SR-10, Almer Str. 29, 59929 Brilon
 SR-11: SR-11, Stammelstraße 22, 59929 Brilon
 SR-17: SR-17, Radlinghauser Str. 3, 59929 Brilon

Projekt:
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SHADOW - Grafischer Kalender pro WEA

Berechnung: Gesamtbelastung



Schattenrezeptoren

Anlage B: Schattenausbreitung der Vor- und Zusatzbelastung

Anlage B1: SHADOW-Hauptergebnis mit Darstellung der Vorbelastung, Immissionssorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

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SHADOW - Hauptergebnis

Berechnung: Vorbelastung

Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA
Schatten nur relevant, wo Rotorblatt mind. 20% der Sonne verdeckt
Siehe WEA-Tabelle

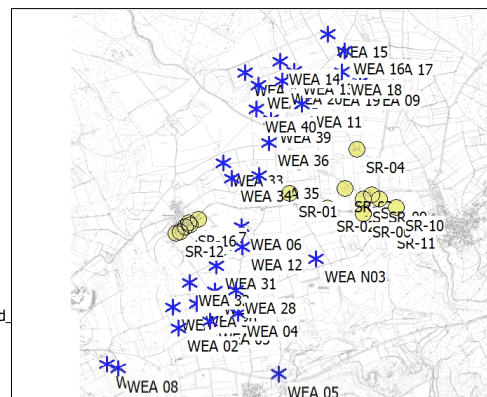
Minimale relevante Sonnenhöhe über Horizont 3 °
Tage zwischen Berechnungen 1 Tag(e)
Berechnungszeitsprung 1 Minuten
Die dargestellten Zeiten sind die astronomisch maximal mögliche
Beschattungsdauer, berechnet unter folgenden Annahmen:
Die Sonne scheint täglich von Sonnenauf- bis -untergang
Die Rotorfläche 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: Höhenrastr-Objekt: 216094-01 WP Brilon-Madfeld
Hindernisse in Berechnung verwendet
Berechnungshöhe ü.Gr. für Karte: 1,5 m
Rasterauflösung: 5,0 m

