

## **SCHATTENWURFPROGNOSE NR. R-2-2023-0060.02**

über die optischen Immissionen in der Umgebung von 16 geplanten  
Windenergieanlagen des Typs Vestas V162-6.2 MW im Windpark  
Müncheberg-Mittelheide bei 15374 Müncheberg

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## 1.) Zusammenfassung

Die vorliegende Untersuchung bezieht sich auf den Betrieb von 16 geplanten Windenergieanlagen (WEA) vom Typ Vestas V162-6.2 MW im Windpark Müncheberg-Mittelheide. Es wird die Schattenausbreitung der astronomisch maximal möglichen Beschattungsdauer nach den Vorgaben der Bund/Länder-Arbeitsgemeinschaft Immissionsschutz (LAI) [1] im Rahmen der Gesamtbelastung an den ermittelten Immissionsorten untersucht. Am Standort Müncheberg befinden sich 65 existierende oder geplante WEA, die als Vorbelastung zu berücksichtigen sind.

Bei Normalbetrieb der WEA ergeben die Berechnungen unzulässige Überschreitungen der Immissionsrichtwerte durch den kumulativen periodischen Schattenwurf (Gesamtbelastung mit Einfluss der Zusatzbelastung). Im Rahmen dieser Berechnung werden insgesamt 95 Schattenrezeptoren untersucht. Der jährliche Grenzwert der Schattenwurfdauer wird am SR-60 um maximal 116:06:00 Stunden pro Jahr überschritten (der jährliche Grenzwert wird an insgesamt 94 Immissionsorten seitens der Gesamtbelastung überschritten). Der tägliche Grenzwert wird um maximal 34 Minuten am SR-60 überschritten (der tägliche Grenzwert wird an insgesamt 32 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, 12.09.2023 RMR/BB



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## 2.) Situation und Aufgabenstellung

Die Naturwind Potsdam GmbH plant die Errichtung von 16 Windenergieanlagen (WEA) vom Typ Vestas V162-6.2 MW mit einer Nabenhöhen von  $h_N = 169$  m und einer elektrischen Leistung von  $P_{el} = 6.200$  kW im Windpark Müncheberg-Mittelheide am Standort 15374 Müncheberg, Landkreis Märkisch-Oderland in Brandenburg. 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 Windkraftanlagen nach den Vorgaben der Bund/Länder-Arbeitsgemeinschaft Immissionsschutz (LAI) [1] angewendet.

In der Umgebung des Standortes befinden sich 65 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 geplanten 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 und Unterlagen herangezogen:

- [1] Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windkraftanlagen (WKA-Schattenwurf-Hinweise), Bund/Länder-Arbeitsgemeinschaft Immissionsschutz (LAI), Aktualisierung 2019, 23.01.2020
- [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 3.6.366, 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 = 427.824, HW = 5.809.201; obere rechte Ecke: RW = 436.885, HW = 5.817.372), Herausgeber: Landesvermessung und Geobasisinformation Brandenburg, © GeoBasis DE/LGB 2021
- [5] Vorbelastungsanfrage an das LfU Frankfurt (Oder), Frau Nadine Kusche, 22.05.2023
- [6] Ortstermin zur Besichtigung der Immissionspunkte am 25.03.2020 durch KÖTTER Consulting Engineers Berlin GmbH, Herrn Peter Bachmann

#### 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  $3^\circ$ .

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 Windkraftanlagen der Bund/Länder-Arbeitsgemeinschaft 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 Sonneneinfallrichtung.
- Minimale relevante Sonnenhöhe über Horizont mit 3°.
- Es werden keine Hindernisse angenommen, die eine abschirmende Wirkung besitzen.
- An den Wohngebäuden 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 3.6.366 [3]. Als Immissionspunkt wird ein Schattenrezeptor (SR) an der kritischen Fensterseite der Gebäude 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 65 Windenergieanlagen wovon 29 als Vorbelastung zu berücksichtigen sind. Die 36 WEA nordwestlich des geplanten Windparks befinden sich außerhalb des Schatteneinwirkungsbereiches. Die Informationen über die anzusetzende Vorbelastung wurde mit dem Landesamt für Umwelt (Technischer Umweltschutz Überwachung Frankfurt (Oder) abgestimmt [5]. Die UTM/ETRS 89-Koordinaten (Zone 33) befinden sich im SHADOW-Hauptergebnis in Anlage A2.

Typ	Enron Wind EW 1.5sl	Siemens Gamesa SG 6.2-170	Vestas V162-5.6 MW
Bezeichnung	WEA 1 bis WEA 7	WEA VB 01 bis WEA VB 21	WEA 13
Hersteller	Enron Wind	Siemens Gamesa	Vestas Wind Systems
Nabenhöhe $h_N$ [m]	80,0	165,0	166,0
Rotordurchmesser [m]	77,0	170,0	162,0
Nennleistung [kW]	1.500	6.200	5.600
Maximale Blatttiefe [m]	k. A.	4,5 [3]	4,32 [3]
Schattenbereich [m]	2.500	2.037	2.037

Tabelle 1: Anlagendaten der vorhandenen Windenergieanlagen der Vorbelastung im Windpark Müncheberg-Mittelheide

#### 4.4. Windenergieanlagen der Zusatzbelastung

Die relevante Zusatzbelastung im Windpark Müncheberg-Mittelheide besteht aus 16 geplanten WEA vom Typ Vestas V162-6.2 MW mit einer Nabenhöhe von  $h_N = 169$  m und einem Rotordurchmesser von 162 m. Die Nabenhöhe ist vom Auftraggeber vorgegeben. Die UTM/ETRS 89-Koordinaten (Zone 32) befinden sich im SHADOW-Hauptergebnis in Anlage A2.

Typ	Vestas V162-6.2 MW
Bezeichnung	WEA ZB01 bis WEA ZB16
Hersteller	Vestas
Nabenhöhe $h_N$ [m]	169
Rotordurchmesser [m]	162,0
Nennleistung [kW]	6.200
Maximale Blatttiefe [m]	4,32 [3]
Schattenbereich [m]	2.037 [3]

Tabelle 2: Anlagendaten der Windenergieanlage der Zusatzbelastung im Windpark Müncheberg-Mittelheide

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 innerhalb der jährlichen und täglichen Grenzwerte der Gesamtbelastung, bei denen die Zusatzbelastung einen Einfluss hat, im Rahmen der weiteren Berechnung der einzelnen Schattenwurfzeiten untersucht. Innerhalb dieser Auflistung sind 95 maßgebliche Schattenrezeptoren aufgenommen worden. Die Tabelle 3 zeigt die Schattenrezeptoren mit deren Adressen und den UTM/ETRS 89-Koordinaten (Zone 33) auf.

Bezeichnung	Adresse	UTM-Koordinaten	
		Ost	Nord
SR-01a	Neue Mühle 1, 15518 Jänickendorf	431.106	5.813.145
SR-01b	Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	431.170	5.813.181
SR-02	Ausbau Schönfelder Weg 1, 15518 Jänickendorf	433.938	5.811.330
SR-03	Ausbau Schönfelder Weg 2, 15518 Jänickendorf	434.068	5.811.536
SR-04	Ausbau Schönfelder Weg 3, 15518 Jänickendorf	434.184	5.811.569
SR-05	Beerfelde Ausbau 3, 15518 Steinhöfel	434.584	5.811.549
SR-06	Neumühler Straße 5, 15518 Schönfelde	435.103	5.812.854
SR-07	Neumühler Straße 5a, 15518 Schönfelde	435.067	5.812.891
SR-08	Neumühler Straße 6, 15518 Schönfelde	435.042	5.812.883
SR-09	Hoppegartener Straße 18, 15518 Schönfelde	435.315	5.813.074
SR-10	Hoppegartener Straße 19, 15518 Schönfelde	435.300	5.813.111
SR-11	Hoppegartener Straße 20, 15518 Schönfelde	435.289	5.813.136
SR-12	Hoppegartener Straße 20a, 15518 Schönfelde	435.265	5.813.193
SR-13	Hoppegartener Straße 21, 15518 Schönfelde	435.240	5.813.247
SR-14	Hoppegartener Straße 22, 15518 Schönfelde	435.192	5.813.315
SR-15	Am Maxsee 4, 15374 Müncheberg	433.047	5.815.033
SR-16	Am Fuchsbau 9, 15374 Müncheberg	431.144	5.813.955
SR-17	Am Fuchsbau 8, 15374 Müncheberg	431.136	5.813.975
SR-18	Am Fuchsbau 7, 15374 Müncheberg	431.118	5.813.987
SR-19	Am Fuchsbau 5/5a, 15374 Müncheberg	431.097	5.814.031
SR-20	Am Fuchsbau 4/4a, 15374 Müncheberg	431.075	5.814.057
SR-21	Am Fuchsbau 2/2a, 15374 Müncheberg	431.073	5.814.102
SR-22	Am Fuchsbau 1, 15374 Müncheberg	431.039	5.814.112
SR-23	Wilhelm-Maass-Weg 31, 15374 Müncheberg	431.056	5.814.129
SR-24	Wilhelm-Maass-Weg 29, 15374 Müncheberg	431.105	5.814.127
SR-25	Wilhelm-Maass-Weg 28, 15374 Müncheberg	431.117	5.814.138
SR-26	Wilhelm-Maass-Weg 27, 15374 Müncheberg	431.130	5.814.147
SR-27	Wilhelm-Maass-Weg 26, 15374 Müncheberg	431.146	5.814.156
SR-28	Wilhelm-Maass-Weg 25/25a, 15374 Müncheberg	431.178	5.814.160
SR-29	Wilhelm-Maass-Weg 24, 15374 Müncheberg	431.184	5.814.193
SR-30	Wilhelm-Maass-Weg 23, 15374 Müncheberg	431.196	5.814.204
SR-31	Wilhelm-Maass-Weg 23a, 15374 Müncheberg	431.221	5.814.206
SR-32	Wilhelm-Maass-Weg 22a, 15374 Müncheberg	431.211	5.814.222
SR-33	Wilhelm-Maass-Weg 21/21a, 15374 Müncheberg	431.244	5.814.210
SR-34	Wilhelm-Maass-Weg 20/20a, 15374 Müncheberg	431.260	5.814.222
SR-35	Wilhelm-Maass-Weg 17a, 15374 Müncheberg	431.305	5.814.241

Bezeichnung	Adresse	UTM-Koordinaten	
		Ost	Nord
SR-36	Wilhelm-Maass-Weg 16b, 15374 Müncheberg	431.340	5.814.234
SR-37	Wilhelm-Maass-Weg 16/16a, 15374 Müncheberg	431.322	5.814.263
SR-38	Wilhelm-Maass-Weg 15, 15374 Müncheberg	431.343	5.814.267
SR-39	Wilhelm-Maass-Weg 14, 15374 Müncheberg	431.361	5.814.273
SR-40	Wilhelm-Maass-Weg 13, 15374 Müncheberg	431.374	5.814.284
SR-41	Wilhelm-Maass-Weg 12, 15374 Müncheberg	431.389	5.814.307
SR-42	Wilhelm-Maass-Weg 1, 15374 Müncheberg	430.998	5.814.164
SR-43	Wilhelm-Maass-Weg 1b, 15374 Müncheberg	431.005	5.814.192
SR-44	Rehweg 1, 15374 Müncheberg	430.988	5.814.208
SR-45	Rehweg 2, 15374 Müncheberg	430.965	5.814.215
SR-46	Wilhelm-Maass-Weg 2, 15374 Müncheberg	431.033	5.814.184
SR-47	Rehweg 17, 15374 Müncheberg	431.018	5.814.228
SR-48	Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	431.053	5.814.194
SR-49	Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.041	5.814.299
SR-50	Wilhelm-Maass-Weg 3, 15374 Müncheberg	431.065	5.814.232
SR-51	Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.084	5.814.237
SR-52	Hasenweg 1a, 15374 Müncheberg	431.113	5.814.255
SR-53	Hasenweg 1, 15374 Müncheberg	431.076	5.814.255
SR-54	Hasenweg 2a, 15374 Müncheberg	431.097	5.814.285
SR-55	Hasenweg 3A, 15374 Müncheberg	431.087	5.814.310
SR-56	Wilhelm-Maass-Weg 5, 15374 Müncheberg	431.142	5.814.258
SR-57	Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.156	5.814.273
SR-58	Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.174	5.814.289
SR-59	Am Höllengrund 3, 15537 Kienbaum	430.462	5.811.645
SR-60	Beerfelde Ausbau 2, 15518 Steinhöfel	435.063	5.811.423
SR-61	Neue Mühle 2, 15518 Jänickendorf	430.960	5.813.095
SR-62	Hoppegartener Straße 23, 15518 Schönfelde	435.392	5.813.063
SR-63	Hoppegartener Straße 24, 15518 Schönfelde	435.444	5.813.070
SR-64	Hoppegartener Straße 23a, 15518 Schönfelde	435.373	5.813.016
SR-65	Hoppegartener Straße 25, 15518 Schönfelde	435.389	5.812.979
SR-66	Hoppegartener Straße 16/17, 15518 Schönfelde	435.344	5.812.970
SR-67	Grünstraße 26, 15518 Steinhöfel	435.393	5.812.918
SR-68	Grünstraße 27, 15518 Steinhöfel	435.434	5.812.920
SR-69	Grünstraße 28, 15518 Steinhöfel	435.455	5.812.922
SR-70	Grünstraße 30/31, 15518 Steinhöfel	435.530	5.812.945
SR-71	Grünstraße 32/32a, 15518 Steinhöfel	435.601	5.812.953



Bezeichnung	Adresse	UTM-Koordinaten	
		Ost	Nord
SR-72	Grünstraße 33, 15518 Steinhöfel	435.652	5.812.955
SR-73	Eggersdorfer Straße 50, 15518 Steinhöfel	435.549	5.812.814
SR-74	Eggersdorfer Straße 51, 15518 Steinhöfel	435.458	5.812.804
SR-75	Eggersdorfer Straße 52/52a, 15518 Steinhöfel	435.418	5.812.800
SR-76	Eggersdorfer Straße 53, 15518 Steinhöfel	435.377	5.812.798
SR-77	Eggersdorfer Straße 54/55, 15518 Steinhöfel	435.417	5.812.836
SR-78	Eggersdorfer Straße 58, 15518 Steinhöfel	435.383	5.812.836
SR-79	Neumühler Straße 57/58, 15518 Steinhöfel	435.349	5.812.849
SR-80	Neumühler Straße 59, 15518 Steinhöfel	435.323	5.812.855
SR-81	Neumühler Straße 15/15a, 15518 Steinhöfel	435.332	5.812.903
SR-82	Neumühler Straße 14, 15518 Steinhöfel	435.306	5.812.912
SR-83	Neumühler Straße 12/13, 15518 Steinhöfel	435.273	5.812.888
SR-84	Neumühler Straße 11/11a, 15518 Steinhöfel	435.225	5.812.883
SR-85	Neumühler Straße 10, 15518 Steinhöfel	435.189	5.812.890
SR-86	Neumühler Straße 9, 15518 Steinhöfel	435.163	5.812.884
SR-87	Neumühler Straße 8, 15518 Steinhöfel	435.147	5.812.895
SR-88	Neumühler Straße 7, 15518 Steinhöfel	435.123	5.812.883
SR-89	Neumühler Straße 4a, 15518 Steinhöfel	435.139	5.812.849
SR-90	Neumühler Straße 4, 15518 Steinhöfel	435.136	5.812.806
SR-91	Neumühler Straße 3/3a, 15518 Steinhöfel	435.177	5.812.797
SR-92	Neumühler Straße 2, 15518 Steinhöfel	435.247	5.812.783
SR-93	Neumühler Straße 1, 15518 Steinhöfel	435.296	5.812.793
SR-94	Neumühler Straße 1b, 15518 Steinhöfel	435.330	5.812.825
SR-95	Neumühler Straße 1a, 15518 Steinhöfel	435.337	5.812.786

Tabelle 3: Immissionsorte am Standort Müncheberg

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

Bezeichnung	Abstand WEA ZB01 [m]	Abstand WEA ZB02 [m]	Abstand WEA ZB03 [m]	Abstand WEA ZB04 [m]	Abstand WEA ZB05 [m]	Abstand WEA ZB06 [m]	Abstand WEA ZB07 [m]	Abstand WEA ZB08 [m]
SR-01a	2.887	2.260	2.625	1.805	2.349	1.301	1.104	1.698
SR-01b	2.815	2.189	2.556	1.736	2.284	1.237	1.053	1.652
SR-02	2.625	2.450	2.249	2.374	1.970	2.398	2.330	1.744
SR-03	2.426	2.292	2.064	2.257	1.811	2.334	2.307	1.708
SR-04	2.405	2.303	2.056	2.292	1.823	2.396	2.386	1.784
SR-05	2.507	2.502	2.203	2.555	2.034	2.718	2.742	2.138
SR-06	1.647	1.991	1.576	2.299	1.694	2.715	2.935	2.421
SR-07	1.596	1.943	1.527	2.255	1.651	2.675	2.899	2.390
SR-08	1.582	1.924	1.508	2.233	1.628	2.651	2.874	2.364
SR-09	1.686	2.110	1.691	2.461	1.869	2.910	3.155	2.665
SR-10	1.654	2.085	1.666	2.441	1.851	2.894	3.143	2.658
SR-11	1.632	2.068	1.649	2.426	1.839	2.882	3.135	2.653
SR-12	1.583	2.030	1.612	2.396	1.813	2.858	3.116	2.642
SR-13	1.535	1.993	1.576	2.365	1.787	2.834	3.098	2.632
SR-14	1.462	1.932	1.516	2.312	1.741	2.788	3.060	2.604
SR-15	1.361	1.361	1.605	1.584	1.839	1.964	2.358	2.498
SR-16	2.733	2.170	2.582	1.810	2.417	1.484	1.510	2.090
SR-17	2.741	2.180	2.593	1.823	2.431	1.501	1.530	2.110
SR-18	2.759	2.199	2.613	1.844	2.452	1.523	1.551	2.131
SR-19	2.781	2.226	2.641	1.877	2.486	1.564	1.598	2.176
SR-20	2.804	2.252	2.668	1.906	2.515	1.597	1.632	2.210
SR-21	2.808	2.262	2.678	1.922	2.532	1.624	1.667	2.242
SR-22	2.842	2.297	2.713	1.958	2.567	1.658	1.697	2.274
SR-23	2.826	2.284	2.700	1.948	2.557	1.653	1.699	2.273
SR-24	2.777	2.235	2.652	1.901	2.510	1.612	1.665	2.237
SR-25	2.766	2.226	2.643	1.894	2.503	1.609	1.666	2.236
SR-26	2.754	2.215	2.632	1.885	2.494	1.604	1.665	2.233
SR-27	2.738	2.201	2.618	1.873	2.483	1.597	1.662	2.228
SR-28	2.707	2.170	2.588	1.845	2.454	1.574	1.646	2.209
SR-29	2.704	2.172	2.590	1.852	2.461	1.591	1.669	2.229
SR-30	2.693	2.163	2.581	1.846	2.455	1.588	1.671	2.229
SR-31	2.668	2.139	2.557	1.824	2.432	1.571	1.658	2.214

Bezeichnung	Abstand WEA ZB01 [m]	Abstand WEA ZB02 [m]	Abstand WEA ZB03 [m]	Abstand WEA ZB04 [m]	Abstand WEA ZB05 [m]	Abstand WEA ZB06 [m]	Abstand WEA ZB07 [m]	Abstand WEA ZB08 [m]
SR-32	2.679	2.153	2.571	1.840	2.448	1.589	1.677	2.232
SR-33	2.645	2.118	2.536	1.805	2.413	1.556	1.648	2.201
SR-34	2.631	2.105	2.524	1.795	2.403	1.552	1.649	2.200
SR-35	2.588	2.066	2.485	1.763	2.370	1.533	1.641	2.185
SR-36	2.552	2.031	2.450	1.728	2.336	1.503	1.617	2.158
SR-37	2.574	2.056	2.475	1.758	2.364	1.536	1.651	2.191
SR-38	2.553	2.037	2.456	1.741	2.347	1.524	1.644	2.181
SR-39	2.536	2.021	2.441	1.728	2.334	1.516	1.640	2.175
SR-40	2.525	2.012	2.431	1.722	2.327	1.515	1.644	2.176
SR-41	2.513	2.005	2.424	1.720	2.324	1.522	1.657	2.185
SR-42	2.887	2.347	2.764	2.014	2.623	1.721	1.763	2.339
SR-43	2.882	2.346	2.764	2.018	2.627	1.731	1.780	2.354
SR-44	2.900	2.366	2.784	2.039	2.649	1.755	1.803	2.377
SR-45	2.924	2.390	2.808	2.063	2.673	1.777	1.823	2.398
SR-46	2.853	2.317	2.735	1.989	2.598	1.704	1.755	2.328
SR-47	2.872	2.341	2.760	2.019	2.628	1.742	1.799	2.370
SR-48	2.834	2.300	2.718	1.974	2.583	1.694	1.750	2.321
SR-49	2.857	2.336	2.755	2.026	2.635	1.768	1.840	2.404
SR-50	2.826	2.297	2.715	1.977	2.586	1.708	1.772	2.339
SR-51	2.807	2.279	2.698	1.962	2.571	1.696	1.764	2.330
SR-52	2.780	2.256	2.674	1.942	2.551	1.685	1.761	2.323
SR-53	2.817	2.291	2.710	1.976	2.585	1.713	1.783	2.348
SR-54	2.800	2.279	2.698	1.970	2.578	1.716	1.795	2.356
SR-55	2.813	2.295	2.714	1.989	2.597	1.740	1.821	2.381
SR-56	2.752	2.228	2.647	1.917	2.526	1.665	1.746	2.305
SR-57	2.740	2.219	2.638	1.911	2.519	1.664	1.750	2.307
SR-58	2.724	2.205	2.625	1.902	2.509	1.661	1.753	2.307
SR-59	4.122	3.499	3.762	3.025	3.389	2.475	2.086	2.417
SR-60	2.795	2.877	2.541	2.981	2.427	3.182	3.225	2.622
SR-61	3.041	2.414	2.777	1.958	2.497	1.449	1.234	1.821
SR-62	1.758	2.187	1.768	2.539	1.947	2.987	3.231	2.739
SR-63	1.799	2.235	1.816	2.589	1.998	3.039	3.284	2.791
SR-64	1.766	2.183	1.764	2.528	1.933	2.970	3.210	2.712
SR-65	1.799	2.210	1.791	2.550	1.953	2.989	3.224	2.722
SR-66	1.766	2.171	1.752	2.508	1.910	2.944	3.178	2.676
SR-67	1.836	2.234	1.816	2.566	1.966	2.997	3.226	2.717

Bezeichnung	Abstand WEA ZB01 [m]	Abstand WEA ZB02 [m]	Abstand WEA ZB03 [m]	Abstand WEA ZB04 [m]	Abstand WEA ZB05 [m]	Abstand WEA ZB06 [m]	Abstand WEA ZB07 [m]	Abstand WEA ZB08 [m]
SR-68	1.869	2.272	1.853	2.606	2.007	3.038	3.267	2.758
SR-69	1.885	2.291	1.872	2.626	2.027	3.059	3.288	2.779
SR-70	1.937	2.355	1.935	2.695	2.098	3.132	3.363	2.856
SR-71	1.994	2.420	2.000	2.763	2.167	3.202	3.435	2.928
SR-72	2.037	2.468	2.048	2.813	2.217	3.253	3.486	2.978
SR-73	2.024	2.417	1.999	2.741	2.139	3.163	3.381	2.860
SR-74	1.955	2.337	1.919	2.656	2.052	3.074	3.290	2.769
SR-75	1.925	2.301	1.884	2.618	2.013	3.034	3.250	2.729
SR-76	1.894	2.264	1.847	2.579	1.974	2.994	3.209	2.688
SR-77	1.903	2.286	1.869	2.608	2.005	3.029	3.249	2.731
SR-78	1.876	2.255	1.837	2.575	1.972	2.995	3.215	2.697
SR-79	1.841	2.219	1.801	2.539	1.936	2.960	3.181	2.665
SR-80	1.816	2.192	1.775	2.512	1.909	2.934	3.155	2.640
SR-81	1.795	2.183	1.764	2.510	1.909	2.938	3.165	2.654
SR-82	1.769	2.155	1.737	2.483	1.882	2.911	3.139	2.630
SR-83	1.756	2.134	1.716	2.456	1.854	2.880	3.105	2.594
SR-84	1.722	2.091	1.674	2.410	1.807	2.833	3.057	2.546
SR-85	1.689	2.055	1.638	2.374	1.771	2.797	3.021	2.511
SR-86	1.673	2.034	1.617	2.350	1.746	2.771	2.995	2.484
SR-87	1.654	2.015	1.598	2.332	1.729	2.754	2.979	2.470
SR-88	1.643	1.997	1.581	2.311	1.708	2.732	2.955	2.445
SR-89	1.677	2.026	1.610	2.336	1.731	2.752	2.971	2.456
SR-90	1.704	2.042	1.627	2.344	1.738	2.754	2.968	2.448
SR-91	1.740	2.083	1.668	2.386	1.780	2.796	3.009	2.488
SR-92	1.802	2.152	1.737	2.457	1.851	2.867	3.080	2.557
SR-93	1.833	2.192	1.776	2.502	1.896	2.914	3.128	2.607
SR-94	1.840	2.210	1.793	2.526	1.922	2.944	3.162	2.643
SR-95	1.870	2.232	1.816	2.543	1.938	2.956	3.170	2.647