Alle Koordinatenangaben in:
UTM (north)-WGS84 Zone: 32

WEA

	Ost	Nord	Z	Beschreibung	WEA-Typ	Hersteller	Typ	Nenn- leistung	Rotor- durch- messer	Naben- höhe	Schattendaten	U/min
			[m]		Ak- tu- ell			[kW]	[m]	[m]	Beschatt.- Bereich	[U/min]
WEA 01	476.990	5.696.757	502,8	ENERCON E-82 ...Ja		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 02	477.071	5.696.472	509,3	ENERCON E-82 ...Ja		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 03	477.496	5.696.565	517,7	ENERCON E-82 ...Ja		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 04	477.879	5.696.673	519,0	ENERCON E-82 ...Ja		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 05	478.437	5.695.837	517,1 (28143)	ENERCON E-40/5.40-500	Nein	ENERCON	E-40/5.40-500	500	40,3	48,0	898	38,0
WEA 06	477.929	5.697.855	490,2 (0260972)	ENERCON E-82 E2-2.300		ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 07	476.091	5.695.971	474,8 (8251110)	NORDEX N29-250-250/45	Nein	NORDEX	N29-250-250/45	250	29,7	50,0	2.500	40,0
WEA 08	476.247	5.695.910	483,5 (8251176)	NORDEX N29-250-250/45	Nein	NORDEX	N29-250-250/45	250	29,7	50,0	2.500	40,0
WEA 09	479.544	5.699.823	455,9 (9111291)	DEWIND D6/64-1,25MW-1.250		DEWIND	D6/64-1,25MW-1.250	1.250	64,0	91,5	2.500	21,1
WEA 11	478.751	5.699.533	450,8 (9138727)	FUHLRLÄNDER FL-MD77-1.500	Nein	FUHLRLÄNDER	FL-MD77-1.500	1.500	77,0	100,0	2.500	17,3
WEA 12	477.944	5.697.581	502,5 (9139150)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 13	478.651	5.699.978	464,1 (9140523)	FUHLRLÄNDER FL-MD77-1.500	Nein	FUHLRLÄNDER	FL-MD77-1.500	1.500	77,0	100,0	2.500	17,3
WEA 14	478.460	5.700.115	460,6 (9140539)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 15	479.109	5.700.488	451,5 (9140540)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 16	479.334	5.700.253	452,8 (9140541)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 17	479.723	5.700.241	436,3 (9140543)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 18	479.299	5.699.969	457,0 (9140544)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 19	478.997	5.699.821	462,9 (9140545)	ENERCON E-82-2.000	Nein	ENERCON	E-82-2.000	2.000	82,0	98,3	1.550	19,5
WEA 20	478.489	5.699.845	467,3 (9140546)	ENERCON E-48-800	Ja	ENERCON	E-48-800	800	48,0	75,6	1.047	30,0
WEA 28	477.853	5.696.988	512,5 (9974503)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 29	477.568	5.696.976	515,8 (9974504)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 30	477.318	5.696.805	512,7 (9974505)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 31	477.588	5.697.316	510,1 (9974506)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 32	477.221	5.697.088	511,3 (9974507)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 33	477.678	5.698.726	444,6 (9974508)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 34	477.796	5.698.518	451,6 (9974509)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 35	478.170	5.698.550	460,7 (9974510)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 36	478.305	5.699.007	439,8 (9974511)	ENERCON E-66/20.70-2.000	Nein	ENERCON	E-66/20.70-2.000	2.000	70,0	98,0	2.500	22,0
WEA 39	478.337	5.699.317	432,9 (9974513)	ENERCON E-82 E2-2.300	Ja	ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 40	478.131	5.699.457	446,9 WEA L-02 ENER...	ENERCON	Ja	ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 41	478.156	5.699.787	466,0 WEA L-03 ENER...	ENERCON	Ja	ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA 42	477.977	5.699.956	453,0 WEA L-04 ENER...	ENERCON	Ja	ENERCON	E-82 E2-2.300	2.300	82,0	138,4	1.599	18,0
WEA N03	478.944	5.697.414	488,3 NORDEX N131/...	NORDEX	Ja	NORDEX	N131/3300 DE-3.300	3.300	131,0	164,0	1.719	10,9



* Existierende WEA

● Schattenrezeptor

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:34/3.4.388

SHADOW - Hauptergebnis

Berechnung: Vorbelastung

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
					[m]	[m]	[m]	[°]		[m]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	478.592	5.698.307	458,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	479.104	5.698.105	481,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Almer Str. 41, 59929 Brilon	479.342	5.698.373	471,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Lohweg 1, 59929 Brilon	479.507	5.698.903	469,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Almer Str. 39, 59929 Brilon	479.591	5.698.231	476,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	479.591	5.698.027	482,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	479.673	5.698.098	474,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Almer Str. 26, 59929 Brilon	479.708	5.698.284	472,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Almer Str. 24, 59929 Brilon	479.817	5.698.224	467,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Almer Str. 29, 59929 Brilon	480.048	5.698.117	467,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Stammelstraße 22, 59929 Brilon	479.934	5.697.873	473,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	477.039	5.697.758	487,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	477.098	5.697.781	486,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	477.169	5.697.849	481,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	477.234	5.697.877	482,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	477.215	5.697.900	480,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	477.350	5.697.950	485,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