Teil 3 von Tabelle 4

Bezeichnung	Abstand WEA ZB09 [m]	Abstand WEA ZB10 [m]	Abstand WEA ZB11 [m]	Abstand WEA ZB12 [m]	Abstand WEA ZB13 [m]	Abstand WEA ZB14 [m]	Abstand WEA ZB15 [m]	Abstand WEA ZB16 [m]
SR-01a	1.339	2.007	2.373	2.328	1.970	1.689	2.246	2.320
SR-01b	1.314	1.950	2.321	2.287	1.936	1.677	2.222	2.311
SR-02	2.041	1.709	1.326	1.091	1.394	1.816	1.185	1.430
SR-03	2.072	1.610	1.207	1.052	1.413	1.896	1.271	1.578
SR-04	2.169	1.658	1.249	1.132	1.509	2.005	1.383	1.698
SR-05	2.555	1.960	1.545	1.500	1.896	2.404	1.784	2.091
SR-06	3.015	2.018	1.730	2.029	2.462	3.069	2.582	3.026
SR-07	2.987	1.984	1.702	2.008	2.440	3.047	2.568	3.015
SR-08	2.961	1.958	1.676	1.982	2.413	3.021	2.542	2.989
SR-09	3.269	2.245	1.987	2.308	2.736	3.344	2.873	3.322
SR-10	3.264	2.235	1.982	2.310	2.736	3.344	2.878	3.330
SR-11	3.259	2.228	1.979	2.311	2.735	3.343	2.881	3.334
SR-12	3.251	2.213	1.974	2.314	2.735	3.343	2.890	3.346
SR-13	3.243	2.199	1.970	2.318	2.735	3.342	2.898	3.357
SR-14	3.218	2.166	1.951	2.309	2.722	3.328	2.896	3.358
SR-15	2.884	2.222	2.516	2.899	2.963	3.286	3.366	3.775
SR-16	1.936	2.253	2.663	2.748	2.476	2.348	2.820	2.988
SR-17	1.957	2.270	2.680	2.767	2.497	2.369	2.841	3.009
SR-18	1.977	2.292	2.702	2.788	2.518	2.388	2.861	3.028
SR-19	2.025	2.332	2.743	2.833	2.565	2.437	2.909	3.077
SR-20	2.059	2.365	2.776	2.867	2.599	2.470	2.943	3.110
SR-21	2.099	2.391	2.802	2.899	2.634	2.511	2.981	3.151
SR-22	2.125	2.425	2.836	2.931	2.664	2.535	3.009	3.175
SR-23	2.130	2.419	2.832	2.930	2.666	2.543	3.013	3.183
SR-24	2.104	2.377	2.790	2.892	2.633	2.519	2.983	3.159
SR-25	2.108	2.374	2.786	2.891	2.634	2.524	2.985	3.163
SR-26	2.110	2.368	2.781	2.888	2.633	2.527	2.985	3.166
SR-27	2.110	2.360	2.773	2.883	2.630	2.528	2.984	3.167
SR-28	2.098	2.336	2.749	2.863	2.614	2.519	2.969	3.157
SR-29	2.125	2.350	2.764	2.882	2.637	2.546	2.994	3.184
SR-30	2.130	2.347	2.761	2.882	2.638	2.552	2.997	3.189
SR-31	2.120	2.328	2.742	2.866	2.625	2.544	2.985	3.181
SR-32	2.139	2.346	2.760	2.884	2.644	2.563	3.004	3.200
SR-33	2.114	2.312	2.727	2.853	2.615	2.539	2.976	3.175
SR-34	2.118	2.307	2.721	2.851	2.615	2.544	2.978	3.180
SR-35	2.118	2.283	2.698	2.834	2.605	2.546	2.971	3.180

Bezeichnung	Abstand WEA ZB09 [m]	Abstand WEA ZB10 [m]	Abstand WEA ZB11 [m]	Abstand WEA ZB12 [m]	Abstand WEA ZB13 [m]	Abstand WEA ZB14 [m]	Abstand WEA ZB15 [m]	Abstand WEA ZB16 [m]
SR-36	2.098	2.252	2.667	2.806	2.580	2.527	2.948	3.161
SR-37	2.131	2.284	2.699	2.839	2.614	2.560	2.982	3.194
SR-38	2.127	2.270	2.685	2.828	2.606	2.557	2.975	3.190
SR-39	2.126	2.260	2.675	2.821	2.601	2.557	2.971	3.189
SR-40	2.131	2.258	2.673	2.821	2.604	2.563	2.975	3.195
SR-41	2.148	2.262	2.676	2.829	2.615	2.580	2.988	3.211
SR-42	2.190	2.487	2.899	2.996	2.730	2.600	3.075	3.240
SR-43	2.211	2.497	2.909	3.010	2.747	2.622	3.094	3.262
SR-44	2.233	2.520	2.932	3.033	2.770	2.644	3.116	3.284
SR-45	2.251	2.543	2.955	3.055	2.790	2.661	3.136	3.301
SR-46	2.189	2.469	2.882	2.984	2.723	2.602	3.071	3.242
SR-47	2.235	2.506	2.919	3.025	2.766	2.648	3.115	3.288
SR-48	2.188	2.458	2.871	2.976	2.718	2.602	3.068	3.242
SR-49	2.286	2.528	2.942	3.058	2.808	2.702	3.161	3.341
SR-50	2.215	2.470	2.883	2.994	2.740	2.631	3.092	3.271
SR-51	2.211	2.457	2.871	2.984	2.732	2.628	3.086	3.267
SR-52	2.213	2.444	2.858	2.976	2.729	2.632	3.084	3.270
SR-53	2.230	2.474	2.888	3.002	2.751	2.647	3.105	3.286
SR-54	2.247	2.475	2.889	3.009	2.762	2.666	3.118	3.304
SR-55	2.274	2.498	2.912	3.034	2.788	2.693	3.145	3.331
SR-56	2.202	2.423	2.837	2.958	2.714	2.623	3.071	3.261
SR-57	2.209	2.420	2.835	2.959	2.718	2.631	3.076	3.269
SR-58	2.216	2.416	2.830	2.958	2.720	2.639	3.080	3.276
SR-59	1.799	2.870	3.073	2.787	2.344	1.751	2.343	2.075
SR-60	3.050	2.416	2.004	1.991	2.391	2.896	2.272	2.558
SR-61	1.426	2.144	2.503	2.440	2.069	1.752	2.328	2.373
SR-62	3.341	2.321	2.058	2.375	2.804	3.412	2.935	3.382
SR-63	3.394	2.373	2.110	2.425	2.855	3.463	2.985	3.430
SR-64	3.312	2.297	2.028	2.339	2.770	3.378	2.897	3.341
SR-65	3.320	2.310	2.035	2.340	2.773	3.380	2.894	3.336
SR-66	3.274	2.265	1.990	2.295	2.727	3.335	2.850	3.293
SR-67	3.312	2.310	2.027	2.323	2.757	3.364	2.871	3.309
SR-68	3.353	2.352	2.068	2.362	2.797	3.404	2.908	3.346
SR-69	3.374	2.373	2.089	2.383	2.818	3.424	2.928	3.365
SR-70	3.452	2.449	2.167	2.461	2.896	3.503	3.006	3.442
SR-71	3.523	2.520	2.238	2.531	2.966	3.573	3.074	3.508

Bezeichnung	Abstand WEA ZB09 [m]	Abstand WEA ZB10 [m]	Abstand WEA ZB11 [m]	Abstand WEA ZB12 [m]	Abstand WEA ZB13 [m]	Abstand WEA ZB14 [m]	Abstand WEA ZB15 [m]	Abstand WEA ZB16 [m]
SR-72	3.573	2.571	2.289	2.580	3.016	3.622	3.121	3.554
SR-73	3.448	2.464	2.165	2.440	2.878	3.483	2.971	3.398
SR-74	3.357	2.373	2.074	2.349	2.788	3.393	2.883	3.313
SR-75	3.317	2.333	2.033	2.310	2.748	3.353	2.844	3.275
SR-76	3.276	2.292	1.993	2.270	2.708	3.313	2.806	3.238
SR-77	3.321	2.332	2.037	2.320	2.757	3.362	2.858	3.291
SR-78	3.288	2.298	2.004	2.287	2.724	3.330	2.827	3.261
SR-79	3.256	2.264	1.972	2.259	2.695	3.301	2.801	3.237
SR-80	3.232	2.238	1.947	2.236	2.672	3.278	2.780	3.217
SR-81	3.249	2.249	1.964	2.260	2.695	3.302	2.809	3.249
SR-82	3.226	2.223	1.941	2.239	2.673	3.280	2.790	3.231
SR-83	3.189	2.189	1.904	2.200	2.634	3.241	2.750	3.190
SR-84	3.141	2.141	1.856	2.153	2.587	3.194	2.704	3.146
SR-85	3.107	2.105	1.822	2.122	2.555	3.162	2.675	3.119
SR-86	3.080	2.079	1.795	2.095	2.528	3.136	2.649	3.093
SR-87	3.066	2.064	1.781	2.084	2.517	3.124	2.640	3.085
SR-88	3.040	2.039	1.755	2.058	2.490	3.098	2.613	3.058
SR-89	3.050	2.054	1.765	2.061	2.495	3.102	2.612	3.055
SR-90	3.039	2.051	1.755	2.043	2.479	3.085	2.590	3.030
SR-91	3.078	2.092	1.794	2.079	2.515	3.122	2.624	3.062
SR-92	3.145	2.162	1.862	2.141	2.579	3.184	2.681	3.116
SR-93	3.195	2.211	1.912	2.191	2.629	3.234	2.730	3.164
SR-94	3.234	2.245	1.950	2.233	2.670	3.276	2.774	3.209
SR-95	3.234	2.252	1.951	2.228	2.666	3.271	2.765	3.197

Tabelle 4: Horizontale Abstände der Zusatzbelastung im Windpark Müncheberg-Mittelheide 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 und 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 65 WEA dargestellt, wobei sich lediglich 29 WEA der Vorbelastung im Schatteneinwirkungsbereich befinden:

Immissionsorte	Maximal mögliche Schatten-dauer jährlich VB [hh:mm]	Grenzwertüber-schreitung 30 h/a VB [hh:mm]	Maximal mögliche Schatten-dauer täglich VB [hh:mm]	Grenzwertüber-schreitung 30 min/d VB [hh:mm]
SR-01a	00:00	--	00:00	--
SR-01b	00:00	--	00:00	--
SR-02	66:39	36:39	00:45	00:15
SR-03	65:46	35:46	00:53	00:23
SR-04	39:05	9:05	00:40	00:10
SR-05	35:56	5:56	00:33	00:03
SR-06	40:15	10:15	00:29	--
SR-07	38:00	8:00	00:28	--
SR-08	37:36	7:36	00:28	--
SR-09	14:20	--	00:24	--
SR-10	13:09	--	00:24	--
SR-11	13:00	--	00:23	--
SR-12	12:56	--	00:23	--
SR-13	16:19	--	00:22	--
SR-14	22:54	--	00:24	--
SR-15	12:21	--	00:23	--
SR-16	00:00	--	00:00	--
SR-17	00:00	--	00:00	--
SR-18	00:00	--	00:00	--
SR-19	00:00	--	00:00	--



Immissionsorte	Maximal mögliche Schatten-dauer jährlich VB [hh:mm]	Grenzwertüberschreitung 30 h/a VB [hh:mm]	Maximal mögliche Schatten-dauer täglich VB [hh:mm]	Grenzwertüberschreitung 30 min/d VB [hh:mm]
SR-20	00:00	--	00:00	--
SR-21	00:00	--	00:00	--
SR-22	00:00	--	00:00	--
SR-23	00:00	--	00:00	--
SR-24	00:00	--	00:00	--
SR-25	00:00	--	00:00	--
SR-26	00:00	--	00:00	--
SR-27	00:00	--	00:00	--
SR-28	00:00	--	00:00	--
SR-29	00:00	--	00:00	--
SR-30	00:00	--	00:00	--
SR-31	00:00	--	00:00	--
SR-32	00:00	--	00:00	--
SR-33	00:00	--	00:00	--
SR-34	00:00	--	00:00	--
SR-35	00:00	--	00:00	--
SR-36	00:00	--	00:00	--
SR-37	00:00	--	00:00	--
SR-38	00:00	--	00:00	--
SR-39	00:00	--	00:00	--
SR-40	00:00	--	00:00	--
SR-41	00:00	--	00:00	--
SR-42	00:00	--	00:00	--
SR-43	00:00	--	00:00	--
SR-44	00:00	--	00:00	--
SR-45	00:00	--	00:00	--
SR-46	00:00	--	00:00	--
SR-47	00:00	--	00:00	--
SR-48	00:00	--	00:00	--
SR-49	00:00	--	00:00	--
SR-50	00:00	--	00:00	--
SR-51	00:00	--	00:00	--
SR-52	00:00	--	00:00	--
SR-53	00:00	--	00:00	--
SR-54	00:00	--	00:00	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich VB [hh:mm]	Grenzwertüberschreitung 30 h/a VB [hh:mm]	Maximal mögliche Schatten-dauer täglich VB [hh:mm]	Grenzwertüberschreitung 30 min/d VB [hh:mm]
SR-55	00:00	--	00:00	--
SR-56	00:00	--	00:00	--
SR-57	00:00	--	00:00	--
SR-58	00:00	--	00:00	--
SR-59	00:00	--	00:00	--
SR-60	124:52	94:52	00:59	00:29
SR-61	00:00	--	00:00	--
SR-62	15:28	--	00:25	--
SR-63	19:26	--	00:26	--
SR-64	18:08	--	00:25	--
SR-65	39:11	9:11	00:31	00:01
SR-66	24:54	--	00:25	--
SR-67	45:17	15:17	00:35	00:05
SR-68	45:00	15:00	00:36	00:06
SR-69	44:56	14:56	00:37	00:07
SR-70	38:17	8:17	00:29	--
SR-71	41:48	11:48	00:34	00:04
SR-72	48:07	18:07	00:36	00:06
SR-73	56:04	26:04	00:45	00:15
SR-74	55:05	25:05	00:43	00:13
SR-75	55:27	25:27	00:42	00:12
SR-76	55:34	25:34	00:42	00:12
SR-77	52:04	22:04	00:41	00:11
SR-78	51:46	21:46	00:39	00:09
SR-79	50:43	20:43	00:39	00:09
SR-80	50:18	20:18	00:38	00:08
SR-81	45:35	15:35	00:35	00:05
SR-82	44:40	14:40	00:33	00:03
SR-83	47:21	17:21	00:35	00:05
SR-84	38:03	8:03	00:30	--
SR-85	37:59	7:59	00:30	--
SR-86	38:44	8:44	00:29	--
SR-87	38:07	8:07	00:29	--
SR-88	39:03	9:03	00:29	--
SR-89	40:54	10:54	00:29	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich VB [hh:mm]	Grenzwertüber-schreitung 30 h/a VB [hh:mm]	Maximal mögliche Schatten-dauer täglich VB [hh:mm]	Grenzwertüber-schreitung 30 min/d VB [hh:mm]
SR-90	42:34	12:34	00:30	--
SR-91	44:16	14:16	00:31	00:01
SR-92	55:42	25:42	00:41	00:11
SR-93	55:38	25:38	00:40	00:10
SR-94	52:48	22:48	00:39	00:09
SR-95	56:16	26:16	00:41	00:11

**Tabelle 5:** Schattenwurfzeiten der Vorbelastung im Windpark Müncheberg-Mittelheide; Überschreitung der Grenzwerte an den Immissionsorten

Im Rahmen der Schattenwurfzeiten führen die WEA der Vorbelastung an 38 Schattenrezeptoren zu unzulässigen Überschreitungen mindestens eines Grenzwertes. Der jährliche Grenzwert der Schattenwurfdauer wird am SR-60 um maximal 94:52:00 Stunden pro Jahr überschritten. Der tägliche Grenzwert wird um maximal 29 Minuten am SR-60 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 mit 16 Vestas V162-6.2 MW dargestellt:

Immissionsorte	Maximal mögliche Schatten-dauer jährlich ZB [hh:mm]	Grenzwertüber-schreitung 30 h/a ZB [hh:mm]	Maximal mögliche Schatten-dauer täglich ZB [hh:mm]	Grenzwertüber-schreitung 30 min/d ZB [hh:mm]
SR-01a	100:23	70:23	00:52	00:22
SR-01b	104:11	74:11	00:53	00:23
SR-02	66:45	36:45	00:34	00:04
SR-03	55:16	25:16	00:42	00:12
SR-04	80:24	50:24	00:49	00:19
SR-05	32:00	2:00	00:26	--
SR-06	53:03	23:03	00:25	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich ZB [hh:mm]	Grenzwertüberschreitung 30 h/a ZB [hh:mm]	Maximal mögliche Schatten-dauer täglich ZB [hh:mm]	Grenzwertüberschreitung 30 min/d ZB [hh:mm]
SR-07	53:55	23:55	00:26	--
SR-08	60:32	30:32	00:27	--
SR-09	43:55	13:55	00:24	--
SR-10	45:48	15:48	00:24	--
SR-11	46:54	16:54	00:25	--
SR-12	49:43	19:43	00:27	--
SR-13	49:44	19:44	00:28	--
SR-14	49:12	19:12	00:31	00:01
SR-15	31:43	1:43	00:29	--
SR-16	44:20	14:20	00:26	--
SR-17	45:01	15:01	00:26	--
SR-18	43:46	13:46	00:26	--
SR-19	42:51	12:51	00:25	--
SR-20	41:31	11:31	00:25	--
SR-21	40:49	10:49	00:24	--
SR-22	39:32	9:32	00:24	--
SR-23	39:49	9:49	00:24	--
SR-24	40:37	10:37	00:24	--
SR-25	40:19	10:19	00:24	--
SR-26	39:39	9:39	00:25	--
SR-27	39:11	9:11	00:25	--
SR-28	38:56	8:56	00:25	--
SR-29	36:39	6:39	00:24	--
SR-30	35:59	5:59	00:25	--
SR-31	35:28	5:28	00:25	--
SR-32	34:02	4:02	00:25	--
SR-33	34:46	4:46	00:25	--
SR-34	33:42	3:42	00:25	--
SR-35	31:42	1:42	00:26	--
SR-36	37:09	7:09	00:26	--
SR-37	30:09	0:09	00:26	--
SR-38	35:09	5:09	00:26	--
SR-39	35:18	5:18	00:26	--
SR-40	37:30	7:30	00:26	--
SR-41	40:46	10:46	00:26	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich ZB [hh:mm]	Grenzwertüberschreitung 30 h/a ZB [hh:mm]	Maximal mögliche Schatten-dauer täglich ZB [hh:mm]	Grenzwertüberschreitung 30 min/d ZB [hh:mm]
SR-42	37:20	7:20	00:23	--
SR-43	36:35	6:35	00:22	--
SR-44	36:01	6:01	00:23	--
SR-45	30:03	0:03	00:22	--
SR-46	37:22	7:22	00:23	--
SR-47	35:33	5:33	00:23	--
SR-48	37:09	7:09	00:23	--
SR-49	31:38	1:38	00:22	--
SR-50	35:24	5:24	00:23	--
SR-51	35:05	5:05	00:23	--
SR-52	33:45	3:45	00:23	--
SR-53	34:07	4:07	00:23	--
SR-54	32:04	2:04	00:23	--
SR-55	30:33	0:33	00:22	--
SR-56	33:13	3:13	00:24	--
SR-57	31:49	1:49	00:24	--
SR-58	30:36	0:36	00:24	--
SR-59	19:16	--	00:22	--
SR-60	21:14	--	00:21	--
SR-61	68:36	38:36	00:38	00:08
SR-62	36:42	6:42	00:23	--
SR-63	33:34	3:34	00:22	--
SR-64	40:17	10:17	00:23	--
SR-65	38:15	8:15	00:23	--
SR-66	36:58	6:58	00:23	--
SR-67	34:08	4:08	00:22	--
SR-68	30:10	0:10	00:22	--
SR-69	30:50	0:50	00:22	--
SR-70	26:29	--	00:21	--
SR-71	23:39	--	00:20	--
SR-72	12:34	--	00:20	--
SR-73	20:34	--	00:20	--
SR-74	15:41	--	00:20	--
SR-75	24:24	--	00:21	--
SR-76	23:14	--	00:21	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich ZB [hh:mm]	Grenzwertüberschreitung 30 h/a ZB [hh:mm]	Maximal mögliche Schatten-dauer täglich ZB [hh:mm]	Grenzwertüberschreitung 30 min/d ZB [hh:mm]
SR-77	27:26	--	00:21	--
SR-78	26:06	--	00:21	--
SR-79	26:01	--	00:22	--
SR-80	26:00	--	00:22	--
SR-81	30:26	0:26	00:22	--
SR-82	30:15	0:15	00:23	--
SR-83	26:52	--	00:23	--
SR-84	27:50	--	00:23	--
SR-85	29:41	--	00:24	--
SR-86	33:39	3:39	00:25	--
SR-87	34:07	4:07	00:25	--
SR-88	42:03	12:03	00:25	--
SR-89	37:57	7:57	00:25	--
SR-90	41:07	11:07	00:25	--
SR-91	35:40	5:40	00:24	--
SR-92	29:40	--	00:23	--
SR-93	26:25	--	00:22	--
SR-94	24:08	--	00:22	--
SR-95	24:21	--	00:22	--

**Tabelle 6:** Schattenwurfzeiten der Zusatzbelastung im Windpark Müncheberg-Mittelheide; Überschreitung der Grenzwerte an den Immissionsorten

Im Rahmen der Schattenwurfzeiten führt die WEA der Zusatzbelastung an 76 Schattenrezeptoren zu unzulässigen Überschreitungen mindestens eines Grenzwertes. Der jährliche Grenzwert der Schattenwurf-dauer wird am SR-01b um maximal 74:11:00 Stunden pro Jahr überschritten. Der tägliche Grenzwert wird um maximal 23 Minuten am SR-01b überschritten.

### **5.3. Astronomisch maximal mögliche Beschattungsdauer der Gesamtbelastung**

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

Immissionsorte	Maximal mögliche Schattendauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Maximal mögliche Schattendauer täglich GB [hh:mm]	Grenzwertüberschreitung 30 min/d GB [hh:mm]
SR-01a	100:23	70:23	00:52	00:22
SR-01b	104:11	74:11	00:53	00:23
SR-02	133:24	103:24	00:45	00:15
SR-03	121:02	91:02	00:59	00:29
SR-04	119:29	89:29	01:00	00:30
SR-05	67:56	37:56	00:35	00:05
SR-06	93:18	63:18	00:29	--
SR-07	91:55	61:55	00:28	--
SR-08	98:08	68:08	00:28	--
SR-09	58:15	28:15	00:24	--
SR-10	58:57	28:57	00:24	--
SR-11	59:54	29:54	00:25	--
SR-12	62:39	32:39	00:27	--
SR-13	66:03	36:03	00:28	--
SR-14	72:06	42:06	00:31	00:01
SR-15	44:04	14:04	00:42	00:12
SR-16	44:20	14:20	00:26	--
SR-17	45:01	15:01	00:26	--
SR-18	43:46	13:46	00:26	--
SR-19	42:51	12:51	00:25	--
SR-20	41:31	11:31	00:25	--
SR-21	40:49	10:49	00:24	--
SR-22	39:32	9:32	00:24	--
SR-23	39:49	9:49	00:24	--
SR-24	40:37	10:37	00:24	--
SR-25	40:19	10:19	00:24	--
SR-26	39:39	9:39	00:25	--
SR-27	39:11	9:11	00:25	--
SR-28	38:56	8:56	00:25	--
SR-29	36:39	6:39	00:24	--
SR-30	35:59	5:59	00:25	--
SR-31	35:28	5:28	00:25	--
SR-32	34:02	4:02	00:25	--
SR-33	34:46	4:46	00:25	--
SR-34	33:42	3:42	00:25	--

Immissionsorte	Maximal mögliche Schatten-dauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Maximal mögliche Schatten-dauer täglich GB [hh:mm]	Grenzwertüberschreitung 30 min/d GB [hh:mm]
SR-35	31:42	1:42	00:26	--
SR-36	37:09	7:09	00:26	--
SR-37	30:09	0:09	00:26	--
SR-38	35:09	5:09	00:26	--
SR-39	35:18	5:18	00:26	--
SR-40	37:30	7:30	00:26	--
SR-41	40:46	10:46	00:26	--
SR-42	37:20	7:20	00:23	--
SR-43	36:35	6:35	00:22	--
SR-44	36:01	6:01	00:23	--
SR-45	30:03	0:03	00:22	--
SR-46	37:22	7:22	00:23	--
SR-47	35:33	5:33	00:23	--
SR-48	37:09	7:09	00:23	--
SR-49	31:38	1:38	00:22	--
SR-50	35:24	5:24	00:23	--
SR-51	35:05	5:05	00:23	--
SR-52	33:45	3:45	00:23	--
SR-53	34:07	4:07	00:23	--
SR-54	32:04	2:04	00:23	--
SR-55	30:33	0:33	00:22	--
SR-56	33:13	3:13	00:24	--
SR-57	31:49	1:49	00:24	--
SR-58	30:36	0:36	00:24	--
SR-59	19:16	--	00:22	--
SR-60	146:06	116:06	01:04	00:34
SR-61	68:36	38:36	00:38	00:08
SR-62	52:10	22:10	00:25	--
SR-63	53:00	23:00	00:26	--
SR-64	58:25	28:25	00:25	--
SR-65	77:26	47:26	00:31	00:01
SR-66	61:52	31:52	00:25	--
SR-67	79:25	49:25	00:35	00:05
SR-68	75:10	45:10	00:36	00:06
SR-69	75:46	45:46	00:37	00:07



Immissionsorte	Maximal mögliche Schatten-dauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Maximal mögliche Schatten-dauer täglich GB [hh:mm]	Grenzwertüberschreitung 30 min/d GB [hh:mm]
SR-70	64:46	34:46	00:29	--
SR-71	65:27	35:27	00:34	00:04
SR-72	60:41	30:41	00:36	00:06
SR-73	76:38	46:38	00:45	00:15
SR-74	70:46	40:46	00:43	00:13
SR-75	79:51	49:51	00:42	00:12
SR-76	78:48	48:48	00:42	00:12
SR-77	79:30	49:30	00:41	00:11
SR-78	77:52	47:52	00:39	00:09
SR-79	76:44	46:44	00:39	00:09
SR-80	76:18	46:18	00:38	00:08
SR-81	76:01	46:01	00:35	00:05
SR-82	74:55	44:55	00:33	00:03
SR-83	74:13	44:13	00:35	00:05
SR-84	65:53	35:53	00:30	--
SR-85	67:40	37:40	00:30	--
SR-86	72:23	42:23	00:29	--
SR-87	72:14	42:14	00:29	--
SR-88	81:06	51:06	00:29	--
SR-89	78:51	48:51	00:29	--
SR-90	83:41	53:41	00:30	--
SR-91	79:56	49:56	00:31	00:01
SR-92	85:22	55:22	00:41	00:11
SR-93	82:03	52:03	00:40	00:10
SR-94	76:56	46:56	00:39	00:09
SR-95	80:37	50:37	00:41	00:11

**Tabelle 7:** Schattenwurfzeiten der Gesamtbelastung im Windpark Müncheberg-Mittelheide; Überschreitung der Grenzwerte an den Immissionsorten

Die Berechnung zeigt an allen untersuchten Schattenrezeptoren, bis auf SR-59, unzulässige Überschreitungen durch periodischen Schattenwurf der Gesamtbelastung bei mindestens einem zu berücksichtigenden Grenzwert auf.

Das Ergebnis stellt eine Maximalbetrachtung dar. Der jährliche Grenzwert der Schattenschurfdauer wird am SR-60 um maximal 116:06:00 Stunden pro Jahr überschritten. Der tägliche Grenzwert wird um maximal 34 Minuten am SR-60 überschritten.

## 6.) Bewertung

Im Zuge der Bewertung weist die Zusatzbelastung eine Relevanz auf, sofern die 16 geplanten WEA zu einer Überschreitung der jährlichen Grenzwerte von 30 Stunden/Jahr oder die täglichen Grenzwerte von 30 Minuten/Tag führen. 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 die durch die Zusatzbelastung verursachten Überschreitungen bewertet:

IO	Maximal mögliche Schattendauer jährlich VB [hh:mm]	Maximal mögliche Schattendauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-01a	00:00	100:23	70:23	100:23	ja
SR-01b	00:00	104:11	74:11	104:11	ja
SR-02	66:39	133:24	103:24	66:45	ja
SR-03	65:46	121:02	91:02	55:16	ja
SR-04	39:05	119:29	89:29	80:24	ja
SR-05	35:56	67:56	37:56	32	ja
SR-06	40:15	93:18	63:18	53:03	ja
SR-07	38:00	91:55	61:55	53:55	ja
SR-08	37:36	98:08	68:08	60:32	ja
SR-09	14:20	58:15	28:15	43:55	ja
SR-10	13:09	58:57	28:57	45:48	ja
SR-11	13:00	59:54	29:54	46:54	ja
SR-12	12:56	62:39	32:39	49:43	ja
SR-13	16:19	66:03	36:03	49:44	ja
SR-14	22:54	72:06	42:06	49:12	ja
SR-15	12:21	44:04	14:04	31:43	ja
SR-16	00:00	44:20	14:20	44:20	ja
SR-17	00:00	45:01	15:01	45:01	ja
SR-18	00:00	43:46	13:46	43:46	ja

IO	Maximal mögliche Schattendauer jährlich VB [hh:mm]	Maximal mögliche Schattendauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-19	00:00	42:51	12:51	42:51	ja
SR-20	00:00	41:31	11:31	41:31	ja
SR-21	00:00	40:49	10:49	40:49	ja
SR-22	00:00	39:32	9:32	39:32	ja
SR-23	00:00	39:49	9:49	39:49	ja
SR-24	00:00	40:37	10:37	40:37	ja
SR-25	00:00	40:19	10:19	40:19	ja
SR-26	00:00	39:39	9:39	39:39	ja
SR-27	00:00	39:11	9:11	39:11	ja
SR-28	00:00	38:56	8:56	38:56	ja
SR-29	00:00	36:39	6:39	36:39	ja
SR-30	00:00	35:59	5:59	35:59	ja
SR-31	00:00	35:28	5:28	35:28	ja
SR-32	00:00	34:02	4:02	34:02	ja
SR-33	00:00	34:46	4:46	34:46	ja
SR-34	00:00	33:42	3:42	33:42	ja
SR-35	00:00	31:42	1:42	31:42	ja
SR-36	00:00	37:09	7:09	37:09	ja
SR-37	00:00	30:09	0:09	30:09	ja
SR-38	00:00	35:09	5:09	35:09	ja
SR-39	00:00	35:18	5:18	35:18	ja
SR-40	00:00	37:30	7:30	37:30	ja
SR-41	00:00	40:46	10:46	40:46	ja
SR-42	00:00	37:20	7:20	37:20	ja
SR-43	00:00	36:35	6:35	36:35	ja
SR-44	00:00	36:01	6:01	36:01	ja
SR-45	00:00	30:03	0:03	30:03	ja
SR-46	00:00	37:22	7:22	37:22	ja
SR-47	00:00	35:33	5:33	35:33	ja
SR-48	00:00	37:09	7:09	37:09	ja
SR-49	00:00	31:38	1:38	31:38	ja
SR-50	00:00	35:24	5:24	35:24	ja
SR-51	00:00	35:05	5:05	35:05	ja
SR-52	00:00	33:45	3:45	33:45	ja

IO	Maximal mögliche Schattendauer jährlich VB [hh:mm]	Maximal mögliche Schattendauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-53	00:00	34:07	4:07	34:07	ja
SR-54	00:00	32:04	2:04	32:04	ja
SR-55	00:00	30:33	0:33	30:33	ja
SR-56	00:00	33:13	3:13	33:13	ja
SR-57	00:00	31:49	1:49	31:49	ja
SR-58	00:00	30:36	0:36	30:36	ja
SR-59	00:00	19:16	--	19:16	nein
SR-60	124:52	146:06	116:06	21:14	ja
SR-61	00:00	68:36	38:36	68:36	ja
SR-62	15:28	52:10	22:10	36:42	ja
SR-63	19:26	53:00	23:00	33:34	ja
SR-64	18:08	58:25	28:25	40:17	ja
SR-65	39:11	77:26	47:26	38:15	ja
SR-66	24:54	61:52	31:52	36:58	ja
SR-67	45:17	79:25	49:25	34:08	ja
SR-68	45:00	75:10	45:10	30:10	ja
SR-69	44:56	75:46	45:46	30:50	ja
SR-70	38:17	64:46	34:46	26:29	ja
SR-71	41:48	65:27	35:27	23:39	ja
SR-72	48:07	60:41	30:41	12:34	ja
SR-73	56:04	76:38	46:38	20:34	ja
SR-74	55:05	70:46	40:46	15:41	ja
SR-75	55:27	79:51	49:51	24:24	ja
SR-76	55:34	78:48	48:48	23:14	ja
SR-77	52:04	79:30	49:30	27:26	ja
SR-78	51:46	77:52	47:52	26:06	ja
SR-79	50:43	76:44	46:44	26:01	ja
SR-80	50:18	76:18	46:18	26:00	ja
SR-81	45:35	76:01	46:01	30:26	ja
SR-82	44:40	74:55	44:55	30:15	ja
SR-83	47:21	74:13	44:13	26:52	ja
SR-84	38:03	65:53	35:53	27:50	ja
SR-85	37:59	67:40	37:40	29:41	ja
SR-86	38:44	72:23	42:23	33:39	ja

IO	Maximal mögliche Schattendauer jährlich VB [hh:mm]	Maximal mögliche Schattendauer jährlich GB [hh:mm]	Grenzwertüberschreitung 30 h/a GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-87	38:07	72:14	42:14	34:07	ja
SR-88	39:03	81:06	51:06	42:03	ja
SR-89	40:54	78:51	48:51	37:57	ja
SR-90	42:34	83:41	53:41	41:07	ja
SR-91	44:16	79:56	49:56	35:40	ja
SR-92	55:42	85:22	55:22	29:40	ja
SR-93	55:38	82:03	52:03	26:25	ja
SR-94	52:48	76:56	46:56	24:08	ja
SR-95	56:16	80:37	50:37	24:21	ja

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

An 94 Immissionsorten kommt es zu einer Überschreitung des Grenzwertes der Gesamtbelastung. Diese tritt an den Immissionsorten SR-02 bis SR-08, SR-60, SR-65 und SR-67 bis SR-95 durch die Vorbelastung auf und wird durch die Zusatzbelastung weiter erhöht. Die maximale Erhöhung der Zusatzbelastung tritt an SR-01b mit zusätzlichen 104:11:00 Stunden im Jahr auf.

## 6.2. Maximal mögliche tägliche Schattendauer

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

IO	Maximal mögliche Schattendauer täglich VB [hh:mm]	Maximal mögliche Schattendauer täglich GB [hh:mm]	Grenzwertüberschreitung 30 min/d GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-01a	00:00	00:52	00:22	00:52	ja
SR-01b	00:00	00:53	00:23	00:53	ja
SR-02	00:45	00:45	00:15	--	nein
SR-03	00:53	00:59	00:29	00:06	ja

IO	Maximal mögliche Schattendauer täglich VB [hh:mm]	Maximal mögliche Schattendauer täglich GB [hh:mm]	Grenzwertüber- schreitung 30 min/d GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Rele- vanz
SR-04	00:40	01:00	00:30	00:20	ja
SR-05	00:33	00:35	00:05	00:02	ja
SR-06	00:29	00:29	--	--	nein
SR-07	00:28	00:28	--	--	nein
SR-08	00:28	00:28	--	--	nein
SR-09	00:24	00:24	--	--	nein
SR-10	00:24	00:24	--	--	nein
SR-11	00:23	00:25	--	00:02	nein
SR-12	00:23	00:27	--	00:04	nein
SR-13	00:22	00:28	--	00:06	nein
SR-14	00:24	00:31	00:01	00:07	ja
SR-15	00:23	00:42	00:12	00:19	ja
SR-16	00:00	00:26	--	00:26	nein
SR-17	00:00	00:26	--	00:26	nein
SR-18	00:00	00:26	--	00:26	nein
SR-19	00:00	00:25	--	00:25	nein
SR-20	00:00	00:25	--	00:25	nein
SR-21	00:00	00:24	--	00:24	nein
SR-22	00:00	00:24	--	00:24	nein
SR-23	00:00	00:24	--	00:24	nein
SR-24	00:00	00:24	--	00:24	nein
SR-25	00:00	00:24	--	00:24	nein
SR-26	00:00	00:25	--	00:25	nein
SR-27	00:00	00:25	--	00:25	nein
SR-28	00:00	00:25	--	00:25	nein
SR-29	00:00	00:24	--	00:24	nein
SR-30	00:00	00:25	--	00:25	nein
SR-31	00:00	00:25	--	00:25	nein
SR-32	00:00	00:25	--	00:25	nein
SR-33	00:00	00:25	--	00:25	nein
SR-34	00:00	00:25	--	00:25	nein
SR-35	00:00	00:26	--	00:26	nein
SR-36	00:00	00:26	--	00:26	nein
SR-37	00:00	00:26	--	00:26	nein
SR-38	00:00	00:26	--	00:26	nein

IO	Maximal mögliche Schattendauer täglich VB [hh:mm]	Maximal mögliche Schattendauer täglich GB [hh:mm]	Grenzwertüber- schreitung 30 min/d GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Rele- vanz
SR-39	00:00	00:26	--	00:26	nein
SR-40	00:00	00:26	--	00:26	nein
SR-41	00:00	00:26	--	00:26	nein
SR-42	00:00	00:23	--	00:23	nein
SR-43	00:00	00:22	--	00:22	nein
SR-44	00:00	00:23	--	00:23	nein
SR-45	00:00	00:22	--	00:22	nein
SR-46	00:00	00:23	--	00:23	nein
SR-47	00:00	00:23	--	00:23	nein
SR-48	00:00	00:23	--	00:23	nein
SR-49	00:00	00:22	--	00:22	nein
SR-50	00:00	00:23	--	00:23	nein
SR-51	00:00	00:23	--	00:23	nein
SR-52	00:00	00:23	--	00:23	nein
SR-53	00:00	00:23	--	00:23	nein
SR-54	00:00	00:23	--	00:23	nein
SR-55	00:00	00:22	--	00:22	nein
SR-56	00:00	00:24	--	00:24	nein
SR-57	00:00	00:24	--	00:24	nein
SR-58	00:00	00:24	--	00:24	nein
SR-59	00:00	00:22	--	00:22	nein
SR-60	00:59	01:04	00:34	00:05	ja
SR-61	00:00	00:38	00:08	00:38	ja
SR-62	00:25	00:25	--	--	nein
SR-63	00:26	00:26	--	--	nein
SR-64	00:25	00:25	--	--	nein
SR-65	00:31	00:31	00:01	--	nein
SR-66	00:25	00:25	--	--	nein
SR-67	00:35	00:35	00:05	--	nein
SR-68	00:36	00:36	00:06	--	nein
SR-69	00:37	00:37	00:07	--	nein
SR-70	00:29	00:29	--	--	nein
SR-71	00:34	00:34	00:04	--	nein
SR-72	00:36	00:36	00:06	--	nein
SR-73	00:45	00:45	00:15	--	nein



IO	Maximal mögliche Schattendauer täglich VB [hh:mm]	Maximal mögliche Schattendauer täglich GB [hh:mm]	Grenzwertüberschreitung 30 min/d GB [hh:mm]	Erhöhung durch ZB [hh:mm]	Relevanz
SR-74	00:43	00:43	00:13	--	nein
SR-75	00:42	00:42	00:12	--	nein
SR-76	00:42	00:42	00:12	--	nein
SR-77	00:41	00:41	00:11	--	nein
SR-78	00:39	00:39	00:09	--	nein
SR-79	00:39	00:39	00:09	--	nein
SR-80	00:38	00:38	00:08	--	nein
SR-81	00:35	00:35	00:05	--	nein
SR-82	00:33	00:33	00:03	--	nein
SR-83	00:35	00:35	00:05	--	nein
SR-84	00:30	00:30	--	--	nein
SR-85	00:30	00:30	--	--	nein
SR-86	00:29	00:29	--	--	nein
SR-87	00:29	00:29	--	--	nein
SR-88	00:29	00:29	--	--	nein
SR-89	00:29	00:29	--	--	nein
SR-90	00:30	00:30	--	--	nein
SR-91	00:31	00:31	00:01	--	nein
SR-92	00:41	00:41	00:11	--	nein
SR-93	00:40	00:40	00:10	--	nein
SR-94	00:39	00:39	00:09	--	nein
SR-95	00:41	00:41	00:11	--	nein

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

An 32 Immissionsorten führt die Gesamtbelastung zu einer Überschreitung der Schattendauerdauer bzw. des Grenzwertes. An den Immissionsorten SR-03 bis SR-05 sowie SR-60 tritt diese bereits durch die Vorbelastung auf und wird durch die Zusatzbelastung weiter erhöht. Die maximale Erhöhung der Zusatzbelastung tritt am SR-01b mit zusätzlichen 53 Minuten am Tag auf.

## 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-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Anlage A3: SHADOW-Kalender mit Darstellung der Schattenzeiten je Immissionsort SR-01 bis SR-95 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-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Anlage B2: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Vorbelastung unterteilt in Minuten / Tag und Stunden / Jahr

Anlage B3: SHADOW-Hauptergebnis mit Darstellung der Zusatzbelastung, Immissionsorte SR-01 bis SR-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Anlage B4: 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

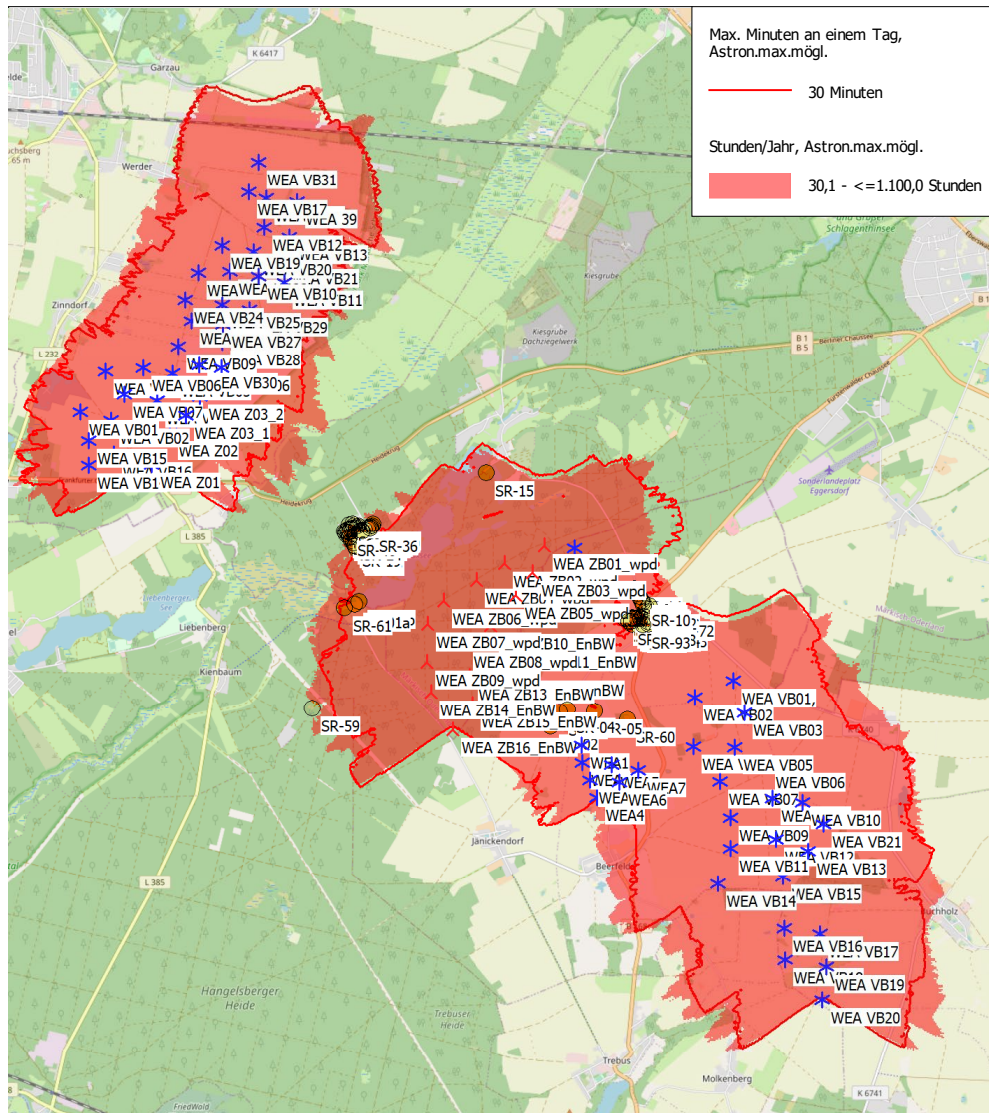
Anlage A1: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Gesamtbelastung unterteilt in Minuten / Tag und Stunden / Jahr (Grenzwerte)

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Karte**

Berechnung: WEA\_GB



Karte: EMD OpenStreetMap , Maßstab 1:80.000, Mitte: UTM (north)-ETRS89 Zone: 33 Ost: 433.320 Nord: 5.813.860  
 \* Neue WEA \* Existierende WEA \* Schattenrezeptor  
 Höhe der Schattenkarte: German Brandenburg Elevation Model (DGMS - 5m grid)  
 Zeitschritt: 3 Minuten, Schrittweite: 7 Tag(e), Kartenaufösung: 20 m, Sichtbarkeit Auflösung: 10 m, Augenhöhe: 1,5 m

Anlage A2: SHADOW-Hauptergebnis mit Darstellung der Gesamtbelastung, Immissionsorte SR-01 bis SR-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Hauptergebnis

**Berechnung:** WEA\_GB

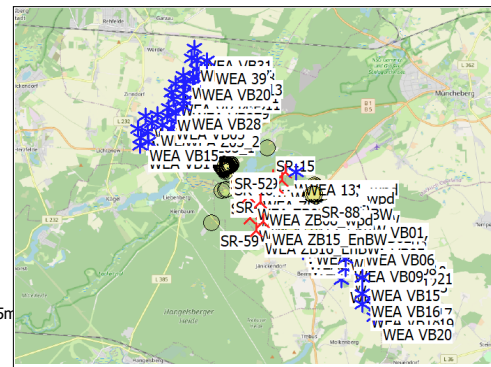
#### Annahmen für Schattenwurfberechnung

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 Sonneneinstrahlungsrichtung  
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: German Brandenburg Elevation Model (DGMS - 5m)  
Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:  
UTM (north)-ETRS89 Zone: 33



#### WEA

WEA	Ost	Nord	Z	Beschreibung	WEA-Typ		Typ	Nennleistung	Rotor-durchmesser	Nabenhöhe	Schattendaten	
					Aktuell	Hersteller					Beschatt.-Bereich	U/min
				[m]				[kW]	[m]	[m]	[m]	[U/min]
WEA 13	434.325	5.813.918	60,4	WEA 13, V16...	Ja	VESTAS	V162-5.600	5.600	162,0	166,0	2.037	0,0
WEA 39	430.344	5.819.016	72,7	WEA 39, V16...	Ja	VESTAS	V162-5.600	5.600	162,0	169,0	2.037	0,0
WEA VB01	427.137	5.815.996	55,8	WEA VB01, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB01	436.613	5.811.968	67,4	WEA VB01, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB02	436.046	5.811.734	66,4	WEA VB02, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB02	427.585	5.815.878	57,5	WEA VB02, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB03	436.764	5.811.503	65,5	WEA VB03, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB04	436.011	5.811.008	62,0	WEA VB04, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB04	428.258	5.816.142	56,0	WEA VB04, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB05	436.622	5.810.990	63,1	WEA VB05, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB05	428.492	5.816.537	60,7	WEA VB05, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB06	437.078	5.810.728	65,7	WEA VB06, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB06	428.062	5.816.627	58,6	WEA VB06, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB07	436.401	5.810.489	63,9	WEA VB07, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB07	427.785	5.816.247	59,0	WEA VB07, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB08	427.518	5.816.583	56,2	WEA VB08, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB08	437.153	5.810.244	75,9	WEA VB08, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB09	436.545	5.809.967	68,4	WEA VB09, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB09	428.583	5.816.928	61,1	WEA VB09, V...	Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0
WEA VB10	429.759	5.817.950	61,4	WEA VB10, V...	Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7
WEA VB10	437.602	5.810.171	78,2	WEA VB10, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB11	436.541	5.809.511	78,3	WEA VB11, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB11	430.146	5.817.851	64,6	WEA VB11, V...	Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7
WEA VB12	429.853	5.818.660	63,3	WEA VB12, V...	Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7
WEA VB12	437.204	5.809.644	79,8	WEA VB12, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB13	437.676	5.809.465	80,3	WEA VB13, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB13	430.226	5.818.513	66,4	WEA VB13, V...	Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7
WEA VB14	436.353	5.809.010	65,5	WEA VB14, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB14	427.251	5.815.229	54,8	WEA VB14, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB15	437.299	5.809.090	74,9	WEA VB15, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB15	427.264	5.815.578	54,5	WEA VB15, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB16	427.612	5.815.391	55,1	WEA VB16, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB16	437.307	5.808.344	79,1	WEA VB16, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB17	429.639	5.819.176	67,5	WEA VB17, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB17	437.832	5.808.252	77,3	WEA VB17, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB18	429.897	5.819.085	68,4	WEA VB18, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB18	437.315	5.807.882	72,7	WEA VB18, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB19	437.915	5.807.770	76,1	WEA VB19, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB19	429.251	5.818.393	61,2	WEA VB19, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB20	429.696	5.818.298	62,5	WEA VB20, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

## SHADOW - Hauptergebnis

### Berechnung: WEA\_GB

...(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 VB20	437.848	5.807.292	73,3	WEA VB20, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB21	430.079	5.818.169	62,9	WEA VB21, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB21	437.903	5.809.855	84,1	WEA VB21, S...	Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA VB22	428.888	5.818.012	59,8	WEA VB22, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB23	429.345	5.818.022	61,0	WEA VB23, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB24	428.692	5.817.620	58,4	WEA VB24, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB25	429.234	5.817.540	58,9	WEA VB25, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB26	428.777	5.817.311	57,6	WEA VB26, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB27	429.246	5.817.247	58,8	WEA VB27, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB28	429.228	5.816.987	58,2	WEA VB28, E...	Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5
WEA VB29	429.630	5.817.456	60,1	WEA VB29, N...	Ja	NORDEX	N117/2400-2.400	2.400	116,8	140,6	1.486	11,8
WEA VB30	428.883	5.816.661	57,7	WEA VB30, N...	Ja	NORDEX	N117/2400-2.400	2.400	116,8	140,6	1.486	11,8
WEA VB31	429.786	5.819.608	70,8	WEA VB31, V...	Ja	VESTAS	V162-5.600	5.600	162,0	169,0	2.041	0,0
WEA Z01	428.166	5.815.226	60,1	WEA Z01, SG...	Nein	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
WEA Z02	428.438	5.815.677	57,6	WEA Z02, V1...	Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0
WEA Z03_1	428.680	5.815.924	56,6	WEA Z03_1, ...	Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0
WEA Z03_2	428.886	5.816.197	56,7	WEA Z03_2, ...	Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0
WEA Z06	429.209	5.816.608	58,3	WEA Z06, V1...	Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0
WEA ZB01_wpd	433.877	5.813.954	61,3	WEA ZB01_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB02_wpd	433.298	5.813.695	60,3	WEA ZB02_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB03_wpd	433.697	5.813.566	60,1	WEA ZB03_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB04_wpd	432.884	5.813.457	59,6	WEA ZB04_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB05_wpd	433.453	5.813.239	58,7	WEA ZB05_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB06_wpd	432.407	5.813.176	58,2	WEA ZB06_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB07_wpd	432.168	5.812.845	55,8	WEA ZB07_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB08_wpd	432.700	5.812.559	57,0	WEA ZB08_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB09_wpd	432.140	5.812.295	55,9	WEA ZB09_w...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB10_EnBW	433.085	5.812.811	57,4	WEA ZB10_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB11_EnBW	433.401	5.812.542	57,8	WEA ZB11_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB12_EnBW	433.205	5.812.138	55,9	WEA ZB12_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB13_EnBW	432.765	5.812.083	53,2	WEA ZB13_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB14_EnBW	432.200	5.811.858	51,5	WEA ZB14_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB15_EnBW	432.805	5.811.676	51,5	WEA ZB15_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA ZB16_EnBW	432.508	5.811.297	51,9	WEA ZB16_E...	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2.041	0,0
WEA1	434.379	5.811.062	55,9	WEA1, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA2	434.387	5.810.798	59,4	WEA2, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA3	434.497	5.810.540	70,1	WEA3, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA4	434.607	5.810.283	65,8	WEA4, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA5	434.819	5.810.763	71,6	WEA5, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA6	434.933	5.810.497	70,2	WEA6, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0
WEA7	435.200	5.810.671	72,9	WEA7, Enron...	Nein	ENRONWIND	EW 1.5sl-1.500	1.500	77,0	80,0	2.500	18,0

### Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
SR-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	431.106	5.813.145	40,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	431.170	5.813.181	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	433.938	5.811.330	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	434.068	5.811.536	55,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	434.184	5.811.569	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	434.584	5.811.549	58,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	435.103	5.812.854	60,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	435.067	5.812.891	61,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	435.042	5.812.883	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	435.315	5.813.074	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	435.300	5.813.111	70,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	435.289	5.813.136	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	435.265	5.813.193	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	435.240	5.813.247	71,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	435.192	5.813.315	71,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Am Fuchsau 4, 15374 Müncheberg	433.047	5.815.033	41,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Am Fuchsau 9, 15374 Müncheberg	431.144	5.813.955	53,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Am Fuchsau 8, 15374 Müncheberg	431.136	5.813.975	57,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

(Fortsetzung nächste Seite)...