Berechnungsergebnisse

Schattenrezeptor

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	68:12	186	0:53
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	63:04	185	0:47
SR-03	SR-03, Almer Str. 41, 59929 Brilon	27:56	171	0:23
SR-04	SR-04, Lohweg 1, 59929 Brilon	13:34	84	0:22
SR-05	SR-05, Almer Str. 39, 59929 Brilon	40:11	147	0:31
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	30:10	89	0:43
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	26:09	104	0:39
SR-08	SR-08, Almer Str. 26, 59929 Brilon	29:33	126	0:28
SR-09	SR-09, Almer Str. 24, 59929 Brilon	19:30	84	0:32
SR-10	SR-10, Almer Str. 29, 59929 Brilon	11:46	48	0:29
SR-11	SR-11, Stammelstraße 22, 59929 Brilon	13:04	42	0:27
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	51:08	190	0:32
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	45:18	180	0:24
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	46:37	171	0:25
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	50:44	150	0:35
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	50:42	163	0:33
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	34:58	123	0:31

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal [h/a]
WEA 01	ENERCON E-82 E2 2300 82.0 !OI NH: 138,4 m (Ges:179,4 m) (1)	0:00
WEA 02	ENERCON E-82 E2 2300 82.0 !OI NH: 138,4 m (Ges:179,4 m) (2)	0:00
WEA 03	ENERCON E-82 E2 2300 82.0 !OI NH: 138,4 m (Ges:179,4 m) (3)	0:00
WEA 04	ENERCON E-82 E2 2300 82.0 !OI NH: 138,4 m (Ges:179,4 m) (4)	15:08
WEA 05	(28143) ENERCON E-40/5.40 500 40.3 !OI NH: 48,0 m (Ges:68,2 m) (5)	0:00
WEA 06	(0260972) ENERCON E-82 E2 2300 82.0 !OI NH: 138,4 m (Ges:179,4 m) (6)	63:00
WEA 07	(8251110) NORDEX N29-250 250-45 29.7 !-I NH: 50,0 m (Ges:64,8 m) (7)	0:00
WEA 08	(8251176) NORDEX N29-250 250-45 29.7 !-I NH: 50,0 m (Ges:64,8 m) (8)	0:00
WEA 09	(9111291) DEWIND D6/64-1,25MW 1250 64.0 !OI NH: 91,5 m (Ges:123,5 m) (9)	0:00
WEA 11	(9138727) FUHLÄNDER FL-MD77 1500 77.0 !-I NH: 100,0 m (Ges:138,5 m) (11)	0:00
WEA 12	(9139150) ENERCON E-66/20.70 2000 70.0 !-I NH: 98,0 m (Ges:133,0 m) (12)	53:51
WEA 13	(9140523) FUHLÄNDER FL-MD77 1500 77.0 !-I NH: 100,0 m (Ges:138,5 m) (13)	0:00
WEA 14	(9140539) ENERCON E-82 2000 82.0 !OI NH: 98,3 m (Ges:139,3 m) (14)	0:00
WEA 15	(9140540) ENERCON E-82 2000 82.0 !OI NH: 98,3 m (Ges:139,3 m) (15)	0:00
WEA 16	(9140541) ENERCON E-82 2000 82.0 !OI NH: 98,3 m (Ges:139,3 m) (16)	0:00
WEA 17	(9140543) ENERCON E-82 2000 82.0 !OI NH: 98,3 m (Ges:139,3 m) (17)	0:00
WEA 18	(9140544) ENERCON E-82 2000 82.0 !OI NH: 98,3 m (Ges:139,3 m) (18)	0:00

(Fortsetzung nächste Seite)...

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Berechnet:
18.09.2020 10:34/3.4.388

SHADOW - Hauptergebnis

Berechnung: Vorbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA 19 (9140545)	ENERCON E-82 2000 82.0 !O! NH: 98,3 m (Ges:139,3 m) (19)	0:00
WEA 20 (9140546)	ENERCON E-48 800 48.0 !O! NH: 75,6 m (Ges:99,6 m) (20)	0:00
WEA 28 (9974503)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (28)	39:21
WEA 29 (9974504)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (29)	15:38
WEA 30 (9974505)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (30)	0:52
WEA 31 (9974506)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (31)	81:22
WEA 32 (9974507)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (32)	4:08
WEA 33 (9974508)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (33)	7:25
WEA 34 (9974509)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (34)	10:23
WEA 35 (9974510)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (35)	21:47
WEA 36 (9974511)	ENERCON E-66/20.70 2000 70.0 !-! NH: 98,0 m (Ges:133,0 m) (36)	6:48
WEA 39 (9974513)	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (39)	4:58
WEA 40 WEA L-02	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (40)	3:52
WEA 41 WEA L-03	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (41)	0:00
WEA 42 WEA L-04	ENERCON E-82 E2 2300 82.0 !O! NH: 138,4 m (Ges:179,4 m) (42)	0:00
WEA N03 NORDEX	N131/3300 DE 3300 131.0 !-! NH: 164,0 m (Ges:229,5 m) (58)	174:55

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.

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:32/3.4.388

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: Höhenrastr-Objekt: 216094-01 WP Brilon-Madfeld
Hindernisse in Berechnung verwendet
Berechnungshöhe ü.Gr. für Karte: 1,5 m
Rasterauflösung: 5,0 m

Alle Koordinatenangaben in:
UTM (north)-WGS84 Zone: 32

WEA

	Ost	Nord	Z	Beschreibung	WEA-Typ Ak- tu- ell	Hersteller	Typ	Nenn- leistung	Rotor- durch- messer	Naben- höhe	Schattendaten Beschatt.- Bereich	U/min
	[m]							[kW]	[m]	[m]	[m]	[U/min]
WEA 01	478.665	5.697.768	477,6	NORDEX N149/5.X 5700 14...	Ja	NORDEX	N149/5.X-5.700	5.700	149,0	125,0	1.808	10,7
WEA 02	478.366	5.697.436	508,1	NORDEX N163/5.X 5700 16...	Ja	NORDEX	N163/5.X-5.700	5.700	163,0	164,0	1.784	10,7



Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
					[m]	[m]	[m]	[°]		[m]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	478.592	5.698.307	458,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	479.104	5.698.105	481,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Almer Str. 41, 59929 Brilon	479.342	5.698.373	471,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Lohweg 1, 59929 Brilon	479.507	5.698.903	469,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Almer Str. 39, 59929 Brilon	479.591	5.698.231	476,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	479.591	5.698.027	482,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	479.673	5.698.098	474,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Almer Str. 26, 59929 Brilon	479.708	5.698.284	472,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Almer Str. 24, 59929 Brilon	479.817	5.698.224	467,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Almer Str. 29, 59929 Brilon	480.048	5.698.117	467,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Stemmelsstraße 22, 59929 Brilon	479.934	5.697.873	473,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	477.039	5.697.758	487,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	477.098	5.697.781	486,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	477.169	5.697.849	481,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	477.234	5.697.877	482,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	477.215	5.697.900	480,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	477.350	5.697.950	485,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

Berechnungsergebnisse

Schattenrezeptor

Nr.	Name	Stunden/Jahr	astron. max. mögl. Beschattungsdauer Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	124:40	88	1:51
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	78:32	95	1:02
SR-03	SR-03, Almer Str. 41, 59929 Brilon	39:43	75	0:42
SR-04	SR-04, Lohweg 1, 59929 Brilon	9:09	34	0:21
SR-05	SR-05, Almer Str. 39, 59929 Brilon	32:02	58	0:51

(Fortsetzung nächste Seite)...

Projekt:
216094-04 WP Brilon-Madfeld

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Berechnet:
18.09.2020 10:32/3.4.388

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	33:50	69	0:45
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	29:04	62	0:46
SR-08	SR-08, Almer Str. 26, 59929 Brilon	26:10	54	0:47
SR-09	SR-09, Almer Str. 24, 59929 Brilon	22:35	53	0:43
SR-10	SR-10, Almer Str. 29, 59929 Brilon	8:56	31	0:24
SR-11	SR-11, Stammelstraße 22, 59929 Brilon	19:57	61	0:27
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	17:46	61	0:27
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	19:24	63	0:29
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	21:34	67	0:29
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	23:42	69	0:31
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	22:58	69	0:30
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	28:01	77	0:33

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal [h/a]
WEA 01	NORDEX N149/5.X 5700 149.0 !O! NH: 125,0 m (Ges:199,5 m) (8)	261:10
WEA 02	NORDEX N163/5.X 5700 163.0 !O! NH: 164,0 m (Ges:245,5 m) (9)	165:06

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.