Projekt:  
**R-2-2023-0060**

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**SHADOW - Hauptergebnis**

**Berechnung: WEA\_GB**

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
		[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
SR-18	SR-18, Am Fuchsbau 7, 15374 Müncheberg	431.118	5.813.987	56,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-19	SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg	431.097	5.814.031	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-20	SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg	431.075	5.814.057	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-21	SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg	431.073	5.814.102	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-22	SR-22, Am Fuchsbau 1, 15374 Müncheberg	431.039	5.814.112	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	431.056	5.814.129	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	431.105	5.814.127	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	431.117	5.814.138	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	431.130	5.814.147	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	431.146	5.814.156	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	431.178	5.814.160	54,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	431.184	5.814.193	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	431.196	5.814.204	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	431.221	5.814.206	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	431.211	5.814.222	56,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	431.244	5.814.210	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	431.260	5.814.222	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	431.305	5.814.241	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	431.340	5.814.234	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	431.322	5.814.263	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	431.343	5.814.267	54,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	431.361	5.814.273	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	431.374	5.814.284	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	431.389	5.814.307	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	430.998	5.814.164	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	431.005	5.814.192	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	430.988	5.814.208	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	430.965	5.814.215	55,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	431.033	5.814.184	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	431.018	5.814.228	53,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	431.053	5.814.194	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.041	5.814.299	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	431.065	5.814.232	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.084	5.814.237	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	431.113	5.814.255	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	431.076	5.814.255	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	431.097	5.814.285	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-55	SR-55, Hasenweg 3a, 15374 Müncheberg	431.087	5.814.310	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	431.142	5.814.258	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.156	5.814.273	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.174	5.814.289	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-59	SR-59, Am Hüllengrund 3, 15374 Kienbaum	430.462	5.811.645	52,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	435.063	5.811.423	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	430.960	5.813.095	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	435.392	5.813.063	70,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	435.444	5.813.070	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	435.373	5.813.016	67,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	435.389	5.812.979	65,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	435.344	5.812.970	65,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	435.393	5.812.918	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	435.434	5.812.920	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	435.455	5.812.922	62,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	435.530	5.812.945	64,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	435.601	5.812.953	63,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	435.652	5.812.955	64,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	435.549	5.812.814	64,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	435.458	5.812.804	63,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	435.418	5.812.800	62,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	435.377	5.812.798	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	435.417	5.812.836	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	435.383	5.812.836	62,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	435.349	5.812.849	61,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	435.323	5.812.855	61,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	435.332	5.812.903	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	435.306	5.812.912	63,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	435.273	5.812.888	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	435.225	5.812.883	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	435.189	5.812.890	62,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	435.163	5.812.884	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	435.147	5.812.895	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	435.123	5.812.883	61,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	435.139	5.812.849	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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**SHADOW - Hauptergebnis**

**Berechnung: WEA\_GB**

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
					[m]	[m]	[m]	[°]		[m]
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	435.136	5.812.806	60,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	435.177	5.812.797	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	435.247	5.812.783	61,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	435.296	5.812.793	61,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	435.330	5.812.825	61,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	435.337	5.812.786	62,4	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-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	100:23	230	0:52
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	104:11	231	0:53
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	133:24	298	0:45
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	121:02	256	0:59
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	119:29	264	1:00
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	67:56	183	0:35
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	93:18	296	0:29
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	91:55	290	0:28
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	98:08	305	0:28
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	58:15	206	0:24
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	58:57	201	0:24
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	59:54	202	0:25
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	62:39	211	0:27
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	66:03	219	0:28
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	72:06	227	0:31
SR-15	SR-15, Am Maxsee 4, 15374 Müncheberg	44:04	96	0:42
SR-16	SR-16, Am Fuchsbau 9, 15374 Müncheberg	44:20	143	0:26
SR-17	SR-17, Am Fuchsbau 8, 15374 Müncheberg	45:01	141	0:26
SR-18	SR-18, Am Fuchsbau 7, 15374 Müncheberg	43:46	140	0:26
SR-19	SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg	42:51	136	0:25
SR-20	SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg	41:31	134	0:25
SR-21	SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg	40:49	129	0:24
SR-22	SR-22, Am Fuchsbau 1, 15374 Müncheberg	39:32	131	0:24
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	39:49	126	0:24
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	40:37	127	0:24
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	40:19	124	0:24
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	39:39	122	0:25
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	39:11	120	0:25
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	38:56	122	0:25
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	36:39	118	0:24
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	35:59	117	0:25
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	35:28	116	0:25
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	34:02	113	0:25
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	34:46	114	0:25
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	33:42	112	0:25
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	31:42	110	0:26
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	37:09	133	0:26
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	30:09	106	0:26
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	35:09	129	0:26
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	35:18	120	0:26
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	37:30	130	0:26
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	40:46	133	0:26
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	37:20	125	0:23
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	36:35	124	0:22
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	36:01	122	0:23
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	30:03	98	0:22
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	37:22	124	0:23
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	35:33	119	0:23
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	37:09	122	0:23
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	31:38	113	0:22
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	35:24	117	0:23

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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04.09.2023 13:15/3.6.366

## SHADOW - Hauptergebnis

**Berechnung:** WEA\_GB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	35:05	118	0:23
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	33:45	114	0:23
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	34:07	116	0:23
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	32:04	112	0:23
SR-55	SR-55, Hasenweg 3A, 15374 Müncheberg	30:33	110	0:22
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	33:13	113	0:24
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	31:49	111	0:24
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	30:36	110	0:24
SR-59	SR-59, Am Höllegrund 3, 15537 Kienbaum	19:16	70	0:22
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	146:06	289	1:04
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	68:36	201	0:38
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	52:10	181	0:25
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	53:00	185	0:26
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	58:25	210	0:25
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	77:26	244	0:31
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	61:52	216	0:26
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	79:25	242	0:35
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	75:10	219	0:36
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	75:46	219	0:37
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	64:46	196	0:29
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	65:27	196	0:34
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	60:41	167	0:36
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	76:38	197	0:45
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	70:46	191	0:43
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	79:51	236	0:42
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	78:48	229	0:42
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	79:30	240	0:41
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	77:52	238	0:39
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	76:44	234	0:39
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	76:18	231	0:38
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	76:01	239	0:35
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	74:55	237	0:33
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	74:13	228	0:35
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	65:53	199	0:30
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	67:40	204	0:30
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	72:23	220	0:29
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	72:14	218	0:29
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	81:06	256	0:29
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	78:51	236	0:29
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	83:41	252	0:30
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	79:56	239	0:31
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	85:22	237	0:41
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	82:03	228	0:40
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	76:56	222	0:39
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	80:37	221	0:41

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal
		[h/a]
WEA 13	WEA 13, V162 5.6 (Greenwind)	27:03
WEA 39	WEA 39, V162-5.6	0:00
WEA VB01	WEA VB01, Vestas V66	0:00
WEA VB01	WEA VB01, SG6.2-170	87:52
WEA VB02	WEA VB02, SG6.2-170	153:10
WEA VB02	WEA VB02, Vestas V66	0:00
WEA VB03	WEA VB03, SG6.2-170	65:18
WEA VB04	WEA VB04, SG6.2-170	35:55
WEA VB04	WEA VB04, Vestas V66	0:00
WEA VB05	WEA VB05, SG6.2-170	9:35
WEA VB05	WEA VB05, Vestas V66	0:00
WEA VB06	WEA VB06, SG6.2-170	0:00
WEA VB06	WEA VB06, Vestas V66	0:00
WEA VB07	WEA VB07, SG6.2-170	12:08

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Projekt:  
**R-2-2023-0060**

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## SHADOW - Hauptergebnis

**Berechnung:** WEA\_GB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA VB07	WEA VB07, Vestas V66	0:00
WEA VB08	WEA VB08, Vestas V66	0:00
WEA VB08	WEA VB08, SG6.2-170	0:00
WEA VB09	WEA VB09, SG6.2-170	0:00
WEA VB09	WEA VB09, Vestas V66	0:00
WEA VB10	WEA VB10, Vestas V80	0:00
WEA VB10	WEA VB10, SG6.2-170	0:00
WEA VB11	WEA VB11, SG6.2-170	0:00
WEA VB11	WEA VB11, Vestas V80	0:00
WEA VB12	WEA VB12, Vestas V80	0:00
WEA VB12	WEA VB12, SG6.2-170	0:00
WEA VB13	WEA VB13, SG6.2-170	0:00
WEA VB13	WEA VB13, Vestas V80	0:00
WEA VB14	WEA VB14, SG6.2-170	0:00
WEA VB14	WEA VB14, Enercon E-82	0:00
WEA VB15	WEA VB15, SG6.2-170	0:00
WEA VB15	WEA VB15, Enercon E-82	0:00
WEA VB16	WEA VB16, Enercon E-82	0:00
WEA VB16	WEA VB16, SG6.2-170	0:00
WEA VB17	WEA VB17, Enercon E-82	0:00
WEA VB17	WEA VB17, SG6.2-170	0:00
WEA VB18	WEA VB18, Enercon E-82	0:00
WEA VB18	WEA VB18, SG6.2-170	0:00
WEA VB19	WEA VB19, SG6.2-170	0:00
WEA VB19	WEA VB19, Enercon E-82	0:00
WEA VB20	WEA VB20, Enercon E-82	0:00
WEA VB20	WEA VB20, SG6.2-170	0:00
WEA VB21	WEA VB21, Enercon E-82	0:00
WEA VB21	WEA VB21, SG6.2-170	0:00
WEA VB22	WEA VB22, Enercon E-82	0:00
WEA VB23	WEA VB23, Enercon E-82	0:00
WEA VB24	WEA VB24, Enercon E-82	0:00
WEA VB25	WEA VB25, Enercon E-82	0:00
WEA VB26	WEA VB26, Enercon E-82	0:00
WEA VB27	WEA VB27, Enercon E-82	0:00
WEA VB28	WEA VB28, Enercon E-82	0:00
WEA VB29	WEA VB29, Nordex N117 2.4	0:00
WEA VB30	WEA VB30, Nordex N117 2.4	0:00
WEA VB31	WEA VB31, V162-5.6	0:00
WEA Z01	WEA Z01, SG 6.0-170	0:00
WEA Z02	WEA Z02, V162-6.0	0:00
WEA Z03_1	WEA Z03_1, V162-6.0	0:00
WEA Z03_2	WEA Z03_2, V162-6.0	0:00
WEA Z06	WEA Z06, V162-6.0	0:00
WEA ZB01_wpd	WEA ZB01_wpd, V162-6.2MW	89:05
WEA ZB02_wpd	WEA ZB02_wpd, V162-6.2MW	32:12
WEA ZB03_wpd	WEA ZB03_wpd, V162-6.2MW	72:46
WEA ZB04_wpd	WEA ZB04_wpd, V162-6.2MW	43:45
WEA ZB05_wpd	WEA ZB05_wpd, V162-6.2MW	36:13
WEA ZB06_wpd	WEA ZB06_wpd, V162-6.2MW	97:33
WEA ZB07_wpd	WEA ZB07_wpd, V162-6.2MW	93:12
WEA ZB08_wpd	WEA ZB08_wpd, V162-6.2MW	34:00
WEA ZB09_wpd	WEA ZB09_wpd, V162-6.2MW	61:46
WEA ZB10_EnBW	WEA ZB10_EnBW, V162-6.2MW	14:45
WEA ZB11_EnBW	WEA ZB11_EnBW, V162-6.2MW	43:16
WEA ZB12_EnBW	WEA ZB12_EnBW, V162-6.2MW	58:51
WEA ZB13_EnBW	WEA ZB13_EnBW, V162-6.2MW	64:44
WEA ZB14_EnBW	WEA ZB14_EnBW, V162-6.2MW	71:17
WEA ZB15_EnBW	WEA ZB15_EnBW, V162-6.2MW	43:21
WEA ZB16_EnBW	WEA ZB16_EnBW, V162-6.2MW	21:00
WEA1	WEA1, Enron Wind EW 1.5 sl	81:00
WEA2	WEA2, Enron Wind EW 1.5 sl	40:26
WEA3	WEA3, Enron Wind EW 1.5 sl	8:12
WEA4	WEA4, Enron Wind EW 1.5 sl	0:00
WEA5	WEA5, Enron Wind EW 1.5 sl	29:22

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Hauptergebnis

**Berechnung:** WEA\_GB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA6	WEA6, Enron Wind EW 1.5 sl	10:25
WEA7	WEA7, Enron Wind EW 1.5 sl	12:51

*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-95 über das ganze Jahr

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.636

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-01a - SR-01a, Neue Mühle 1, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:56 (WEA ZB14_EnBW)07:48	08:29 (WEA ZB09_wpd)06:53	07:23 (WEA ZB08_wpd)06:41	07:15 (WEA ZB06_wpd)05:35	04:49
2	16:01	09:17 (WEA ZB14_EnBW)16:49	08:55 (WEA ZB09_wpd)17:42	07:44 (WEA ZB08_wpd)19:37	07:27 (WEA ZB06_wpd)20:29	04:48
3	16:02	09:18 (WEA ZB14_EnBW)16:51	08:29 (WEA ZB09_wpd)06:51	07:23 (WEA ZB08_wpd)06:39	07:12 (WEA ZB06_wpd)05:33	04:48
4	08:15	08:57 (WEA ZB14_EnBW)07:43	08:09 (WEA ZB13_EnBW)06:46	07:22 (WEA ZB08_wpd)06:37	07:09 (WEA ZB06_wpd)05:31	04:47
5	16:04	09:19 (WEA ZB14_EnBW)16:53	08:57 (WEA ZB09_wpd)17:46	07:44 (WEA ZB08_wpd)19:41	07:30 (WEA ZB06_wpd)20:33	04:47
6	08:14	08:57 (WEA ZB14_EnBW)07:43	08:09 (WEA ZB13_EnBW)06:46	07:22 (WEA ZB08_wpd)06:34	07:08 (WEA ZB06_wpd)05:29	04:46
7	16:04	09:19 (WEA ZB14_EnBW)16:55	08:57 (WEA ZB09_wpd)17:48	07:44 (WEA ZB08_wpd)19:43	07:31 (WEA ZB06_wpd)20:35	04:46
8	08:14	08:57 (WEA ZB14_EnBW)07:41	08:07 (WEA ZB13_EnBW)06:44	07:22 (WEA ZB08_wpd)06:32	07:07 (WEA ZB06_wpd)05:28	04:46
9	16:05	09:20 (WEA ZB14_EnBW)16:57	08:57 (WEA ZB09_wpd)17:49	07:44 (WEA ZB08_wpd)19:44	07:32 (WEA ZB06_wpd)20:36	04:46
10	08:14	08:57 (WEA ZB14_EnBW)07:39	08:06 (WEA ZB13_EnBW)06:42	07:22 (WEA ZB08_wpd)06:30	07:06 (WEA ZB06_wpd)05:26	04:45
11	16:06	09:20 (WEA ZB14_EnBW)16:59	08:57 (WEA ZB09_wpd)17:51	07:44 (WEA ZB08_wpd)19:46	07:33 (WEA ZB06_wpd)20:38	04:45
12	08:14	08:58 (WEA ZB14_EnBW)07:38	08:05 (WEA ZB13_EnBW)06:40	07:19 (WEA ZB07_wpd)06:27	07:05 (WEA ZB06_wpd)05:24	04:44
13	16:08	09:21 (WEA ZB14_EnBW)17:01	08:57 (WEA ZB09_wpd)17:53	07:44 (WEA ZB08_wpd)19:48	07:33 (WEA ZB06_wpd)20:40	04:44
14	08:13	08:58 (WEA ZB14_EnBW)07:36	08:04 (WEA ZB13_EnBW)06:37	07:16 (WEA ZB07_wpd)06:25	07:02 (WEA ZB06_wpd)05:22	04:44
15	16:09	09:21 (WEA ZB14_EnBW)17:03	08:57 (WEA ZB09_wpd)17:55	07:44 (WEA ZB08_wpd)19:50	07:33 (WEA ZB06_wpd)20:41	04:44
16	08:13	08:59 (WEA ZB14_EnBW)07:34	08:04 (WEA ZB13_EnBW)06:35	07:13 (WEA ZB07_wpd)06:23	07:04 (WEA ZB06_wpd)05:20	04:43
17	16:10	09:23 (WEA ZB14_EnBW)17:04	08:57 (WEA ZB09_wpd)17:57	07:38 (WEA ZB08_wpd)19:51	07:33 (WEA ZB06_wpd)20:43	04:43
18	08:12	08:59 (WEA ZB14_EnBW)07:32	08:05 (WEA ZB13_EnBW)06:33	07:12 (WEA ZB07_wpd)06:20	07:03 (WEA ZB06_wpd)05:19	04:43
19	16:12	09:23 (WEA ZB14_EnBW)17:06	08:57 (WEA ZB09_wpd)17:58	07:37 (WEA ZB08_wpd)19:53	07:32 (WEA ZB06_wpd)20:45	04:43
20	08:12	08:59 (WEA ZB14_EnBW)07:30	08:05 (WEA ZB13_EnBW)06:30	07:11 (WEA ZB07_wpd)06:18	07:04 (WEA ZB06_wpd)05:17	04:42
21	16:13	09:23 (WEA ZB14_EnBW)17:08	08:56 (WEA ZB09_wpd)18:00	07:39 (WEA ZB08_wpd)19:55	07:32 (WEA ZB06_wpd)20:46	04:42
22	08:11	09:00 (WEA ZB14_EnBW)07:28	08:05 (WEA ZB13_EnBW)06:28	06:51 (WEA ZB07_wpd)06:16	06:43 (WEA ZB06_wpd)05:15	04:42
23	16:15	09:23 (WEA ZB14_EnBW)17:10	08:56 (WEA ZB09_wpd)18:02	07:39 (WEA ZB08_wpd)19:56	07:31 (WEA ZB06_wpd)20:48	04:42
24	08:10	09:00 (WEA ZB14_EnBW)07:26	08:06 (WEA ZB13_EnBW)06:26	06:49 (WEA ZB07_wpd)06:14	06:39 (WEA ZB06_wpd)05:13	04:42
25	16:16	09:23 (WEA ZB14_EnBW)17:12	08:54 (WEA ZB09_wpd)18:04	07:39 (WEA ZB08_wpd)19:58	07:30 (WEA ZB06_wpd)20:49	04:42
26	08:10	09:01 (WEA ZB14_EnBW)07:25	08:06 (WEA ZB13_EnBW)06:24	06:47 (WEA ZB07_wpd)06:11	06:37 (WEA ZB06_wpd)05:12	04:42
27	16:18	09:23 (WEA ZB14_EnBW)17:14	08:52 (WEA ZB09_wpd)18:06	07:40 (WEA ZB08_wpd)20:00	07:30 (WEA ZB06_wpd)20:51	04:42
28	08:09	09:01 (WEA ZB14_EnBW)07:23	08:07 (WEA ZB13_EnBW)06:21	06:45 (WEA ZB07_wpd)06:09	06:35 (WEA ZB06_wpd)05:10	04:41
29	16:19	09:24 (WEA ZB14_EnBW)17:16	08:50 (WEA ZB09_wpd)18:07	07:39 (WEA ZB08_wpd)20:02	07:28 (WEA ZB06_wpd)20:53	04:41
30	08:08	09:02 (WEA ZB14_EnBW)07:21	08:09 (WEA ZB13_EnBW)06:19	06:45 (WEA ZB07_wpd)06:07	06:34 (WEA ZB06_wpd)05:09	04:41
31	16:21	09:24 (WEA ZB14_EnBW)17:18	08:46 (WEA ZB09_wpd)18:09	07:40 (WEA ZB08_wpd)20:03	07:26 (WEA ZB06_wpd)20:54	04:41
1	08:07	09:03 (WEA ZB14_EnBW)07:19	06:17	06:44 (WEA ZB07_wpd)06:05	06:33 (WEA ZB06_wpd)05:07	04:41
2	16:23	09:24 (WEA ZB14_EnBW)17:20	18:11	07:39 (WEA ZB08_wpd)20:05	07:25 (WEA ZB06_wpd)20:56	04:41
3	08:06	09:04 (WEA ZB14_EnBW)07:17	06:14	06:44 (WEA ZB07_wpd)06:02	06:33 (WEA ZB06_wpd)05:06	04:41
4	16:24	09:24 (WEA ZB14_EnBW)17:22	18:13	07:39 (WEA ZB08_wpd)20:07	07:22 (WEA ZB06_wpd)20:57	04:41
5	08:05	09:05 (WEA ZB14_EnBW)07:14	06:12	06:44 (WEA ZB07_wpd)06:00	06:33 (WEA ZB06_wpd)05:04	04:41
6	16:26	09:24 (WEA ZB14_EnBW)17:23	18:15	07:38 (WEA ZB08_wpd)20:09	07:18 (WEA ZB06_wpd)20:59	04:41
7	08:04	09:05 (WEA ZB14_EnBW)07:12	06:09	06:44 (WEA ZB07_wpd)05:58	06:33 (WEA ZB06_wpd)05:03	04:41
8	16:28	09:23 (WEA ZB14_EnBW)17:25	18:16	07:37 (WEA ZB08_wpd)20:10	07:20 (WEA ZB06_wpd)21:00	04:41
9	08:03	09:06 (WEA ZB14_EnBW)07:10	06:07	06:45 (WEA ZB07_wpd)05:56	06:33 (WEA ZB06_wpd)05:01	04:41
10	16:29	09:22 (WEA ZB14_EnBW)17:27	18:18	07:36 (WEA ZB08_wpd)20:12	07:18 (WEA ZB06_wpd)21:02	04:41
11	08:02	09:08 (WEA ZB14_EnBW)07:08	06:05	06:46 (WEA ZB07_wpd)05:54	06:33 (WEA ZB06_wpd)05:00	04:42
12	16:31	09:22 (WEA ZB14_EnBW)17:29	18:20	07:35 (WEA ZB08_wpd)20:14	07:16 (WEA ZB06_wpd)21:03	04:41
13	08:00	09:10 (WEA ZB14_EnBW)07:06	06:02	06:48 (WEA ZB07_wpd)05:52	06:34 (WEA ZB06_wpd)04:59	04:42
14	16:33	09:20 (WEA ZB14_EnBW)17:31	18:22	07:33 (WEA ZB08_wpd)20:16	07:14 (WEA ZB06_wpd)21:05	04:41
15	07:59	09:14 (WEA ZB14_EnBW)07:04	06:00	06:49 (WEA ZB07_wpd)05:50	06:34 (WEA ZB06_wpd)04:57	04:42
16	16:35	09:17 (WEA ZB14_EnBW)17:33	18:23	07:32 (WEA ZB08_wpd)20:17	07:16 (WEA ZB06_wpd)21:06	04:41
17	07:58	08:37 (WEA ZB09_wpd)07:02	07:29 (WEA ZB08_wpd)05:58	07:11 (WEA ZB07_wpd)05:47	06:50 (WEA ZB06_wpd)04:56	04:42
18	16:36	08:44 (WEA ZB09_wpd)17:35	07:39 (WEA ZB08_wpd)18:25	07:30 (WEA ZB07_wpd)20:19	06:48 (WEA ZB06_wpd)21:08	04:41
19	07:56	08:35 (WEA ZB09_wpd)07:00	07:27 (WEA ZB08_wpd)05:55	07:12 (WEA ZB07_wpd)05:45	06:37 (WEA ZB06_wpd)04:55	04:43
20	16:38	08:48 (WEA ZB09_wpd)17:37	07:41 (WEA ZB08_wpd)18:27	07:27 (WEA ZB07_wpd)20:21	06:46 (WEA ZB06_wpd)21:09	04:41
21	07:55	08:33 (WEA ZB09_wpd)06:58	07:25 (WEA ZB08_wpd)05:53	07:18 (WEA ZB07_wpd)05:43	06:50 (WEA ZB06_wpd)21:06	04:41
22	16:40	08:49 (WEA ZB09_wpd)17:38	07:42 (WEA ZB08_wpd)18:29	07:21 (WEA ZB07_wpd)20:23	06:45 (WEA ZB06_wpd)21:07	04:43
23	07:54	08:32 (WEA ZB09_wpd)06:55	07:24 (WEA ZB08_wpd)05:51	07:15 (WEA ZB07_wpd)05:41	06:44 (WEA ZB06_wpd)21:05	04:43
24	16:42	08:52 (WEA ZB09_wpd)17:40	07:43 (WEA ZB08_wpd)18:30	07:20	06:44 (WEA ZB06_wpd)21:06	04:43
25	07:52	08:31 (WEA ZB09_wpd)	06:48	07:19	06:43 (WEA ZB06_wpd)21:05	04:44
26	16:44	08:52 (WEA ZB09_wpd)	19:32	20:26	06:43 (WEA ZB06_wpd)21:05	04:43
27	07:51	08:31 (WEA ZB09_wpd)	06:46	07:18	06:43 (WEA ZB06_wpd)21:05	04:45
28	16:46	08:54 (WEA ZB09_wpd)	19:34	20:28	06:43 (WEA ZB06_wpd)21:05	04:45
29	07:49	08:30 (WEA ZB09_wpd)	06:44	07:17	06:43 (WEA ZB06_wpd)21:05	04:45
30	16:47	08:55 (WEA ZB09_wpd)	19:36	20:28	06:43 (WEA ZB06_wpd)21:05	04:45
31	07:49	08:30 (WEA ZB09_wpd)	06:44	07:17	06:43 (WEA ZB06_wpd)21:05	04:45
Sonneneinstrahlung	256		276		417	
astr. max. mögl. Beschattung	610		660	852	665	502

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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-01a - SR-01a, Neue Mühle 1, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

- Die dargestellten Zeiten sind die astronomisch maximale 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	09:46 21:31	05:23 20:58	08:34 19:55	07:02 (WEA Z806_wpd) 07:30 (WEA Z806_wpd)	07:04 18:44	07:30 (WEA Z813_ErbW) 08:26 (WEA Z809_wpd)	07:51 15:55	08:41 (WEA Z814_ErbW) 09:05 (WEA Z814_ErbW)
2	09:46 21:30	05:24 20:55	08:35 19:52	07:02 (WEA Z806_wpd) 07:31 (WEA Z806_wpd)	07:06 18:42	07:01 08:26 (WEA Z809_wpd)	07:53 15:54	08:42 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
3	09:47 21:30	05:26 20:54	08:37 19:50	07:02 (WEA Z806_wpd) 07:31 (WEA Z806_wpd)	07:07 18:39	07:03 08:16 (WEA Z807_wpd)	07:54 15:54	08:43 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
4	09:48 21:29	05:28 20:53	08:39 19:48	07:02 (WEA Z806_wpd) 07:30 (WEA Z806_wpd)	07:09 18:37	07:05 08:15 (WEA Z807_wpd)	07:55 15:53	08:44 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
5	09:49 21:29	05:29 20:51	08:41 19:45	07:02 (WEA Z806_wpd) 07:29 (WEA Z806_wpd)	07:11 18:35	07:06 08:17 (WEA Z807_wpd)	07:57 15:53	08:45 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
6	09:49 21:28	05:31 20:49	08:42 19:43	07:02 (WEA Z806_wpd) 07:28 (WEA Z806_wpd)	07:13 18:32	07:08 08:17 (WEA Z807_wpd)	07:58 15:52	08:46 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
7	09:50 21:28	05:32 20:47	08:43 19:41	07:02 (WEA Z806_wpd) 07:28 (WEA Z806_wpd)	07:14 18:30	07:10 08:18 (WEA Z807_wpd)	07:59 15:52	08:47 (WEA Z814_ErbW) 09:06 (WEA Z814_ErbW)
8	09:51 21:27	05:34 20:45	08:44 19:38	07:02 (WEA Z806_wpd) 07:27 (WEA Z806_wpd)	07:16 18:28	07:12 08:19 (WEA Z807_wpd)	08:01 15:51	08:48 (WEA Z814_ErbW) 09:07 (WEA Z814_ErbW)
9	09:52 21:26	05:36 20:44	08:45 19:36	07:02 (WEA Z806_wpd) 07:25 (WEA Z806_wpd)	07:18 18:25	07:14 08:19 (WEA Z807_wpd)	08:02 15:51	08:49 (WEA Z814_ErbW) 09:07 (WEA Z814_ErbW)
10	09:53 21:26	05:37 20:42	08:46 19:34	07:02 (WEA Z806_wpd) 07:23 (WEA Z806_wpd)	07:20 18:23	07:16 08:18 (WEA Z807_wpd)	08:03 15:51	08:49 (WEA Z814_ErbW) 09:07 (WEA Z814_ErbW)
11	09:54 21:25	05:39 20:40	08:47 19:31	07:02 (WEA Z806_wpd) 07:20 (WEA Z806_wpd)	07:21 18:21	07:17 08:18 (WEA Z807_wpd)	08:04 15:51	08:49 (WEA Z814_ErbW) 09:08 (WEA Z814_ErbW)
12	09:55 21:24	05:41 20:38	08:48 19:29	07:02 (WEA Z806_wpd) 07:19 (WEA Z806_wpd)	07:23 18:19	07:19 08:17 (WEA Z807_wpd)	08:05 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
13	09:57 21:23	05:42 20:36	08:49 19:27	07:02 (WEA Z806_wpd) 07:18 (WEA Z806_wpd)	07:25 18:16	07:21 08:17 (WEA Z807_wpd)	08:06 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
14	09:58 21:22	05:44 20:34	08:50 19:24	07:02 (WEA Z806_wpd) 07:17 (WEA Z806_wpd)	07:27 18:14	07:23 08:16 (WEA Z807_wpd)	08:07 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
15	09:59 21:21	05:46 20:32	08:51 19:22	07:02 (WEA Z806_wpd) 07:16 (WEA Z806_wpd)	07:28 18:12	07:24 08:15 (WEA Z807_wpd)	08:08 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
16	10:00 21:20	05:47 20:30	08:52 19:20	07:02 (WEA Z806_wpd) 07:15 (WEA Z806_wpd)	07:30 18:10	07:26 08:14 (WEA Z807_wpd)	08:09 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
17	10:01 21:19	05:49 20:28	08:53 19:17	07:02 (WEA Z806_wpd) 07:14 (WEA Z806_wpd)	07:32 18:08	07:28 08:13 (WEA Z807_wpd)	08:10 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
18	10:03 21:18	05:51 20:25	08:54 19:15	07:02 (WEA Z806_wpd) 07:13 (WEA Z806_wpd)	07:34 18:05	07:30 08:12 (WEA Z807_wpd)	08:11 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
19	10:04 21:17	05:52 20:23	08:55 19:13	07:02 (WEA Z806_wpd) 07:12 (WEA Z806_wpd)	07:35 18:03	07:31 08:11 (WEA Z807_wpd)	08:12 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
20	10:05 21:16	05:54 20:21	08:56 19:11	07:02 (WEA Z806_wpd) 07:11 (WEA Z806_wpd)	07:37 18:01	07:33 08:10 (WEA Z807_wpd)	08:13 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
21	10:07 21:14	05:56 20:19	08:57 19:08	07:02 (WEA Z806_wpd) 07:10 (WEA Z806_wpd)	07:39 17:59	07:35 08:09 (WEA Z807_wpd)	08:14 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
22	10:08 21:13	05:57 20:17	08:58 19:06	07:02 (WEA Z806_wpd) 07:09 (WEA Z806_wpd)	07:41 17:57	07:37 08:08 (WEA Z807_wpd)	08:15 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
23	10:09 21:12	05:59 20:15	08:59 19:04	07:02 (WEA Z806_wpd) 07:08 (WEA Z806_wpd)	07:43 17:55	07:39 08:07 (WEA Z807_wpd)	08:16 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
24	10:11 21:10	06:01 20:13	09:01 19:01	07:02 (WEA Z806_wpd) 07:07 (WEA Z806_wpd)	07:44 17:53	07:40 08:06 (WEA Z807_wpd)	08:17 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
25	10:12 21:09	06:02 20:10	09:02 18:58	07:02 (WEA Z806_wpd) 07:06 (WEA Z806_wpd)	07:46 17:50	07:42 08:04 (WEA Z807_wpd)	08:18 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
26	10:14 21:07	06:04 20:08	09:04 18:56	07:02 (WEA Z806_wpd) 07:05 (WEA Z806_wpd)	07:48 17:48	07:43 08:03 (WEA Z807_wpd)	08:19 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
27	10:15 21:06	06:06 20:06	09:06 18:53	07:02 (WEA Z806_wpd) 07:04 (WEA Z806_wpd)	07:50 17:46	07:45 08:02 (WEA Z807_wpd)	08:20 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
28	10:17 21:04	06:07 20:04	09:08 18:51	07:02 (WEA Z806_wpd) 07:03 (WEA Z806_wpd)	07:52 17:44	07:47 08:01 (WEA Z807_wpd)	08:21 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
29	10:18 21:03	06:09 20:02	09:10 18:49	07:02 (WEA Z806_wpd) 07:02 (WEA Z806_wpd)	07:54 17:42	07:48 08:00 (WEA Z807_wpd)	08:22 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
30	10:20 21:01	06:11 19:59	09:12 18:46	07:02 (WEA Z806_wpd) 07:01 (WEA Z806_wpd)	07:56 17:40	07:51 08:00 (WEA Z807_wpd)	08:23 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
31	10:21 21:00	06:13 19:57	09:14 18:44	07:02 (WEA Z806_wpd) 07:00 (WEA Z806_wpd)	07:58 17:39	07:53 08:00 (WEA Z807_wpd)	08:24 15:51	08:49 (WEA Z814_ErbW) 09:09 (WEA Z814_ErbW)
Sonnenscheinstunden astronomisch Beschattung	505	455	381	311	264	211	159	241
		404	332	266	211	159	121	69

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-01b - SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:04 (WEA ZB14_EnBW)07:48	08:14 (WEA ZB13_EnBW)06:53	07:29 (WEA ZB08_wpd)06:41	07:16 (WEA ZB06_wpd)05:35	04:49
	16:01	09:28 (WEA ZB14_EnBW)16:49	09:08 (WEA ZB09_wpd)17:42	23 07:52 (WEA ZB08_wpd)19:37	22 07:38 (WEA ZB06_wpd)20:29	21:16
2	08:15	09:05 (WEA ZB14_EnBW)07:46	08:12 (WEA ZB13_EnBW)06:51	07:29 (WEA ZB08_wpd)06:39	07:15 (WEA ZB06_wpd)05:33	04:48
	16:02	24 09:29 (WEA ZB14_EnBW)16:51	44 09:08 (WEA ZB09_wpd)17:44	23 07:52 (WEA ZB08_wpd)19:39	24 07:39 (WEA ZB06_wpd)20:31	21:18
3	08:15	09:06 (WEA ZB14_EnBW)07:44	08:12 (WEA ZB13_EnBW)06:49	07:29 (WEA ZB08_wpd)06:37	07:13 (WEA ZB06_wpd)05:31	04:47
	16:03	24 09:30 (WEA ZB14_EnBW)16:53	46 09:09 (WEA ZB09_wpd)17:46	21 07:50 (WEA ZB08_wpd)19:41	26 07:39 (WEA ZB06_wpd)20:33	21:19
4	08:15	09:06 (WEA ZB14_EnBW)07:43	08:12 (WEA ZB13_EnBW)06:46	07:27 (WEA ZB07_wpd)06:34	07:12 (WEA ZB06_wpd)05:29	04:46
	16:04	23 09:29 (WEA ZB14_EnBW)16:55	47 09:09 (WEA ZB09_wpd)17:48	23 07:50 (WEA ZB08_wpd)19:43	28 07:40 (WEA ZB06_wpd)20:35	21:20
5	08:15	09:07 (WEA ZB14_EnBW)07:41	08:11 (WEA ZB13_EnBW)06:44	07:25 (WEA ZB07_wpd)06:32	07:12 (WEA ZB06_wpd)05:28	04:46
	16:05	23 09:30 (WEA ZB14_EnBW)16:57	47 09:08 (WEA ZB09_wpd)17:49	24 07:49 (WEA ZB08_wpd)19:44	28 07:40 (WEA ZB06_wpd)20:36	21:21
6	08:14	09:07 (WEA ZB14_EnBW)07:39	08:11 (WEA ZB13_EnBW)06:42	07:23 (WEA ZB07_wpd)06:30	07:11 (WEA ZB06_wpd)05:26	04:45
	16:06	23 09:30 (WEA ZB14_EnBW)16:59	46 09:08 (WEA ZB09_wpd)17:51	25 07:48 (WEA ZB07_wpd)19:46	30 07:41 (WEA ZB06_wpd)20:38	21:22
7	08:14	09:08 (WEA ZB14_EnBW)07:38	08:11 (WEA ZB13_EnBW)06:40	07:21 (WEA ZB07_wpd)06:27	07:10 (WEA ZB06_wpd)05:24	04:44
	16:08	23 09:31 (WEA ZB14_EnBW)17:01	46 09:07 (WEA ZB09_wpd)17:53	29 07:50 (WEA ZB07_wpd)19:48	30 07:40 (WEA ZB06_wpd)20:40	21:23
8	08:13	09:08 (WEA ZB14_EnBW)07:36	08:11 (WEA ZB13_EnBW)06:37	07:21 (WEA ZB07_wpd)06:25	07:10 (WEA ZB06_wpd)05:22	04:44
	16:09	23 09:31 (WEA ZB14_EnBW)17:03	43 09:06 (WEA ZB09_wpd)17:55	30 07:51 (WEA ZB07_wpd)19:50	30 07:40 (WEA ZB06_wpd)20:41	21:24
9	08:13	09:09 (WEA ZB14_EnBW)07:34	08:11 (WEA ZB13_EnBW)06:35	07:19 (WEA ZB07_wpd)06:23	07:10 (WEA ZB06_wpd)05:20	04:43
	16:10	23 09:32 (WEA ZB14_EnBW)17:04	41 09:05 (WEA ZB09_wpd)17:57	32 07:51 (WEA ZB07_wpd)19:51	30 07:40 (WEA ZB06_wpd)20:43	21:24
10	08:12	09:09 (WEA ZB14_EnBW)07:32	08:13 (WEA ZB13_EnBW)06:33	06:57 (WEA ZB10_EnBW)06:20	07:09 (WEA ZB06_wpd)05:19	04:43
	16:12	23 09:32 (WEA ZB14_EnBW)17:06	38 09:05 (WEA ZB09_wpd)17:58	39 07:51 (WEA ZB07_wpd)19:53	29 07:38 (WEA ZB06_wpd)20:45	21:25
11	08:12	09:10 (WEA ZB14_EnBW)07:30	08:13 (WEA ZB13_EnBW)06:30	06:54 (WEA ZB10_EnBW)06:18	06:46 (WEA ZB04_wpd)05:17	04:42
	16:13	22 09:32 (WEA ZB14_EnBW)17:08	33 09:03 (WEA ZB09_wpd)18:00	46 07:52 (WEA ZB07_wpd)19:55	32 07:38 (WEA ZB06_wpd)20:46	21:26
12	08:11	09:10 (WEA ZB14_EnBW)07:28	08:14 (WEA ZB13_EnBW)06:28	06:52 (WEA ZB10_EnBW)06:16	06:42 (WEA ZB04_wpd)05:15	04:42
	16:15	22 09:32 (WEA ZB14_EnBW)17:10	25 09:00 (WEA ZB09_wpd)18:02	48 07:51 (WEA ZB07_wpd)19:56	39 07:37 (WEA ZB06_wpd)20:48	21:27
13	08:10	09:11 (WEA ZB14_EnBW)07:26	08:16 (WEA ZB13_EnBW)06:26	06:51 (WEA ZB10_EnBW)06:14	06:40 (WEA ZB04_wpd)05:13	04:42
	16:16	21 09:32 (WEA ZB14_EnBW)17:12	11 08:27 (WEA ZB13_EnBW)18:04	51 07:51 (WEA ZB07_wpd)19:58	41 07:36 (WEA ZB06_wpd)20:49	21:27
14	08:10	09:12 (WEA ZB14_EnBW)07:25	08:18 (WEA ZB13_EnBW)06:24	06:50 (WEA ZB10_EnBW)06:11	06:39 (WEA ZB04_wpd)05:12	04:42
	16:18	19 09:31 (WEA ZB14_EnBW)17:14	6 08:24 (WEA ZB13_EnBW)18:06	52 07:51 (WEA ZB07_wpd)20:00	41 07:35 (WEA ZB06_wpd)20:51	21:28
15	08:09	09:13 (WEA ZB14_EnBW)07:23	06:21	06:49 (WEA ZB10_EnBW)06:09	06:37 (WEA ZB04_wpd)05:10	04:41
	16:19	18 09:31 (WEA ZB14_EnBW)17:16	06:19	53 07:50 (WEA ZB07_wpd)20:02	40 07:32 (WEA ZB06_wpd)20:53	21:29
16	08:08	09:14 (WEA ZB14_EnBW)07:21	06:19	06:49 (WEA ZB10_EnBW)06:07	06:36 (WEA ZB04_wpd)05:09	04:41
	16:21	17 09:31 (WEA ZB14_EnBW)17:18	18:09	53 07:50 (WEA ZB07_wpd)20:03	37 07:30 (WEA ZB06_wpd)20:54	21:29
17	08:07	09:16 (WEA ZB14_EnBW)07:19	06:17	06:48 (WEA ZB10_EnBW)06:05	06:36 (WEA ZB04_wpd)05:07	04:41
	16:23	14 09:30 (WEA ZB14_EnBW)17:20	18:11	52 07:49 (WEA ZB07_wpd)20:05	33 07:28 (WEA ZB06_wpd)20:56	21:30
18	08:06	09:17 (WEA ZB14_EnBW)07:17	06:14	06:49 (WEA ZB10_EnBW)06:02	06:36 (WEA ZB04_wpd)05:06	04:41
	16:24	12 09:29 (WEA ZB14_EnBW)17:22	06:12	48 07:48 (WEA ZB07_wpd)20:07	21 06:57 (WEA ZB04_wpd)20:57	21:30
19	08:05	08:47 (WEA ZB09_wpd)07:14	06:12	06:50 (WEA ZB10_EnBW)06:00	06:36 (WEA ZB04_wpd)05:04	04:41
	16:26	15 09:28 (WEA ZB14_EnBW)17:23	18:15	44 07:47 (WEA ZB07_wpd)20:09	21 06:57 (WEA ZB04_wpd)20:59	21:30
20	08:04	08:44 (WEA ZB09_wpd)07:12	06:09	06:50 (WEA ZB10_EnBW)05:58	06:36 (WEA ZB04_wpd)05:03	04:41
	16:28	13 08:57 (WEA ZB09_wpd)17:25	18:16	40 07:45 (WEA ZB07_wpd)20:10	21 06:57 (WEA ZB04_wpd)21:00	21:31
21	08:03	08:43 (WEA ZB09_wpd)07:10	06:07	06:52 (WEA ZB10_EnBW)05:56	06:36 (WEA ZB04_wpd)05:01	04:41
	16:29	16 08:59 (WEA ZB09_wpd)17:27	18:18	34 07:44 (WEA ZB07_wpd)20:12	20 06:56 (WEA ZB04_wpd)21:02	21:31
22	08:02	08:43 (WEA ZB09_wpd)07:08	06:05	07:21 (WEA ZB07_wpd)05:54	06:36 (WEA ZB04_wpd)05:00	04:42
	16:31	18 09:01 (WEA ZB09_wpd)17:29	9 07:45 (WEA ZB08_wpd)18:20	21 07:42 (WEA ZB07_wpd)20:14	19 06:55 (WEA ZB04_wpd)21:03	21:31
23	08:00	08:41 (WEA ZB09_wpd)07:06	06:02	07:22 (WEA ZB07_wpd)05:52	06:37 (WEA ZB04_wpd)04:59	04:42
	16:33	21 09:02 (WEA ZB09_wpd)17:31	14 07:48 (WEA ZB08_wpd)18:22	17 07:39 (WEA ZB07_wpd)20:16	17 06:54 (WEA ZB04_wpd)21:05	21:31
24	07:59	08:41 (WEA ZB09_wpd)07:04	06:00	07:26 (WEA ZB07_wpd)05:50	06:38 (WEA ZB04_wpd)04:57	04:42
	16:35	22 09:03 (WEA ZB09_wpd)17:33	17 07:49 (WEA ZB08_wpd)18:23	8 07:34 (WEA ZB07_wpd)20:17	15 06:54 (WEA ZB04_wpd)21:06	21:31
25	07:58	08:40 (WEA ZB09_wpd)07:02	06:00	05:47	06:39 (WEA ZB04_wpd)04:56	04:42
	16:36	24 09:04 (WEA ZB09_wpd)17:35	20 07:51 (WEA ZB08_wpd)18:25	20:19	11 06:50 (WEA ZB04_wpd)21:08	21:31
26	07:56	08:40 (WEA ZB09_wpd)07:00	06:00	05:45	06:43 (WEA ZB04_wpd)04:55	04:43
	16:38	25 09:05 (WEA ZB09_wpd)17:37	20 07:51 (WEA ZB08_wpd)18:27	20:21	4 06:47 (WEA ZB04_wpd)21:09	21:31
27	07:55	08:39 (WEA ZB09_wpd)06:58	06:00	05:43	04:54	04:43
	16:40	27 09:06 (WEA ZB09_wpd)17:38	22 07:51 (WEA ZB08_wpd)18:29	20:23	1 21:10	21:31
28	07:54	08:39 (WEA ZB09_wpd)06:55	06:00	05:41	04:53	04:44
	16:42	28 09:07 (WEA ZB09_wpd)17:40	22 07:51 (WEA ZB08_wpd)18:30	20:24	1 21:11	21:31
29	07:52	08:39 (WEA ZB09_wpd)	06:48	07:27 (WEA ZB06_wpd)05:39	04:52	04:44
	16:44	28 09:07 (WEA ZB09_wpd)	19:32	2 07:29 (WEA ZB06_wpd)20:26	1 21:13	21:31
30	07:51	08:39 (WEA ZB09_wpd)	06:46	07:21 (WEA ZB06_wpd)05:37	04:51	04:45
	16:46	29 09:08 (WEA ZB09_wpd)	19:34	14 07:35 (WEA ZB06_wpd)20:28	1 21:14	21:31
31	07:49	08:16 (WEA ZB13_EnBW)	06:44	07:18 (WEA ZB06_wpd)	04:50	04:41
	16:47	38 09:08 (WEA ZB09_wpd)	19:36	18 07:36 (WEA ZB06_wpd)	1 21:15	21:31
Sonnenscheinstunden	256	276	367	417	488	502
astr. max.mögl.Beschattung	682	638	870	689		

**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)			Schattenende (WEA mit letztem Schatten)	
		Minuten mit Schatten			

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-01b - SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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