Anlage B2: SHADOW-Hauptergebnis mit Darstellung der Zusatzbelastung, Immissionsorte SR-01 bis SR-17, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

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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

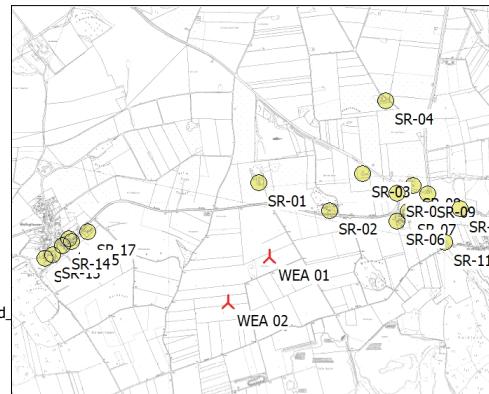
Minimale relevante Sonnenhöhe über Horizont 3 °
Tage zwischen Berechnungen 1 Tag(e)
Berechnungszeitsprung 1 Minuten
Die dargestellten Zeiten sind die astronomisch maximal mögliche
Beschattungsdauer, berechnet unter folgenden Annahmen:
Die Sonne scheint täglich von Sonnenauf- bis -untergang
Die Rotorfläche 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: Höhenrastr-Objekt: 216094-01 WP Brilon-Madfeld
Hindernisse in Berechnung verwendet
Berechnungshöhe ü.Gr. für Karte: 1,5 m
Rasterauflösung: 5,0 m

Alle Koordinatenangaben in:
UTM (north)-WGS84 Zone: 32

WEA

	Ost	Nord	Z	Beschreibung	WEA-Typ Ak- tu- ell	Hersteller	Typ	Nenn- leistung	Rotor- durch- messer	Naben- höhe	Schattendaten Beschatt.- Bereich	U/min
	[m]							[kW]	[m]	[m]	[m]	[U/min]
WEA 01	478.665	5.697.768	477,6	NORDEX N149/5.X 5700 14...	Ja	NORDEX	N149/5.X-5.700	5.700	149,0	125,0	1.808	10,7
WEA 02	478.366	5.697.436	508,1	NORDEX N163/5.X 5700 16...	Ja	NORDEX	N163/5.X-5.700	5.700	163,0	164,0	1.784	10,7



Neue WEA

Schattenrezeptor

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
					[m]	[m]	[m]	[°]		[m]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	478.592	5.698.307	458,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	479.104	5.698.105	481,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Almer Str. 41, 59929 Brilon	479.342	5.698.373	471,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Lohweg 1, 59929 Brilon	479.507	5.698.903	469,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Almer Str. 39, 59929 Brilon	479.591	5.698.231	476,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	479.591	5.698.027	482,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	479.673	5.698.098	474,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Almer Str. 26, 59929 Brilon	479.708	5.698.284	472,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Almer Str. 24, 59929 Brilon	479.817	5.698.224	467,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Almer Str. 29, 59929 Brilon	480.048	5.698.117	467,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Stemmelsstraße 22, 59929 Brilon	479.934	5.697.873	473,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	477.039	5.697.758	487,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	477.098	5.697.781	486,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	477.169	5.697.849	481,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	477.234	5.697.877	482,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	477.215	5.697.900	480,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	477.350	5.697.950	485,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

Berechnungsergebnisse

Schattenrezeptor

Nr.	Name	Stunden/Jahr	astron. max. mögl. Beschattungsdauer Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-01	SR-01, Radlinghauser Str. 4, 59929 Brilon	124:40	88	1:51
SR-02	SR-02, Radlinghauser Str. 7, 59929 Brilon	78:32	95	1:02
SR-03	SR-03, Almer Str. 41, 59929 Brilon	39:43	75	0:42
SR-04	SR-04, Lohweg 1, 59929 Brilon	9:09	34	0:21
SR-05	SR-05, Almer Str. 39, 59929 Brilon	32:02	58	0:51

(Fortsetzung nächste Seite)...