Juli		August		September		Oktober		November		Dezember					
1	09:46	05:23		08:04	06:45 (WEA ZB04_ErWB)	07:04	07:31 (WEA ZB10_ErWB)	08:59	07:41 (WEA ZB13_ErWB)	07:51	08:53 (WEA ZB14_ErWB)				
	21:31	20:58		19:55	32	07:37 (WEA ZB06_ErWB)	18:44	50	08:31 (WEA ZB07_ErWB)	16:37	38	08:34 (WEA ZB09_ErWB)	15:55	22	08:34 (WEA ZB14_ErWB)
	1	09:46	05:24	08:05		07:08 (WEA ZB06_ErWB)	07:06	07:31 (WEA ZB10_ErWB)	07:01	07:41 (WEA ZB13_ErWB)	07:53	08:53 (WEA ZB14_ErWB)			
	2	11:20	1:05:56	19:52	29	07:37 (WEA ZB06_ErWB)	18:42	47	08:30 (WEA ZB07_ErWB)	16:35	41	08:31 (WEA ZB09_ErWB)	15:54	22	08:31 (WEA ZB14_ErWB)
	3	10:47	05:26	06:17		07:08 (WEA ZB06_ErWB)	07:07	07:31 (WEA ZB10_ErWB)	07:03	07:40 (WEA ZB13_ErWB)	07:54	08:52 (WEA ZB14_ErWB)			
	4	10:48	05:28	06:19		07:07 (WEA ZB06_ErWB)	07:09	07:31 (WEA ZB10_ErWB)	07:05	07:40 (WEA ZB13_ErWB)	07:55	08:53 (WEA ZB14_ErWB)			
	5	10:49	05:29	06:21		07:07 (WEA ZB06_ErWB)	07:11	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	07:57	08:53 (WEA ZB14_ErWB)			
	6	10:49	05:31	06:22		07:06 (WEA ZB06_ErWB)	07:13	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	07:58	08:53 (WEA ZB14_ErWB)			
	7	10:49	05:32	06:24		07:07 (WEA ZB06_ErWB)	07:14	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	07:59	08:54 (WEA ZB14_ErWB)			
	8	10:49	05:34	06:26		07:07 (WEA ZB06_ErWB)	07:16	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:01	08:54 (WEA ZB14_ErWB)			
	9	10:49	05:36	06:27		07:07 (WEA ZB06_ErWB)	07:18	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:02	08:54 (WEA ZB14_ErWB)			
	10	10:49	05:38	06:29		07:08 (WEA ZB06_ErWB)	07:20	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:03	08:54 (WEA ZB14_ErWB)			
	11	10:49	05:40	06:31		07:08 (WEA ZB06_ErWB)	07:22	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:04	08:54 (WEA ZB14_ErWB)			
	12	10:49	05:42	06:33		07:09 (WEA ZB06_ErWB)	07:24	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:05	08:54 (WEA ZB14_ErWB)			
	13	10:49	05:44	06:35		07:09 (WEA ZB06_ErWB)	07:26	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:06	08:54 (WEA ZB14_ErWB)			
	14	10:49	05:46	06:37		07:10 (WEA ZB06_ErWB)	07:28	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:07	08:54 (WEA ZB14_ErWB)			
	15	10:49	05:48	06:39		07:11 (WEA ZB06_ErWB)	07:30	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:08	08:54 (WEA ZB14_ErWB)			
	16	10:49	05:50	06:41		07:12 (WEA ZB06_ErWB)	07:32	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:09	08:54 (WEA ZB14_ErWB)			
	17	10:49	05:52	06:43		07:13 (WEA ZB06_ErWB)	07:34	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:10	08:54 (WEA ZB14_ErWB)			
	18	10:49	05:54	06:45		07:14 (WEA ZB06_ErWB)	07:36	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:11	08:54 (WEA ZB14_ErWB)			
	19	10:49	05:56	06:47		07:15 (WEA ZB06_ErWB)	07:38	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:12	08:54 (WEA ZB14_ErWB)			
	20	10:49	05:58	06:49		07:16 (WEA ZB06_ErWB)	07:40	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:13	08:54 (WEA ZB14_ErWB)			
	21	10:49	06:00	06:51		07:17 (WEA ZB06_ErWB)	07:42	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:14	08:54 (WEA ZB14_ErWB)			
	22	10:49	06:02	06:53		07:18 (WEA ZB06_ErWB)	07:44	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:15	08:54 (WEA ZB14_ErWB)			
	23	10:49	06:04	06:55		07:19 (WEA ZB06_ErWB)	07:46	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:16	08:54 (WEA ZB14_ErWB)			
	24	10:49	06:06	06:57		07:20 (WEA ZB06_ErWB)	07:48	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:17	08:54 (WEA ZB14_ErWB)			
	25	10:49	06:08	06:59		07:21 (WEA ZB06_ErWB)	07:50	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:18	08:54 (WEA ZB14_ErWB)			
	26	10:49	06:10	07:01		07:22 (WEA ZB06_ErWB)	07:52	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:19	08:54 (WEA ZB14_ErWB)			
	27	10:49	06:12	07:03		07:23 (WEA ZB06_ErWB)	07:54	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:20	08:54 (WEA ZB14_ErWB)			
	28	10:49	06:14	07:05		07:24 (WEA ZB06_ErWB)	07:56	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:21	08:54 (WEA ZB14_ErWB)			
	29	10:49	06:16	07:07		07:25 (WEA ZB06_ErWB)	07:58	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:22	08:54 (WEA ZB14_ErWB)			
	30	10:49	06:18	07:09		07:26 (WEA ZB06_ErWB)	08:00	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:23	08:54 (WEA ZB14_ErWB)			
	31	10:49	06:20	07:11		07:27 (WEA ZB06_ErWB)	08:02	07:31 (WEA ZB10_ErWB)	07:06	07:41 (WEA ZB13_ErWB)	08:24	08:54 (WEA ZB14_ErWB)			
	Sonnenscheinstunden astronomisch Beschattung	505	455	386	381	805	590	864	264	864	241	727			

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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-02 - SR-02, A Ausbau Schönfelder Weg 1, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:57 (WEA2)	07:47	06:53		
1	16:01	09:33 (WEA1)	16:49	17:42		
2	08:15	08:57 (WEA2)	07:46	06:51		
1	16:02	09:33 (WEA1)	16:51	17:44		
3	08:15	08:59 (WEA1)	07:44	08:11 (WEA5)	06:48	
1	16:03	09:34 (WEA1)	16:53	18:06 (WEA6)	17:46	
4	16:04	09:33 (WEA1)	07:42	08:09 (WEA5)	06:46	
5	08:14	08:58 (WEA1)	07:41	08:08 (WEA5)	06:44	
1	16:05	09:33 (WEA1)	16:57	18:21 (WEA5)	17:49	
6	08:14	08:59 (WEA1)	07:39	08:07 (WEA5)	06:42	
1	16:06	09:32 (WEA1)	16:59	18:21 (WEA5)	17:51	
7	08:14	08:59 (WEA1)	07:37	08:06 (WEA5)	06:39	
1	16:09	09:32 (WEA1)	17:01	18:22 (WEA5)	17:53	
8	08:13	08:59 (WEA1)	07:36	08:06 (WEA5)	06:37	
1	16:09	09:25 (WEA1)	17:02	17:02 (WEA5)	17:55	
9	08:13	08:59 (WEA1)	07:34	08:05 (WEA5)	06:35	
1	16:10	09:25 (WEA1)	17:04	18:23 (WEA5)	17:57	
10	08:12	09:00 (WEA1)	07:32	08:05 (WEA5)	06:33	
1	16:12	09:26 (WEA1)	17:06	21:06 (WEA1)	17:58	
11	08:11	09:00 (WEA1)	07:30	07:55 (WEA7)	06:30	
1	16:13	09:27 (WEA1)	17:08	25:08 (WEA1)	18:00	
12	08:11	09:00 (WEA1)	07:28	07:53 (WEA7)	06:28	
1	16:15	09:27 (WEA1)	17:10	08:29 (WEA1)	18:02	
13	08:10	09:00 (WEA1)	07:26	07:51 (WEA7)	06:26	
1	16:16	09:27 (WEA1)	17:12	35:08 (WEA1)	18:04	
14	08:09	09:01 (WEA1)	07:24	07:49 (WEA7)	06:23	
1	16:18	09:28 (WEA1)	17:14	40:08 (WEA1)	18:05	
15	08:08	09:01 (WEA1)	07:22	07:47 (WEA7)	06:21	
1	16:19	09:28 (WEA1)	17:16	44:08 (WEA1)	18:07	
16	08:08	09:01 (WEA1)	07:20	07:46 (WEA7)	06:19	
1	16:21	09:28 (WEA1)	17:18	44:08 (WEA1)	18:09	
17	08:07	09:02 (WEA1)	07:18	07:46 (WEA7)	06:16	
1	16:23	09:29 (WEA1)	17:20	48:08 (WEA1)	18:11	
18	08:06	09:03 (WEA1)	07:16	07:46 (WEA7)	06:14	
1	16:24	09:29 (WEA1)	17:21	43:08 (WEA1)	18:13	
19	08:05	09:03 (WEA1)	07:14	07:45 (WEA7)	06:12	
1	16:26	09:30 (WEA1)	17:23	37:08 (WEA1)	18:14	
20	08:04	09:03 (WEA1)	07:12	08:00 (WEA1)	06:09	
1	16:28	09:31 (WEA1)	17:25	34:08 (WEA1)	18:16	
21	08:04	09:03 (WEA1)	07:10	07:59 (WEA7)	06:07	
1	16:29	09:31 (WEA1)	17:27	38:08 (WEA1)	18:18	
22	08:03	09:03 (WEA1)	07:08	07:59 (WEA7)	06:05	
1	16:31	09:32 (WEA1)	17:29	34:08 (WEA1)	18:20	
23	08:03	09:03 (WEA1)	07:06	08:00 (WEA1)	06:02	
1	16:33	09:33 (WEA1)	17:31	33:08 (WEA1)	18:21	
24	07:59	09:28 (WEA1)	07:04	08:01 (WEA1)	06:00	
1	16:35	09:33 (WEA1)	17:33	38:08 (WEA1)	18:23	
25	07:58	09:28 (WEA1)	07:02	08:01 (WEA1)	05:58	
1	16:36	09:34 (WEA1)	17:35	38:08 (WEA1)	18:25	
26	07:56	09:29 (WEA1)	06:59	08:01 (WEA1)	05:55	
1	16:38	09:35 (WEA1)	17:36	39:08 (WEA1)	18:27	
27	07:55	09:29 (WEA1)	06:57	08:02 (WEA1)	05:53	
28	07:54	09:29 (WEA1)	06:55	08:03 (WEA1)	05:51	
29	07:52	09:29 (WEA1)	06:53	08:04 (WEA1)	05:49	
1	16:41	09:36 (WEA1)	17:38	42:08 (WEA1)	18:28	
30	07:50	09:32 (WEA1)	06:51	08:04 (WEA1)	05:47	
1	16:45	09:40 (WEA1)	17:41	48:08 (WEA1)	18:29	
31	07:49	09:40 (WEA1)	06:49	18:33 (WEA2B15_ErEW)	05:45	
1	16:47	09:40 (WEA1)	17:41	48:08 (WEA2B15_ErEW)	18:29	
1	266				417	
	Sonnenscheinstunden				487	
	astr.max.mögl.Beschattung	846	737	244	392	798

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-02 - SR-02, A Ausbau Schönfelder Weg 1, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

- 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	0445	20:23 (WEA ZB13, ErWB)	05:23	19:29 (WEA ZB13, ErWB)	06:14	07:04
2	1:30	20:49 (WEA ZB13, ErWB)	20:58	20:27 (WEA ZB09, vppd)	19:54	18:44
3	0446	20:22 (WEA ZB13, ErWB)	05:24	19:29 (WEA ZB13, ErWB)	06:15	07:06
4	0448	20:49 (WEA ZB13, ErWB)	20:56	19:59 (WEA ZB13, ErWB)	19:52	18:42
5	0449	20:23 (WEA ZB13, ErWB)	05:26	19:28 (WEA ZB13, ErWB)	06:17	07:07
6	0449	20:20 (WEA ZB13, ErWB)	05:29	19:28 (WEA ZB13, ErWB)	06:17	07:07
7	0450	20:49 (WEA ZB13, ErWB)	20:54	19:58 (WEA ZB13, ErWB)	19:50	18:39
8	0451	20:24 (WEA ZB13, ErWB)	05:28	19:29 (WEA ZB13, ErWB)	06:19	07:09
9	0452	20:49 (WEA ZB13, ErWB)	20:52	19:58 (WEA ZB13, ErWB)	19:48	18:37
10	0453	20:24 (WEA ZB13, ErWB)	05:29	19:27 (WEA ZB13, ErWB)	06:20	07:11
11	0453	20:20 (WEA ZB13, ErWB)	05:31	19:27 (WEA ZB13, ErWB)	06:22	07:12
12	0454	20:25 (WEA ZB13, ErWB)	05:32	19:59 (WEA ZB13, ErWB)	19:43	18:37
13	0454	20:25 (WEA ZB13, ErWB)	05:32	19:26 (WEA ZB13, ErWB)	06:24	07:14
14	0454	20:49 (WEA ZB13, ErWB)	20:47	19:58 (WEA ZB13, ErWB)	19:41	18:30
15	0455	20:25 (WEA ZB13, ErWB)	05:34	19:26 (WEA ZB13, ErWB)	06:25	07:16
16	0455	20:24 (WEA ZB13, ErWB)	05:33	19:59 (WEA ZB13, ErWB)	19:38	18:28
17	0455	20:24 (WEA ZB13, ErWB)	05:36	19:26 (WEA ZB13, ErWB)	06:27	07:18
18	0455	20:49 (WEA ZB13, ErWB)	20:43	19:59 (WEA ZB13, ErWB)	19:36	18:25
19	0453	20:23 (WEA ZB13, ErWB)	05:37	19:26 (WEA ZB13, ErWB)	06:29	07:19
20	0454	20:25 (WEA ZB13, ErWB)	05:39	19:59 (WEA ZB13, ErWB)	19:34	18:23
21	0454	20:22 (WEA ZB09, vppd)	05:39	19:26 (WEA ZB13, ErWB)	06:30	07:21
22	0455	20:49 (WEA ZB13, ErWB)	20:39	19:57 (WEA ZB13, ErWB)	19:31	18:21
23	0455	20:21 (WEA ZB09, vppd)	05:41	19:26 (WEA ZB13, ErWB)	06:32	07:23
24	0458	20:47 (WEA ZB13, ErWB)	20:37	19:58 (WEA ZB14, ErWB)	19:29	18:18
25	0456	20:20 (WEA ZB09, vppd)	05:42	19:26 (WEA ZB13, ErWB)	06:34	07:25
26	0458	20:47 (WEA ZB13, ErWB)	20:36	19:58 (WEA ZB14, ErWB)	19:26	18:16
27	0458	20:20 (WEA ZB09, vppd)	05:44	19:27 (WEA ZB13, ErWB)	06:35	07:26
28	0458	20:46 (WEA ZB13, ErWB)	20:33	19:58 (WEA ZB14, ErWB)	19:24	18:14
29	0459	20:20 (WEA ZB09, vppd)	05:45	19:27 (WEA ZB13, ErWB)	06:37	07:28
30	0459	20:46 (WEA ZB13, ErWB)	20:31	19:58 (WEA ZB14, ErWB)	19:22	18:12
31	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
1	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
2	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
3	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
4	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
5	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
6	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
7	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
8	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
9	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
10	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
11	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
12	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
13	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
14	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
15	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
16	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
17	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
18	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
19	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
20	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
21	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
22	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
23	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
24	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
25	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
26	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
27	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
28	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
29	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
30	05:00	20:20 (WEA ZB09, vppd)	05:47	19:26 (WEA ZB13, ErWB)	06:38	07:30
31	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
1	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
2	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
3	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
4	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
5	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
6	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
7	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
8	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
9	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
10	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
11	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
12	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
13	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
14	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
15	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
16	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
17	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
18	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
19	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
20	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
21	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
22	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
23	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
24	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
25	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
26	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
27	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
28	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
29	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
30	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
31	05:01	19:30 (WEA ZB15, ErWB)	06:12	19:30 (WEA ZB15, ErWB)	19:57	18:46
Sommerschneinstunden	555					
astron.mögl. Beschattung	794	622	381	342	686	1072

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-03 - SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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					
1	08:15	08:47 (WEA)	07:47	08:22 (WEA7)	06:53		08:41		05:35		04:49				
1	16:01	09:55 (WEA1)	16:49	10	08:32 (WEA7)	17:42		19:37		20:29	21:16				
2	08:15	08:47 (WEA)	07:46	08:22 (WEA7)	06:51		07:14 (WEA VB04)	06:39	05:33		04:48				
2	16:02	09:55 (WEA1)	16:51	8	08:31 (WEA7)	17:44	1	07:51 (WEA VB04)	06:39	05:31	4	19:53 (WEA ZB13_ErWB)	04:48		
3	08:15	08:47 (WEA)	07:44	08:25 (WEA7)	06:48		07:12 (WEA VB04)	06:36	05:31		04:47	19:49 (WEA ZB13_ErWB)	04:47		
3	16:03	09:56 (WEA1)	16:53	3	08:28 (WEA7)	17:46	7	07:19 (WEA VB04)	06:34	05:31	12	20:01 (WEA ZB13_ErWB)	21:18		
4	08:15	08:46 (WEA)	07:42	06:46			07:10 (WEA VB04)	06:34		05:29		19:46 (WEA ZB13_ErWB)	04:46		
4	16:04	09:56 (WEA1)	16:55	17:47			07:21 (WEA VB04)	06:32	12	19:10 (WEA ZB15_ErWB)	20:34	16	20:02 (WEA ZB13_ErWB)	21:19	
5	08:14	08:46 (WEA)	07:41	06:44			07:07 (WEA VB04)	06:32		05:29		19:46 (WEA ZB13_ErWB)	04:46		
5	16:05	09:57 (WEA1)	16:57	17:49			07:21 (WEA VB04)	06:32	25	19:14 (WEA ZB15_ErWB)	20:36	19	20:05 (WEA ZB13_ErWB)	21:20	
6	08:14	08:46 (WEA)	07:39	06:42			07:05 (WEA VB04)	06:29		05:26		19:44 (WEA ZB13_ErWB)	04:45		
6	16:06	09:57 (WEA1)	16:59	17:51			07:22 (WEA VB04)	06:30	32	19:15 (WEA ZB15_ErWB)	20:38	21	20:05 (WEA ZB13_ErWB)	21:21	
7	08:14	08:46 (WEA)	07:37	06:39			07:03 (WEA VB04)	06:27		05:24		19:43 (WEA ZB13_ErWB)	04:44		
7	16:09	09:59 (WEA1)	17:01	17:53			07:22 (WEA VB04)	06:29	39	19:17 (WEA ZB15_ErWB)	20:39	23	20:06 (WEA ZB13_ErWB)	21:22	
8	08:13	08:46 (WEA)	07:36	06:37			07:02 (WEA VB04)	06:25		05:22		19:42 (WEA ZB13_ErWB)	04:44		
8	16:09	09:57 (WEA1)	17:02	17:55			07:22 (WEA VB04)	06:29	49	19:23 (WEA ZB14_ErWB)	20:41	24	20:06 (WEA ZB13_ErWB)	21:23	
9	08:13	08:46 (WEA)	07:34	06:35			07:03 (WEA VB04)	06:23		05:20		19:43 (WEA ZB13_ErWB)	04:43		
9	16:10	09:57 (WEA1)	17:04	17:57			07:22 (WEA VB04)	06:31	52	19:25 (WEA ZB14_ErWB)	20:43	25	20:07 (WEA ZB13_ErWB)	21:24	
10	08:12	08:47 (WEA)	07:32	06:33			07:03 (WEA VB04)	06:20		05:18		19:41 (WEA ZB13_ErWB)	04:43		
10	16:12	09:58 (WEA1)	17:06	17:58			07:21 (WEA VB04)	06:33	54	19:26 (WEA ZB14_ErWB)	20:44	26	20:07 (WEA ZB13_ErWB)	21:25	
11	08:11	08:47 (WEA)	07:30	06:30			07:03 (WEA VB04)	06:18		05:17		19:41 (WEA ZB13_ErWB)	04:42		
11	16:13	09:58 (WEA1)	17:08	18:00	26	17:34 (WEA ZB16_ErWB)	19:55	57	19:28 (WEA ZB15_ErWB)	20:46	27	20:08 (WEA ZB13_ErWB)	21:26		
12	08:11	08:47 (WEA)	07:28	06:28			07:04 (WEA VB04)	06:16		05:15		19:41 (WEA ZB13_ErWB)	04:42		
12	16:15	09:58 (WEA1)	17:10	18:02			07:23 (WEA VB04)	06:30	59	19:30 (WEA ZB14_ErWB)	20:48	27	20:08 (WEA ZB13_ErWB)	21:26	
13	08:10	08:47 (WEA)	07:26	06:26			07:06 (WEA VB04)	06:13		05:13		19:41 (WEA ZB13_ErWB)	04:42		
13	16:16	09:58 (WEA1)	17:12	18:04	28	17:38 (WEA ZB16_ErWB)	19:58	59	19:31 (WEA ZB14_ErWB)	20:49	27	20:08 (WEA ZB13_ErWB)	21:27		
14	08:09	08:47 (WEA)	07:24	06:23			07:09 (WEA VB04)	06:11		05:12		19:40 (WEA ZB13_ErWB)	04:41		
14	16:18	09:58 (WEA1)	17:14	18:05	25	17:39 (WEA ZB16_ErWB)	20:00	57	19:30 (WEA ZB14_ErWB)	20:51	28	20:08 (WEA ZB13_ErWB)	21:28		
15	08:08	08:47 (WEA)	07:22	06:21			17:18 (WEA ZB16_ErWB)	19:59		05:10		19:41 (WEA ZB13_ErWB)	04:41		
15	16:19	09:58 (WEA1)	17:16	18:07	21	17:39 (WEA ZB16_ErWB)	20:02	54	19:30 (WEA ZB14_ErWB)	20:52	27	20:08 (WEA ZB13_ErWB)	21:28		
16	08:08	08:48 (WEA)	07:20	06:19			17:17 (WEA ZB16_ErWB)	19:57		05:09		19:41 (WEA ZB13_ErWB)	04:41		
16	16:21	09:58 (WEA1)	17:18	18:09	23	17:40 (WEA ZB16_ErWB)	20:03	48	19:29 (WEA ZB14_ErWB)	20:54	27	20:08 (WEA ZB13_ErWB)	21:29		
17	08:07	08:48 (WEA)	07:18	06:16			17:16 (WEA ZB16_ErWB)	19:55		05:07		19:41 (WEA ZB13_ErWB)	04:41		
17	16:23	09:58 (WEA1)	17:20	18:11	23	17:39 (WEA ZB16_ErWB)	20:05	40	19:29 (WEA ZB14_ErWB)	20:56	27	20:08 (WEA ZB13_ErWB)	21:29		
18	08:06	08:49 (WEA)	07:16	06:14			17:16 (WEA ZB16_ErWB)	19:52		05:05		19:41 (WEA ZB13_ErWB)	04:41		
18	16:24	09:58 (WEA1)	17:21	18:13	24	17:40 (WEA ZB16_ErWB)	20:07	38	19:28 (WEA ZB14_ErWB)	20:57	26	20:07 (WEA ZB13_ErWB)	21:30		
19	08:05	08:49 (WEA)	07:14	06:12			17:16 (WEA ZB16_ErWB)	19:50		05:04		19:41 (WEA ZB13_ErWB)	04:41		
19	16:26	09:58 (WEA1)	17:23	18:14	23	17:39 (WEA ZB16_ErWB)	20:08	35	19:26 (WEA ZB14_ErWB)	20:59	26	20:07 (WEA ZB13_ErWB)	21:30		
20	08:04	08:50 (WEA)	07:12	06:09			17:16 (WEA ZB16_ErWB)	19:58		05:03		19:42 (WEA ZB13_ErWB)	04:41		
20	16:28	09:58 (WEA1)	17:25	18:16	22	17:38 (WEA ZB16_ErWB)	20:10	32	19:24 (WEA ZB14_ErWB)	21:00	25	20:07 (WEA ZB13_ErWB)	21:30		
21	08:03	08:51 (WEA)	07:10	06:07			17:17 (WEA ZB16_ErWB)	19:56		05:01		19:43 (WEA ZB13_ErWB)	04:41		
21	16:29	09:55 (WEA1)	17:27	18:18	17	17:38 (WEA ZB16_ErWB)	20:12	19	19:11 (WEA ZB15_ErWB)	21:02	24	20:07 (WEA ZB13_ErWB)	21:31		
22	08:01	08:53 (WEA)	07:08	06:05			17:17 (WEA ZB16_ErWB)	19:54		05:00		19:43 (WEA ZB13_ErWB)	04:41		
22	16:31	09:54 (WEA1)	17:29	18:20	19	17:36 (WEA ZB16_ErWB)	20:14	17	19:10 (WEA ZB15_ErWB)	21:03	23	20:06 (WEA ZB13_ErWB)	21:31		
23	08:00	08:53 (WEA)	07:06	06:02			17:18 (WEA ZB16_ErWB)	19:52		04:59		19:43 (WEA ZB13_ErWB)	04:42		
23	16:33	09:52 (WEA1)	17:31	18:21	17	17:35 (WEA ZB16_ErWB)	20:15	11	19:07 (WEA ZB15_ErWB)	21:04	22	20:05 (WEA ZB13_ErWB)	21:31		
24	07:59	08:27 (WEA)	07:04	06:00			17:20 (WEA ZB16_ErWB)	19:49		04:57		19:44 (WEA ZB13_ErWB)	04:42		
24	16:35	12	09:48 (WEA1)	17:33	18:23	13	17:33 (WEA ZB16_ErWB)	20:17		21:06	21	20:05 (WEA ZB13_ErWB)	21:31		
25	07:58	08:25 (WEA)	07:02	05:58			17:22 (WEA ZB16_ErWB)	19:47		04:56		19:46 (WEA ZB13_ErWB)	04:42		
25	16:36	5	08:30 (WEA1)	17:35	18:25	6	17:28 (WEA ZB16_ErWB)	20:19		21:07	19	20:04 (WEA ZB13_ErWB)	21:31		
26	07:56	08:24 (WEA)	06:59	05:55			17:16 (WEA ZB16_ErWB)	19:45		04:55		19:46 (WEA ZB13_ErWB)	04:43		
26	16:38	8	08:32 (WEA1)	17:36	18:27		17:21 (WEA ZB16_ErWB)	20:21		21:09	18	20:04 (WEA ZB13_ErWB)	21:31		
27	07:55	08:22 (WEA)	06:57	05:53			17:16 (WEA ZB16_ErWB)	19:43		04:54		19:47 (WEA ZB13_ErWB)	04:43		
28	07:53	08:21 (WEA)	06:55	05:50			18:28	20:22		21:10	18	20:03 (WEA ZB13_ErWB)	21:31		
28	16:42	12	08:33 (WEA1)	17:40	18:30		18:28	20:22		04:53		19:48 (WEA ZB13_ErWB)	04:44		
29	07:52	08:20 (WEA)	06:54	05:48			16:42	20:24		21:11	13	20:02 (WEA ZB13_ErWB)	21:31		
29	16:44	13	08:33 (WEA1)	17:42	18:32		16:48	20:24		04:52		19:50 (WEA ZB13_ErWB)	04:44		
30	07:50	08:20 (WEA)	06:53	05:46			16:48	20:24		04:51		19:52 (WEA ZB13_ErWB)	04:45		
30	16:45	13	08:33 (WEA1)	17:44	18:34		16:46	20:24		21:14	6	19:50 (WEA ZB13_ErWB)	21:31		
31	07:49	08:21 (WEA)	06:52	05:43			16:47	20:24		04:50		19:52 (WEA ZB13_ErWB)	04:45		
31	16:47	12	08:33 (WEA1)	17:45	18:35		16:47	20:24		21:15		19:52 (WEA ZB13_ErWB)	04:45		
Sommerhochstunden		266		276		287		297		307		317		327	
astr.max.mögl.Beschattung		1114		1114		1114		1114		1114		1114		1114	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-04 - SR-04, A Ausbau Schönfelder Weg 3, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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	0445	2006 (WEA2B12_ErhW)	0523	1945 (WEA2B13_ErhW)	0614	0649 (WEA2B02)	0704	1738 (WEA2B16_ErhW)	0659	0751	0855 (WEA4)
2	0446	2005 (WEA2B12_ErhW)	0524	1945 (WEA2B13_ErhW)	0615	0649 (WEA2B02)	0706	1836 (WEA2B16_ErhW)	0659	0752	0856 (WEA4)
3	0447	2006 (WEA2B12_ErhW)	0526	1944 (WEA2B13_ErhW)	0617	0647 (WEA2B02)	0707	1834 (WEA2B16_ErhW)	0659	0753	0857 (WEA4)
4	0448	2007 (WEA2B12_ErhW)	0528	1944 (WEA2B13_ErhW)	0619	0647 (WEA2B02)	0709	1837	0659	0754	0858 (WEA4)
5	0448	2007 (WEA2B12_ErhW)	0529	1943 (WEA2B13_ErhW)	0620	0648 (WEA2B02)	0711	1839	0659	0755	0859 (WEA4)
6	0449	2008 (WEA2B12_ErhW)	0531	1944 (WEA2B13_ErhW)	0622	0648 (WEA2B02)	0712	1840	0659	0756	0860 (WEA4)
7	0450	2007 (WEA2B12_ErhW)	0532	1943 (WEA2B13_ErhW)	0624	0650 (WEA2B02)	0714	1841	0659	0757	0861 (WEA4)
8	0451	2008 (WEA2B12_ErhW)	0534	1943 (WEA2B13_ErhW)	0625	0651 (WEA2B02)	0716	1842	0659	0758	0862 (WEA4)
9	0452	2009 (WEA2B12_ErhW)	0536	1943 (WEA2B13_ErhW)	0627	0651 (WEA2B02)	0718	1843	0659	0759	0863 (WEA4)
10	0453	2009 (WEA2B12_ErhW)	0537	1944 (WEA2B13_ErhW)	0629	0652 (WEA2B02)	0719	1844	0659	0760	0864 (WEA4)
11	0454	2009 (WEA2B12_ErhW)	0539	1943 (WEA2B13_ErhW)	0630	0653 (WEA2B02)	0721	1845	0659	0761	0865 (WEA4)
12	0455	2010 (WEA2B12_ErhW)	0540	1944 (WEA2B13_ErhW)	0632	0654 (WEA2B02)	0723	1846	0659	0762	0866 (WEA4)
13	0456	2010 (WEA2B12_ErhW)	0542	1945 (WEA2B13_ErhW)	0634	0655 (WEA2B02)	0725	1847	0659	0763	0867 (WEA4)
14	0458	2011 (WEA2B12_ErhW)	0544	1946 (WEA2B13_ErhW)	0635	0656 (WEA2B02)	0726	1848	0659	0764	0868 (WEA4)
15	0459	2012 (WEA2B12_ErhW)	0546	1947 (WEA2B13_ErhW)	0637	0657 (WEA2B02)	0728	1849	0659	0765	0869 (WEA4)
16	0500	2013 (WEA2B12_ErhW)	0547	1949 (WEA2B13_ErhW)	0639	0659 (WEA2B02)	0730	1850	0659	0766	0870 (WEA4)
17	0501	2014 (WEA2B12_ErhW)	0549	1950 (WEA2B13_ErhW)	0640	0659 (WEA2B02)	0732	1851	0659	0767	0871 (WEA4)
18	0503	2015 (WEA2B12_ErhW)	0550	1951 (WEA2B13_ErhW)	0642	0659 (WEA2B02)	0733	1852	0659	0768	0872 (WEA4)
19	0504	2016 (WEA2B12_ErhW)	0552	1952 (WEA2B13_ErhW)	0644	0659 (WEA2B02)	0735	1853	0659	0769	0873 (WEA4)
20	0505	2018 (WEA2B12_ErhW)	0554	1953 (WEA2B13_ErhW)	0646	0659 (WEA2B02)	0737	1854	0659	0770	0874 (WEA4)
21	0507	2020 (WEA2B12_ErhW)	0555	1954 (WEA2B13_ErhW)	0647	0659 (WEA2B02)	0739	1855	0659	0771	0875 (WEA4)
22	0508	2023 (WEA2B12_ErhW)	0557	1957 (WEA2B13_ErhW)	0649	0659 (WEA2B02)	0741	1856	0659	0772	0876 (WEA4)
23	0509	2028 (WEA2B12_ErhW)	0559	1959 (WEA2B13_ErhW)	0650	0659 (WEA2B02)	0742	1857	0659	0773	0877 (WEA4)
24	0511	1953 (WEA2B13_ErhW)	0604	1953 (WEA2B13_ErhW)	0652	0659 (WEA2B02)	0744	1858	0659	0774	0878 (WEA4)
25	0512	2000 (WEA2B12_ErhW)	0606	1954 (WEA2B13_ErhW)	0654	0659 (WEA2B02)	0746	1859	0659	0775	0879 (WEA4)
26	0514	2003 (WEA2B12_ErhW)	0608	1955 (WEA2B13_ErhW)	0655	0659 (WEA2B02)	0748	1900	0659	0776	0880 (WEA4)
27	0515	2000 (WEA2B12_ErhW)	0609	1956 (WEA2B13_ErhW)	0656	0659 (WEA2B02)	0750	1901	0659	0777	0881 (WEA4)
28	0517	2003 (WEA2B12_ErhW)	0610	1957 (WEA2B13_ErhW)	0657	0659 (WEA2B02)	0752	1902	0659	0778	0882 (WEA4)
29	0518	2003 (WEA2B12_ErhW)	0611	1958 (WEA2B13_ErhW)	0658	0659 (WEA2B02)	0754	1903	0659	0779	0883 (WEA4)
30	0520	2005 (WEA2B12_ErhW)	0613	1959 (WEA2B13_ErhW)	0659	0659 (WEA2B02)	0756	1904	0659	0780	0884 (WEA4)
31	0521	1946 (WEA2B13_ErhW)	0612	1959 (WEA2B13_ErhW)	0659 (WEA2B02)	0757	1905	1905	0659	0781	0885 (WEA4)
Sommerschuldenastr.max.mögl.Beschattung	873	631	455	381	62	31	251	264	151	968	968

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-05 - SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	13:36 (WEA1)	07:47	06:53	25	07:23 (WEA VB04) 06:41	13 18:58 (WEA ZB15_EnBW) 05:35	14 19:32 (WEA ZB13_EnBW) 04:49	
2	16:00	17 13:52 (WEA1)	16:49	17:42		07:48 (WEA VB04) 15:37	13 19:11 (WEA ZB15_EnBW) 20:29	14 19:46 (WEA ZB13_EnBW) 21:16	
3	08:15	13:38 (WEA1)	07:46	06:51	26	07:22 (WEA VB04) 06:39	18:57 (WEA ZB15_EnBW) 05:33	19:33 (WEA ZB13_EnBW) 04:48	
4	16:02	15 13:53 (WEA1)	16:51	17:44		07:48 (WEA VB04) 19:39	16 19:13 (WEA ZB15_EnBW) 20:31	11 19:44 (WEA ZB13_EnBW) 21:17	
5	08:15	13:39 (WEA1)	07:44	06:48	26	07:22 (WEA VB04) 06:36	18:55 (WEA ZB15_EnBW) 05:31	19:35 (WEA ZB13_EnBW) 04:47	
6	16:03	14 13:53 (WEA1)	16:53	17:46		07:48 (WEA VB04) 19:41	19 19:14 (WEA ZB15_EnBW) 20:33	16 20:02 (WEA ZB12_EnBW) 21:18	
7	08:15	13:41 (WEA1)	07:42	06:46	26	07:22 (WEA VB04) 06:34	18:55 (WEA ZB15_EnBW) 05:29	19:49 (WEA ZB12_EnBW) 04:46	
8	16:04	11 13:52 (WEA1)	16:55	17:47		07:48 (WEA VB04) 19:42	20 19:15 (WEA ZB15_EnBW) 20:34	15 20:04 (WEA ZB12_EnBW) 21:19	
9	08:14	13:43 (WEA1)	07:41	06:44	24	07:22 (WEA VB04) 06:32	18:55 (WEA ZB15_EnBW) 05:27	19:48 (WEA ZB12_EnBW) 04:46	
10	16:05	8 13:51 (WEA1)	16:57	17:49		07:23 (WEA VB04) 06:29	18:54 (WEA ZB15_EnBW) 05:26	18 20:06 (WEA ZB12_EnBW) 21:20	
11	08:14		16:59	17:51	23	07:46 (WEA VB04) 19:46	20 19:14 (WEA ZB15_EnBW) 20:38	20 20:07 (WEA ZB12_EnBW) 21:21	
12	16:06		17:37	18:09	22	07:23 (WEA VB04) 06:27	06:56 (WEA VB02) 05:24	20 19:46 (WEA ZB12_EnBW) 04:44	
13	08:13		17:20	17:53		07:45 (WEA VB04) 19:48	14 (WEA ZB15_EnBW) 20:39	22 20:08 (WEA ZB12_EnBW) 21:22	
14	16:08		17:36	18:07		07:24 (WEA VB04) 06:25	06:50 (WEA VB02) 05:22	19:45 (WEA ZB12_EnBW) 04:44	
15	08:13		17:02	17:55	19	07:43 (WEA VB04) 19:49	32 19:13 (WEA ZB15_EnBW) 20:41	23 20:08 (WEA ZB12_EnBW) 21:23	
16	16:09		17:34	18:00		07:25 (WEA VB04) 06:23	06:48 (WEA VB02) 05:20	19:45 (WEA ZB12_EnBW) 04:43	
17	08:13		17:04	17:56	16	07:41 (WEA VB04) 19:51	34 19:12 (WEA ZB15_EnBW) 20:43	24 20:09 (WEA ZB12_EnBW) 21:24	
18	16:10		17:32	18:03		07:28 (WEA VB04) 06:20	06:46 (WEA VB02) 05:18	19:44 (WEA ZB12_EnBW) 04:43	
19	08:12		17:06	17:58	11	07:39 (WEA VB04) 19:53	34 19:10 (WEA ZB15_EnBW) 20:44	25 20:09 (WEA ZB12_EnBW) 21:25	
20	16:12		17:30	18:00		06:18	06:44 (WEA VB02) 05:17	19:44 (WEA ZB12_EnBW) 04:42	
21	08:11		17:08	18:00		19:55	33 19:08 (WEA ZB15_EnBW) 20:46	26 20:10 (WEA ZB12_EnBW) 21:26	
22	16:13		17:28	18:02		06:16	06:43 (WEA VB02) 05:15	19:44 (WEA ZB12_EnBW) 04:42	
23	08:11		17:10	18:02		19:56	24 07:07 (WEA VB02) 05:48	25 20:09 (WEA ZB12_EnBW) 21:26	
24	16:15		17:26	18:05		06:13	06:43 (WEA VB02) 05:13	19:44 (WEA ZB12_EnBW) 04:42	
25	08:10		17:12	18:04		19:58	25 07:08 (WEA VB02) 05:49	26 20:10 (WEA ZB12_EnBW) 21:27	
26	16:16		17:14	18:05		20:00	26 07:07 (WEA VB02) 05:51	25 20:09 (WEA ZB12_EnBW) 21:28	
27	08:09		17:22	18:02		06:09	06:41 (WEA VB02) 05:10	19:44 (WEA ZB12_EnBW) 04:41	
28	16:19		17:16	18:07		20:01	26 07:07 (WEA VB02) 05:52	26 20:10 (WEA ZB12_EnBW) 21:28	
29	08:08		17:20	18:09		06:07	06:41 (WEA VB02) 05:08	19:44 (WEA ZB12_EnBW) 04:41	
30	16:21		17:18	18:09		20:03	26 07:07 (WEA VB02) 05:54	25 20:09 (WEA ZB12_EnBW) 21:29	
31	08:07		17:18	18:11		06:05	06:41 (WEA VB02) 05:07	19:44 (WEA ZB12_EnBW) 04:41	
1	16:22		17:20	18:11		20:05	26 07:07 (WEA VB02) 05:56	25 20:09 (WEA ZB12_EnBW) 21:29	
2	08:06		17:16	18:14		06:02	06:41 (WEA VB02) 05:05	19:44 (WEA ZB12_EnBW) 04:41	
3	16:24		17:21	18:13		20:07	26 07:07 (WEA VB02) 05:57	24 20:08 (WEA ZB12_EnBW) 21:30	
4	08:05		17:14	18:12		06:00	06:41 (WEA VB02) 05:04	19:45 (WEA ZB12_EnBW) 04:41	
5	16:26		17:23	18:14		20:08	30 19:41 (WEA ZB13_EnBW) 20:59	23 20:08 (WEA ZB12_EnBW) 21:30	
6	08:04		17:12	18:09		05:58	06:42 (WEA VB02) 05:03	19:46 (WEA ZB12_EnBW) 04:41	
7	16:28		17:25	18:16		20:10	33 19:43 (WEA ZB13_EnBW) 21:00	22 20:08 (WEA ZB12_EnBW) 21:30	
8	21 08:02		17:10	18:07		05:56	06:41 (WEA VB02) 05:01	19:46 (WEA ZB12_EnBW) 04:41	
9	16:29		17:27	18:18		20:12	35 19:44 (WEA ZB13_EnBW) 21:02	22 20:08 (WEA ZB12_EnBW) 21:31	
10	08:01		17:08	18:05		05:54	06:42 (WEA VB02) 05:00	19:46 (WEA ZB12_EnBW) 04:41	
11	16:31		17:29	18:20		20:14	35 19:46 (WEA ZB13_EnBW) 21:03	21 20:07 (WEA ZB12_EnBW) 21:31	
12	08:00		17:06	18:02		05:51	06:43 (WEA VB02) 04:59	19:47 (WEA ZB12_EnBW) 04:42	
13	16:33		17:31	18:21		20:15	35 19:47 (WEA ZB13_EnBW) 21:04	20 20:06 (WEA ZB12_EnBW) 21:31	
14	07:59		17:28 (WEA VB04) 06:00	18:11		05:49	19:48 (WEA ZB12_EnBW) 04:57	19:48 (WEA ZB12_EnBW) 04:42	
15	16:34		17:33	18:23		20:17	34 19:49 (WEA ZB13_EnBW) 21:06	17 20:05 (WEA ZB12_EnBW) 21:31	
16	07:57		17:02	18:00		05:47	06:47 (WEA VB02) 04:56	19:48 (WEA ZB12_EnBW) 04:42	
17	16:36		17:34	18:25		20:19	34 19:49 (WEA ZB13_EnBW) 21:07	16 20:05 (WEA ZB12_EnBW) 21:31	
18	07:56		17:36	18:27		05:45	19:29 (WEA ZB13_EnBW) 20:55	19:51 (WEA ZB12_EnBW) 04:43	
19	16:38		17:36	18:27		20:21	20 19:48 (WEA ZB13_EnBW) 21:09	13 20:04 (WEA ZB12_EnBW) 21:31	
20	07:55		17:38	18:28		05:43	19:29 (WEA ZB13_EnBW) 20:54	19:52 (WEA ZB12_EnBW) 04:43	
21	16:40		17:38	18:28		20:22	19 19:48 (WEA ZB13_EnBW) 21:10	10 20:02 (WEA ZB12_EnBW) 21:31	
22	07:53		17:40	18:30		05:41	19:29 (WEA ZB13_EnBW) 20:53	19:55 (WEA ZB12_EnBW) 04:44	
23	16:42		17:40	18:30		20:24	19 19:48 (WEA ZB13_EnBW) 21:11	5 20:00 (WEA ZB12_EnBW) 21:31	
24	07:52			18:32		05:39	19:30 (WEA ZB13_EnBW) 20:52		04:44
25	16:44			19:32		20:26	18 19:48 (WEA ZB13_EnBW) 21:12		21:31
26	07:50			19:34		19:02 (WEA ZB15_EnBW) 05:37	19:31 (WEA ZB13_EnBW) 20:51		04:45
27	16:45			19:34		6 19:08 (WEA ZB15_EnBW) 20:27	16 19:47 (WEA ZB13_EnBW) 21:14		21:31
28	07:49			19:35		18:59 (WEA ZB15_EnBW)			
29	16:47			19:35		10 19:09 (WEA ZB15_EnBW)			
30	Sonnenscheinstunden	256		367		417		487	502
31	astr.max.mögl.Beschattung	65	115	234	765		558		

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

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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-05 - SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel  
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- Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember
1	04:45	05:23	19:54 (WEA ZB12_EnBW)06:14	06:43 (WEA VB02) 07:04	06:59	07:51
2	11:30	20:58	26 20:20 (WEA ZB12_EnBW)19:54	34 19:07 (WEA ZB15_EnBW)18:41	16:36	15:55
3	04:46	05:24	19:55 (WEA ZB12_EnBW)06:15	06:45 (WEA VB02) 07:06	07:01	07:52
4	21:30	20:56	25 20:20 (WEA ZB12_EnBW)19:52	34 19:09 (WEA ZB15_EnBW)18:41	16:35	15:54
5	04:47	05:26	19:55 (WEA ZB12_EnBW)06:17	06:45 (WEA VB02) 07:07	07:02	07:54
6	21:30	20:54	24 20:19 (WEA ZB12_EnBW)19:50	34 19:09 (WEA ZB15_EnBW)18:39	7 08:15 (WEA VB04) 16:33	15:54
7	04:48	05:27	19:54 (WEA ZB12_EnBW)06:19	06:47 (WEA VB02) 07:09	08:04 (WEA VB04) 07:04	07:55
8	21:29	20:52	24 20:18 (WEA ZB12_EnBW)19:48	31 19:10 (WEA ZB15_EnBW)18:37	14 08:18 (WEA VB04) 16:31	15:53
9	04:48	05:29	19:55 (WEA ZB12_EnBW)06:20	06:52 (WEA VB02) 07:11	08:01 (WEA VB04) 07:06	07:56
10	21:29	20:51	23 20:18 (WEA ZB12_EnBW)19:45	23 19:11 (WEA ZB15_EnBW)18:34	18 08:19 (WEA VB04) 16:29	15:53
11	04:49	05:31	19:55 (WEA ZB12_EnBW)06:22	18:50 (WEA ZB15_EnBW)07:12	08:00 (WEA VB04) 07:08	07:58
12	21:28	20:49	22 20:17 (WEA ZB12_EnBW)19:43	20 19:10 (WEA ZB15_EnBW)18:32	20 08:20 (WEA VB04) 16:27	15:52
13	04:50	05:32	19:57 (WEA ZB12_EnBW)06:24	18:50 (WEA ZB15_EnBW)07:14	07:59 (WEA VB04) 07:10	07:59
14	21:28	20:47	19 20:16 (WEA ZB12_EnBW)19:41	20 19:10 (WEA ZB15_EnBW)18:30	22 08:21 (WEA VB04) 16:26	15:52
15	04:51	05:34	19:58 (WEA ZB12_EnBW)06:25	18:49 (WEA ZB15_EnBW)07:16	07:58 (WEA VB04) 07:12	08:00
16	21:27	20:45	17 20:15 (WEA ZB12_EnBW)19:38	20 19:09 (WEA ZB15_EnBW)18:28	24 08:22 (WEA VB04) 16:24	15:51
17	04:52	05:36	19:59 (WEA ZB12_EnBW)06:27	18:49 (WEA ZB15_EnBW)07:18	07:57 (WEA VB04) 07:13	08:01
18	21:26	20:43	14 20:13 (WEA ZB12_EnBW)19:36	20 19:09 (WEA ZB15_EnBW)18:25	24 08:21 (WEA VB04) 16:22	15:51
19	04:53	05:37	19:44 (WEA ZB13_EnBW)06:29	18:50 (WEA ZB15_EnBW)07:19	07:56 (WEA VB04) 07:15	08:03
20	21:25	20:41	16 20:11 (WEA ZB12_EnBW)19:34	17 19:07 (WEA ZB15_EnBW)18:23	26 08:22 (WEA VB04) 16:21	15:51
21	04:54	05:39	19:41 (WEA ZB13_EnBW)06:30	18:50 (WEA ZB15_EnBW)07:21	07:56 (WEA VB04) 07:17	08:04
22	21:25	20:39	12 19:53 (WEA ZB13_EnBW)19:31	14 19:04 (WEA ZB15_EnBW)18:21	26 08:22 (WEA VB04) 16:19	15:51
23	04:55	05:40	19:40 (WEA ZB13_EnBW)06:32	18:51 (WEA ZB15_EnBW)07:23	07:56 (WEA VB04) 07:19	08:05
24	21:24	20:37	15 19:55 (WEA ZB13_EnBW)19:29	11 19:02 (WEA ZB15_EnBW)18:18	26 08:22 (WEA VB04) 16:17	15:50
25	04:56	05:42	19:38 (WEA ZB13_EnBW)06:34	18:52 (WEA ZB15_EnBW)07:25	07:56 (WEA VB04) 07:21	08:06
26	21:23	20:35	17 19:55 (WEA ZB13_EnBW)19:26	7 18:59 (WEA ZB15_EnBW)18:16	25 08:21 (WEA VB04) 16:16	15:50
27	04:58	05:44	19:38 (WEA ZB13_EnBW)06:35	07:26	07:56 (WEA VB04) 07:23	08:07
28	21:22	20:33	18 19:56 (WEA ZB13_EnBW)19:24	18:14	24 08:20 (WEA VB04) 16:14	15:50
29	04:59	05:45	19:36 (WEA ZB13_EnBW)06:37	07:28	07:56 (WEA VB04) 07:24	08:08
30	21:21	20:31	20 19:56 (WEA ZB13_EnBW)19:22	18:12	23 08:19 (WEA VB04) 16:13	15:50
31	05:00	20:03 (WEA ZB12_EnBW)05:47	19:36 (WEA ZB13_EnBW)06:39	07:30	07:57 (WEA VB04) 07:26	08:09
1	21:20	8 20:11 (WEA ZB12_EnBW)20:29	20 19:56 (WEA ZB13_EnBW)19:19	18:10	21 08:18 (WEA VB04) 16:11	15:51
2	05:01	20:01 (WEA ZB12_EnBW)05:49	19:35 (WEA ZB13_EnBW)06:40	07:32	07:59 (WEA VB04) 07:28	08:09
3	21:19	11 20:12 (WEA ZB12_EnBW)20:27	20 19:55 (WEA ZB13_EnBW)19:17	18:07	18 08:17 (WEA VB04) 16:10	15:51
4	05:03	20:00 (WEA ZB12_EnBW)05:50	06:53 (WEA VB02) 06:42	07:33	08:00 (WEA VB04) 07:30	08:10
5	21:18	14 20:14 (WEA ZB12_EnBW)20:25	30 19:56 (WEA ZB13_EnBW)19:15	18:05	15 08:15 (WEA VB04) 16:09	15:51
6	05:04	19:58 (WEA ZB12_EnBW)05:52	06:51 (WEA VB02) 06:44	07:35	08:03 (WEA VB04) 07:31	08:11
7	21:16	17 20:15 (WEA ZB12_EnBW)20:23	34 19:55 (WEA ZB13_EnBW)19:12	18:03	9 08:12 (WEA VB04) 16:07	15:51
8	05:05	19:58 (WEA ZB12_EnBW)05:54	06:49 (WEA VB02) 06:45	07:37	16:06	15:52
9	21:15	18 20:16 (WEA ZB12_EnBW)20:21	35 19:53 (WEA ZB13_EnBW)19:10	18:01	16:06	15:52
10	05:07	19:57 (WEA ZB12_EnBW)05:55	06:48 (WEA VB02) 06:47	07:39	07:35	08:12
11	21:14	20 20:17 (WEA ZB12_EnBW)20:19	34 19:51 (WEA ZB13_EnBW)19:07	17:59	16:05	15:52
12	05:08	19:56 (WEA ZB12_EnBW)05:57	06:46 (WEA VB02) 06:49	07:41	07:37	08:12
13	21:13	21 20:17 (WEA ZB12_EnBW)20:17	33 19:48 (WEA ZB13_EnBW)19:05	17:57	16:04	15:52
14	05:09	19:56 (WEA ZB12_EnBW)05:59	06:45 (WEA VB02) 06:50	07:42	07:38	08:13
15	21:11	22 20:18 (WEA ZB12_EnBW)20:15	33 19:47 (WEA ZB13_EnBW)19:03	17:54	16:02	15:53
16	05:11	19:56 (WEA ZB12_EnBW)06:00	06:44 (WEA VB02) 06:52	07:44	07:40	08:14
17	21:10	23 20:19 (WEA ZB12_EnBW)20:12	29 19:44 (WEA ZB13_EnBW)19:00	17:52	16:01	15:54
18	05:12	19:55 (WEA ZB12_EnBW)06:02	06:44 (WEA VB02) 06:54	06:46	07:42	08:14
19	21:09	24 20:19 (WEA ZB12_EnBW)20:10	26 07:10 (WEA VB02) 18:58	16:50	16:00	15:54
20	05:14	19:54 (WEA ZB12_EnBW)06:04	06:44 (WEA VB02) 06:55	06:48	07:43	08:14
21	21:07	25 20:19 (WEA ZB12_EnBW)20:08	26 07:10 (WEA VB02) 18:56	16:48	16:59	15:55
22	05:15	19:55 (WEA ZB12_EnBW)06:05	06:43 (WEA VB02) 06:57	06:50	07:45	08:15
23	21:06	25 20:20 (WEA ZB12_EnBW)20:06	26 07:09 (WEA VB02) 18:53	16:46	15:58	15:56
24	05:17	19:54 (WEA ZB12_EnBW)06:07	06:43 (WEA VB02) 06:59	06:51	07:46	08:15
25	21:04	26 20:20 (WEA ZB12_EnBW)20:03	26 07:09 (WEA VB02) 18:51	16:44	15:57	15:57
26	05:18	19:54 (WEA ZB12_EnBW)06:09	26 06:42 (WEA VB02) 07:00	06:52	07:48	08:15
27	21:03	26 20:20 (WEA ZB12_EnBW)20:01	26 07:08 (WEA VB02) 18:49	16:42	15:57	15:57
28	05:20	19:54 (WEA ZB12_EnBW)06:10	26 06:43 (WEA VB02) 07:02	06:55	07:49	08:15
29	21:01	26 20:20 (WEA ZB12_EnBW)19:59	25 07:08 (WEA VB02) 18:46	16:40	15:56	15:58
30	05:21	19:54 (WEA ZB12_EnBW)06:12	06:43 (WEA VB02)	06:57	08:15	09:24 (WEA7)
31	20:59	26 20:20 (WEA ZB12_EnBW)19:57	25 19:03 (WEA ZB15_EnBW)	16:38	08:15	09:22 (WEA7)
	Sonnenscheinstunden	505	455	381	331	264
	astr.max.mögl.Beschattung	332	740	285	342	640