Projekt:
216094-04 WP Brilon-Madfeld

Lizenzierter Anwender:
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Schaer / t.schaer@koetter-consulting.com
Berechnet:
18.09.2020 10:32/3.4.388

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-06	SR-06, Radlinghauser Str. 3, 59929 Brilon	33:50	69	0:45
SR-07	SR-07, Radlinghauser Str. 1, 59929 Brilon	29:04	62	0:46
SR-08	SR-08, Almer Str. 26, 59929 Brilon	26:10	54	0:47
SR-09	SR-09, Almer Str. 24, 59929 Brilon	22:35	53	0:43
SR-10	SR-10, Almer Str. 29, 59929 Brilon	8:56	31	0:24
SR-11	SR-11, Stammelstraße 22, 59929 Brilon	19:57	61	0:27
SR-12	SR-12, Am Ruhberg 16, 59929 Brilon	17:46	61	0:27
SR-13	SR-13, Am Ruhberg 10, 59929 Brilon	19:24	63	0:29
SR-14	SR-14, Radlinghauser Str. 15, 59929 Brilon	21:34	67	0:29
SR-15	SR-15, Radlinghauser Str. 11, 59929 Brilon	23:42	69	0:31
SR-16	SR-16, Radlinghauser Str. 15, 59929 Brilon	22:58	69	0:30
SR-17	SR-17, Radlinghauser Str. 3, 59929 Brilon	28:01	77	0:33

Gesamtdauer Beschattung an Rezeptoren pro WEA

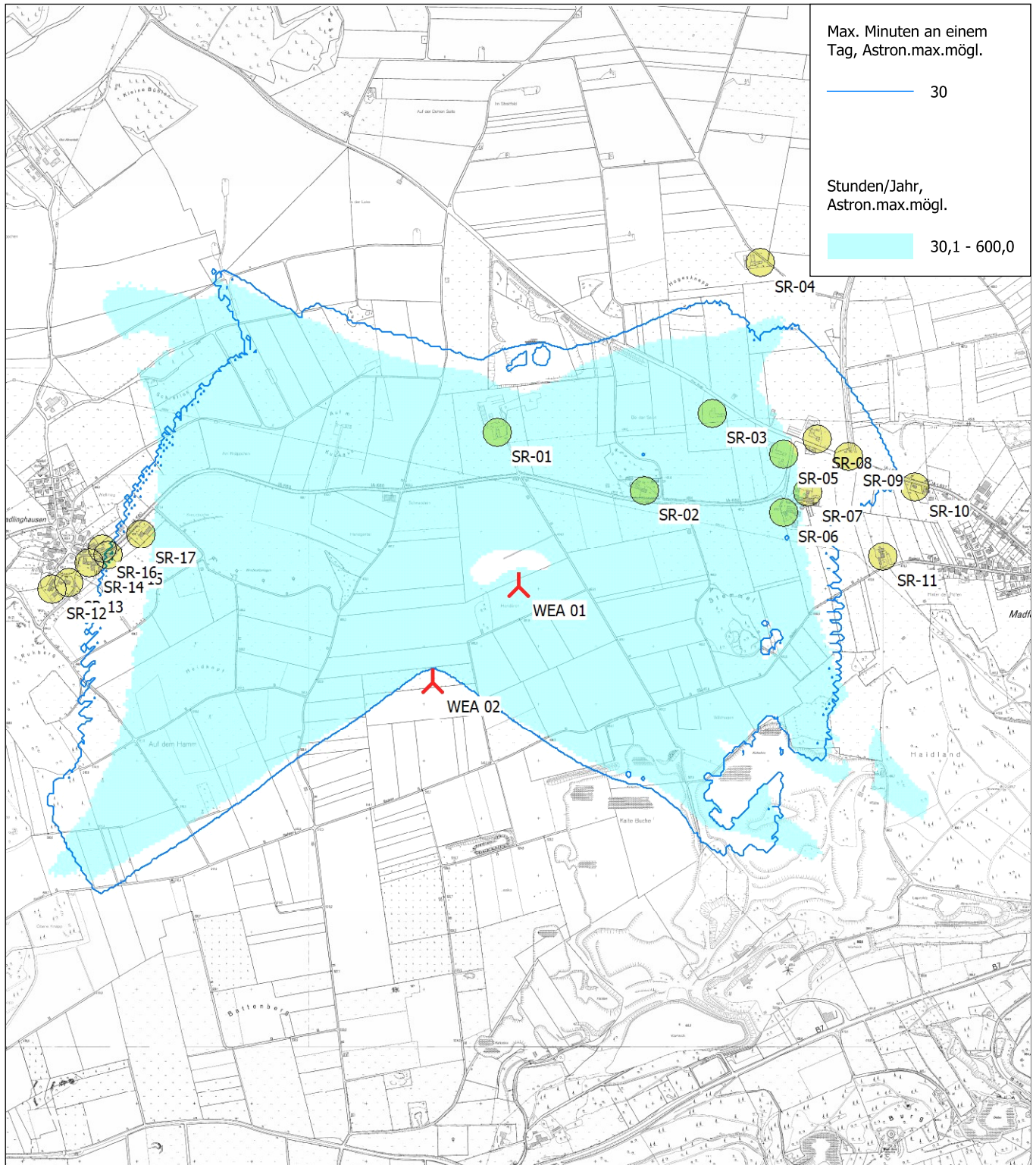
Nr.	Name	Maximal [h/a]
WEA 01	NORDEX N149/5.X 5700 149.0 !O! NH: 125,0 m (Ges:199,5 m) (8)	261:10
WEA 02	NORDEX N163/5.X 5700 163.0 !O! NH: 164,0 m (Ges:245,5 m) (9)	165:06

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.

Anlage B3: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Zusatzbelastung unterteilt in Minuten / Tag und Stunden / Jahr

SHADOW - Karte**Berechnung:** Zusatzbelastung

Seite 144 von 154 zum Bericht Nr. 216094-04.03



Karte: Bitmap-Karte: karte 1.tiff, Maßstab 1:20.000, Mitte: UTM (north)-WGS84 Zone: 32 Ost: 478.665 Nord: 5.697.768

Neue WEA

Schattenrezeptor

Höhe der Schattenkarte: Höhenraster-Objekt: 216094-01 WP Brilon-Madfeld_EMDGrid_0.wpg (1)

Anlage C: Bilder der untersuchten Immissionsorte



Bild 1: Schattenrezeptor SR-01



Bild 2: Schattenrezeptor SR-02



Bild 3: Schattenrezeptor SR-03



Bild 4: Schattenrezeptor SR-04



Bild 5: Schattenrezeptor SR-05



Bild 6: Schattenrezeptor SR-06



Bild 7: Schattenrezeptor SR-07, Nordfassade



Bild 8: Schattenrezeptor SR-08, Nordfassade



Bild 9: Schattenrezeptor SR-09



Bild 10: Schattenrezeptor SR-10



Bild 11: Schattenrezeptor SR-11



Bild 12: Schattenrezeptor SR-12



Bild 13: Schattenrezeptor SR-13



Bild 14: Schattenrezeptor SR-14



Bild 15: Schattenrezeptor SR-15



Bild 16: Schattenrezeptor SR-16



Bild 17: Schattenrezeptor SR-17