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-06 - SR-06, Neumühler Straße 5, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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 08:15 08:56 (WEA_V02)	07:47	06:53	16:50 (WEA_ZB1_ErNW)	06:41	04:49
2 16:00 26 09:22 (WEA_V02)	16:49	17:42	14 17:94 (WEA_ZB1_ErNW)	19:37	21:16
3 08:15 08:57 (WEA_V02)	07:46	06:51	16:51 (WEA_ZB1_ErNW)	06:39	04:48
4 16:00 26 09:23 (WEA_V02)	16:51	17:44	10 17:94 (WEA_ZB1_ErNW)	19:39	21:17
5 08:15 08:57 (WEA_V02)	07:44	06:48		06:36	04:47
6 16:00 26 09:23 (WEA_V02)	16:53	17:46		19:41	21:18
7 08:15 08:57 (WEA_V02)	07:42	06:46		06:34	04:46
8 16:04 26 09:23 (WEA_V02)	16:55	17:47		19:42	21:19
9 08:14 08:58 (WEA_V02)	07:41	06:44		06:32	04:45
10 16:05 27 09:25 (WEA_V02)	16:57	17:49		19:44	21:20
11 08:14 08:57 (WEA_V02)	07:39	06:42		06:29	04:45
12 16:06 28 09:25 (WEA_V02)	16:59	17:51		19:46	21:21
13 08:14 08:58 (WEA_V02)	07:37	06:39		06:27	04:44
14 16:07 28 09:26 (WEA_V02)	17:00	17:53		19:48	21:22
15 08:13 08:59 (WEA_V02)	07:36	06:37	08:05 (WEA_V01)	17:53	06:25
16 16:09 28 09:26 (WEA_V02)	17:02	17:55	6 17:22 (WEA_ZB1_ErNW)	19:49	21:23
17 08:13 08:58 (WEA_V02)	07:34	06:35	17:39 (WEA_ZB1_ErNW)	06:22	04:44
18 16:10 28 09:26 (WEA_V02)	17:04	17:56	11 17:23 (WEA_ZB1_ErNW)	19:51	21:24
19 08:12 08:59 (WEA_V02)	07:32	06:33	17:18 (WEA_ZB1_ErNW)	06:20	04:43
20 16:12 28 09:27 (WEA_V02)	17:06	17:58	15 17:23 (WEA_ZB1_ErNW)	19:53	21:25
21 08:11 08:59 (WEA_V02)	07:30	06:30	17:19 (WEA_ZB1_ErNW)	06:18	04:42
22 16:13 29 09:28 (WEA_V02)	17:08	18:00	18 17:24 (WEA_ZB1_ErNW)	19:55	21:26
23 08:11 09:00 (WEA_V02)	07:28	06:28	17:15 (WEA_ZB1_ErNW)	06:16	04:42
24 16:15 29 09:28 (WEA_V02)	17:10	18:02	20 17:25 (WEA_ZB1_ErNW)	19:56	21:26
25 08:10 09:00 (WEA_V02)	07:26	06:26	17:15 (WEA_ZB1_ErNW)	06:13	04:42
26 16:16 29 09:28 (WEA_V02)	17:12	18:04	21 17:25 (WEA_ZB1_ErNW)	19:58	21:27
27 08:10 09:00 (WEA_V02)	07:24	06:24	17:14 (WEA_ZB1_ErNW)	06:11	04:41
28 16:18 29 09:29 (WEA_V02)	17:14	18:06	21 17:25 (WEA_ZB1_ErNW)	20:00	21:28
29 08:09 09:01 (WEA_V02)	07:22	06:22	17:14 (WEA_ZB1_ErNW)	06:09	04:41
30 16:19 29 09:29 (WEA_V02)	17:16	18:07	21 17:25 (WEA_ZB1_ErNW)	20:01	21:28
31 08:09 09:01 (WEA_V02)	07:20	06:19	17:14 (WEA_ZB1_ErNW)	06:07	04:41
1 16:21 30 09:30 (WEA_V02)	17:18	18:09	21 17:25 (WEA_ZB1_ErNW)	20:03	21:29
2 08:07 09:02 (WEA_V02)	07:18	06:16	17:14 (WEA_ZB1_ErNW)	06:04	04:41
3 16:22 30 09:30 (WEA_V02)	17:19	18:11	19 17:25 (WEA_ZB1_ErNW)	20:05	21:29
4 08:06 09:03 (WEA_V02)	07:16	06:14	17:15 (WEA_ZB1_ErNW)	06:02	04:41
5 16:24 30 09:31 (WEA_V02)	17:21	18:13	18 17:25 (WEA_ZB1_ErNW)	20:07	21:30
6 08:05 09:02 (WEA_V02)	07:14	06:12	17:15 (WEA_ZB1_ErNW)	06:00	04:41
7 16:26 30 09:31 (WEA_V02)	17:23	18:14	16 17:25 (WEA_ZB1_ErNW)	20:08	21:30
8 08:04 09:03 (WEA_V02)	07:12	06:09	17:17 (WEA_ZB1_ErNW)	05:58	04:41
9 16:27 30 09:31 (WEA_V02)	17:25	18:16	12 17:25 (WEA_ZB1_ErNW)	20:10	21:30
10 08:04 09:04 (WEA_V02)	07:10	06:07	17:15 (WEA_ZB1_ErNW)	05:56	04:41
11 16:29 30 09:31 (WEA_V02)	17:27	18:18	2 17:24 (WEA_ZB1_ErNW)	20:12	21:31
12 08:03 09:06 (WEA_V02)	07:08	06:05	17:48 (WEA_ZB0_ErNW)	05:54	04:41
13 16:31 30 09:32 (WEA_V02)	17:29	18:20	6 17:24 (WEA_ZB0_ErNW)	20:14	21:31
14 08:03 09:06 (WEA_V02)	07:06	06:02	17:46 (WEA_ZB0_ErNW)	05:51	04:42
15 16:33 30 09:32 (WEA_V02)	17:31	18:21	10 17:25 (WEA_ZB0_ErNW)	20:15	21:31
16 08:02 09:08 (WEA_V02)	07:04	06:00	17:45 (WEA_ZB0_ErNW)	05:49	04:42
17 16:34 30 09:32 (WEA_V02)	17:33	18:23	13 17:26 (WEA_ZB0_ErNW)	20:17	21:31
18 08:01 09:09 (WEA_V02)	07:02	05:57	17:43 (WEA_ZB0_ErNW)	05:47	04:42
19 16:36 30 09:32 (WEA_V02)	17:34	18:25	16 17:26 (WEA_ZB0_ErNW)	20:19	21:31
20 08:01 09:11 (WEA_V02)	06:59	05:55	17:45 (WEA_ZB0_ErNW)	05:45	04:42
21 16:38 14 09:25 (WEA_V02)	17:36	18:27	18 18:01 (WEA_ZB0_ErNW)	20:21	21:31
22 08:01 09:13 (WEA_V02)	06:57	05:53	17:43 (WEA_ZB0_ErNW)	05:43	04:42
23 16:40 10 09:23 (WEA_V02)	17:38	18:28	18 18:01 (WEA_ZB0_ErNW)	20:22	21:31
24 08:01 09:14 (WEA_V02)	06:55	05:51	17:42 (WEA_ZB0_ErNW)	05:41	04:42
25 16:42 16 09:26 (WEA_V02)	17:40	18:30	18 18:00 (WEA_ZB0_ErNW)	20:24	21:31
26 08:01 09:15 (WEA_V02)	06:53	05:49	17:42 (WEA_ZB0_ErNW)	05:39	04:42
27 16:44 16 09:26 (WEA_V02)	17:42	18:32	17 18:00 (WEA_ZB0_ErNW)	20:26	21:31
28 08:01 09:16 (WEA_V02)	06:51	05:47	17:41 (WEA_ZB0_ErNW)	05:37	04:42
29 16:46 16 09:27 (WEA_V02)	17:44	18:34	16 18:00 (WEA_ZB0_ErNW)	20:27	21:31
30 08:01 09:17 (WEA_V02)	06:49	05:45	17:40 (WEA_ZB0_ErNW)	05:35	04:42
31 16:47 16 09:27 (WEA_V02)	17:46	18:36	15 18:00 (WEA_ZB0_ErNW)	20:29	21:31
Sonnenscheinstunden	1 256	276	367	417	502
akt.max.mögl.Beschattung	679	419	389	286	256

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

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-06 - SR-06, Neumühler Straße 5, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

- Die Sonne scheint täglich von Sonnenauf- bis -untergang
- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:32 (WEA Z803_wpd)	15:22	20:07 (WEA Z802_wpd)	06:14	07:04
2	21:30	20:23 (WEA Z803_wpd)	20:58	20:27 (WEA Z803_wpd)	19:54	18:44
3	04:46	20:11 (WEA Z803_wpd)	15:24	20:07 (WEA Z802_wpd)	06:15	07:06
4	04:47	20:11 (WEA Z803_wpd)	15:26	20:08 (WEA Z802_wpd)	06:17	18:41
5	21:30	20:24 (WEA Z803_wpd)	20:54	20:24 (WEA Z803_wpd)	19:50	18:39
6	04:48	20:11 (WEA Z803_wpd)	15:27	20:08 (WEA Z802_wpd)	06:19	18:39
7	21:29	20:26 (WEA Z803_wpd)	20:52	20:22 (WEA Z802_wpd)	19:48	18:37
8	04:49	20:11 (WEA Z803_wpd)	15:29	20:09 (WEA Z802_wpd)	06:20	18:34
9	21:29	20:26 (WEA Z803_wpd)	20:51	20:21 (WEA Z802_wpd)	19:45	18:34
10	04:50	20:09 (WEA Z803_wpd)	15:31	20:09 (WEA Z802_wpd)	06:22	18:29
11	21:28	20:26 (WEA Z803_wpd)	20:49	20:19 (WEA Z802_wpd)	19:43	18:27
12	04:51	20:09 (WEA Z803_wpd)	15:32	20:11 (WEA Z802_wpd)	06:24	18:27
13	21:28	20:27 (WEA Z803_wpd)	20:47	20:17 (WEA Z802_wpd)	19:41	18:20
14	04:51	20:09 (WEA Z803_wpd)	15:34	20:13 (WEA Z802_wpd)	06:25	18:20
15	21:27	20:27 (WEA Z803_wpd)	20:45	20:15 (WEA Z802_wpd)	19:38	18:20
16	04:52	20:09 (WEA Z803_wpd)	15:35	20:13 (WEA Z802_wpd)	06:27	18:18
17	21:26	20:28 (WEA Z803_wpd)	20:43	20:13 (WEA Z802_wpd)	19:36	18:25
18	04:52	20:09 (WEA Z803_wpd)	15:37	20:13 (WEA Z802_wpd)	06:29	18:20
19	21:25	20:29 (WEA Z803_wpd)	20:41	20:13 (WEA Z802_wpd)	19:33	18:23
20	04:54	20:09 (WEA Z803_wpd)	15:39	20:13 (WEA Z802_wpd)	06:30	18:23
21	21:25	20:29 (WEA Z803_wpd)	20:39	20:13 (WEA Z802_wpd)	19:31	18:21
22	04:55	20:09 (WEA Z803_wpd)	15:40	20:13 (WEA Z802_wpd)	06:32	18:21
23	21:24	20:30 (WEA Z803_wpd)	20:37	20:13 (WEA Z802_wpd)	19:29	18:18
24	04:56	20:09 (WEA Z803_wpd)	15:42	20:13 (WEA Z802_wpd)	06:34	18:18
25	21:23	20:30 (WEA Z803_wpd)	20:35	20:13 (WEA Z802_wpd)	19:26	18:14
26	04:57	20:09 (WEA Z803_wpd)	15:44	19:30 (WEA Z805_wpd)	06:35	18:13
27	21:22	20:30 (WEA Z803_wpd)	20:33	19:40 (WEA Z805_wpd)	19:24	18:14
28	04:59	20:07 (WEA Z803_wpd)	15:45	19:27 (WEA Z805_wpd)	06:37	18:13
29	21:21	20:31 (WEA Z803_wpd)	20:31	19:41 (WEA Z805_wpd)	19:22	18:11
30	05:00	20:08 (WEA Z803_wpd)	15:47	19:26 (WEA Z805_wpd)	06:39	18:11
31	21:20	20:32 (WEA Z803_wpd)	20:29	19:43 (WEA Z805_wpd)	19:19	18:09
1	05:01	20:08 (WEA Z803_wpd)	15:49	19:24 (WEA Z805_wpd)	06:40	18:11
2	21:19	20:32 (WEA Z803_wpd)	20:27	19:43 (WEA Z805_wpd)	19:17	18:09
3	05:02	20:08 (WEA Z803_wpd)	15:50	19:24 (WEA Z805_wpd)	06:42	18:11
4	21:18	20:32 (WEA Z803_wpd)	20:25	19:44 (WEA Z805_wpd)	19:15	18:07
5	05:04	20:07 (WEA Z803_wpd)	15:52	19:23 (WEA Z805_wpd)	06:44	18:11
6	21:17	20:32 (WEA Z803_wpd)	20:23	19:44 (WEA Z805_wpd)	19:13	18:05
7	05:05	20:07 (WEA Z803_wpd)	15:54	19:22 (WEA Z805_wpd)	06:45	18:03
8	21:15	20:32 (WEA Z803_wpd)	20:21	19:44 (WEA Z805_wpd)	19:10	18:03
9	05:06	20:08 (WEA Z803_wpd)	15:55	19:22 (WEA Z805_wpd)	06:47	18:03
10	21:14	20:33 (WEA Z803_wpd)	20:19	19:44 (WEA Z805_wpd)	19:07	18:00
11	05:08	20:08 (WEA Z803_wpd)	15:57	19:21 (WEA Z805_wpd)	06:49	18:01
12	21:13	20:32 (WEA Z803_wpd)	20:17	19:43 (WEA Z805_wpd)	19:05	18:00
13	05:09	20:07 (WEA Z803_wpd)	15:59	19:21 (WEA Z805_wpd)	06:50	18:00
14	21:11	20:32 (WEA Z803_wpd)	20:15	19:43 (WEA Z805_wpd)	19:03	17:59
15	05:11	20:08 (WEA Z803_wpd)	16:00	19:21 (WEA Z805_wpd)	06:52	18:00
16	21:10	20:32 (WEA Z803_wpd)	20:13	19:42 (WEA Z805_wpd)	19:00	17:58
17	05:12	20:08 (WEA Z803_wpd)	16:02	19:21 (WEA Z805_wpd)	06:54	18:00
18	21:09	20:31 (WEA Z803_wpd)	20:11	19:42 (WEA Z805_wpd)	18:58	17:57
19	05:14	20:08 (WEA Z803_wpd)	16:04	19:21 (WEA Z805_wpd)	06:55	18:00
20	21:07	20:31 (WEA Z803_wpd)	20:08	19:41 (WEA Z805_wpd)	18:56	17:57
21	05:15	20:08 (WEA Z803_wpd)	16:05	19:21 (WEA Z805_wpd)	06:57	18:00
22	21:06	20:32 (WEA Z803_wpd)	20:06	19:38 (WEA Z805_wpd)	18:53	17:55
23	05:17	20:07 (WEA Z803_wpd)	16:07	19:20 (WEA Z805_wpd)	06:59	18:00
24	21:04	20:31 (WEA Z803_wpd)	20:03	19:36 (WEA Z805_wpd)	18:51	17:55
25	05:18	20:08 (WEA Z803_wpd)	16:09	19:21 (WEA Z805_wpd)	07:00	18:00
26	21:03	20:31 (WEA Z803_wpd)	20:01	19:33 (WEA Z805_wpd)	18:48	17:55
27	05:20	20:07 (WEA Z803_wpd)	16:10	19:21 (WEA Z805_wpd)	07:02	18:00
28	21:01	20:30 (WEA Z803_wpd)	19:59	19:21 (WEA Z805_wpd)	18:46	17:55
29	05:21	20:08 (WEA Z803_wpd)	16:12	19:21 (WEA Z805_wpd)	07:03	18:00
30	20:59	-	-	-	-	18:38
31	05:22	20:29 (WEA Z803_wpd)	19:57	-	18:1	17:57
Sonnenscheinstunden	165				131	147
astr.max.mögl.Beschattung	669	377	302	468	437	781

**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)		Schattendenende (WEA mit letztem Schatten)	
	SS:MM	SS:MM		SS:MM	SS:MM	SS:MM	SS:MM	SS:MM	SS:MM

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-07 - SR-07, Neumühler Straße 5a, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:55 (WEA V02)	07:47		06:53	16:51 (WEA ZB1_ErWB)		06:41		05:35		04:49	19:58 (WEA ZB3_vpp)
2	08:15	08:55 (WEA V02)	07:47		06:53	16:51 (WEA ZB1_ErWB)		06:41		05:35		04:49	19:58 (WEA ZB3_vpp)
3	08:15	08:55 (WEA V02)	07:47		06:53	16:51 (WEA ZB1_ErWB)		06:41		05:35		04:49	19:58 (WEA ZB3_vpp)
4	08:15	08:55 (WEA V02)	07:47		06:53	16:51 (WEA ZB1_ErWB)		06:41		05:35		04:49	19:58 (WEA ZB3_vpp)
5	08:14	08:57 (WEA V02)	07:41		06:46	16:44 (WEA ZB1_ErWB)		06:34		05:29		04:46	20:00 (WEA ZB3_vpp)
6	08:14	08:57 (WEA V02)	07:41		06:46	16:44 (WEA ZB1_ErWB)		06:34		05:29		04:46	20:00 (WEA ZB3_vpp)
7	08:14	08:59 (WEA V02)	07:37		06:39	16:37 (WEA ZB1_ErWB)		06:27		05:24		04:44	20:02 (WEA ZB3_vpp)
8	08:13	08:57 (WEA V02)	07:36		06:37	16:37 (WEA ZB1_ErWB)		06:25		05:23		04:44	20:04 (WEA ZB3_vpp)
9	08:13	08:57 (WEA V02)	07:36		06:37	16:37 (WEA ZB1_ErWB)		06:25		05:23		04:44	20:04 (WEA ZB3_vpp)
10	08:12	08:59 (WEA V02)	07:32		06:30	16:30 (WEA ZB1_ErWB)		06:20		05:18		04:43	20:05 (WEA ZB3_vpp)
11	08:12	08:59 (WEA V02)	07:32		06:30	16:30 (WEA ZB1_ErWB)		06:20		05:18		04:43	20:05 (WEA ZB3_vpp)
12	08:11	08:59 (WEA V02)	07:30		06:23	16:23 (WEA ZB1_ErWB)		06:18		05:17		04:42	20:07 (WEA ZB3_vpp)
13	08:10	08:59 (WEA V02)	07:29		06:23	16:23 (WEA ZB1_ErWB)		06:18		05:17		04:42	20:07 (WEA ZB3_vpp)
14	08:09	09:00 (WEA V02)	07:24		06:15	16:15 (WEA ZB1_ErWB)		06:11		05:14		04:41	20:08 (WEA ZB3_vpp)
15	08:08	09:00 (WEA V02)	07:24		06:15	16:15 (WEA ZB1_ErWB)		06:11		05:14		04:41	20:08 (WEA ZB3_vpp)
16	08:08	09:01 (WEA V02)	07:20		06:08	16:08 (WEA ZB1_ErWB)		06:07		05:10		04:41	20:10 (WEA ZB3_vpp)
17	08:07	09:02 (WEA V02)	07:18		06:01	16:01 (WEA ZB1_ErWB)		06:04		05:07		04:41	20:12 (WEA ZB3_vpp)
18	08:06	09:02 (WEA V02)	07:16		05:54	16:04 (WEA ZB1_ErWB)		06:02		05:05		04:41	20:14 (WEA ZB3_vpp)
19	08:05	09:02 (WEA V02)	07:14		05:47	16:07 (WEA ZB1_ErWB)		06:00		05:04		04:41	20:16 (WEA ZB3_vpp)
20	08:04	09:03 (WEA V02)	07:12		05:40	16:10 (WEA ZB1_ErWB)		05:58		05:03		04:41	20:18 (WEA ZB3_vpp)
21	08:03	09:05 (WEA V02)	07:10		05:33	16:13 (WEA ZB1_ErWB)		05:56		05:02		04:41	20:20 (WEA ZB3_vpp)
22	08:03	09:06 (WEA V02)	07:08		05:26	16:16 (WEA ZB1_ErWB)		05:54		05:02		04:41	20:22 (WEA ZB3_vpp)
23	08:00	09:06 (WEA V02)	07:06		05:19	16:19 (WEA ZB1_ErWB)		05:52		05:01		04:42	20:24 (WEA ZB3_vpp)
24	07:59	09:08 (WEA V02)	07:04		05:12	16:22 (WEA ZB1_ErWB)		05:49		05:01		04:42	20:26 (WEA ZB3_vpp)
25	07:58	09:10 (WEA V02)	07:02		05:05	16:25 (WEA ZB1_ErWB)		05:47		05:01		04:42	20:28 (WEA ZB3_vpp)
26	07:56	09:13 (WEA V02)	07:00		04:58	16:28 (WEA ZB1_ErWB)		05:45		05:01		04:42	20:30 (WEA ZB3_vpp)
27	07:55	09:15 (WEA V02)	06:57		04:51	16:31 (WEA ZB1_ErWB)		05:43		05:01		04:42	20:32 (WEA ZB3_vpp)
28	07:53	09:18 (WEA V02)	06:55		04:44	16:34 (WEA ZB1_ErWB)		05:41		05:01		04:42	20:34 (WEA ZB3_vpp)
29	07:52	09:20 (WEA V02)	06:53		04:37	16:37 (WEA ZB1_ErWB)		05:39		05:01		04:42	20:36 (WEA ZB3_vpp)
30	07:50	09:23 (WEA V02)	06:51		04:30	16:40 (WEA ZB1_ErWB)		05:37		05:01		04:42	20:38 (WEA ZB3_vpp)
31	07:49	09:25 (WEA V02)	06:49		04:23	16:43 (WEA ZB1_ErWB)		05:35		05:01		04:42	20:40 (WEA ZB3_vpp)
aktmax.mögl Beschattung	628		433		389			289		598		184	

**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)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-07 - SR-07, Neumühler Straße 5a, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:11 (WEA Z803_wpd)	05:23	20:05 (WEA Z802_wpd)	06:14	07:04
2	21:30	20:19 (WEA Z803_wpd)	20:58	20:26 (WEA Z803_wpd)	19:54	18:44
3	04:46	20:10 (WEA Z803_wpd)	05:24	20:04 (WEA Z802_wpd)	06:15	07:06
4	04:47	20:09 (WEA Z803_wpd)	05:26	20:05 (WEA Z802_wpd)	06:17	07:07
5	21:30	20:20 (WEA Z803_wpd)	20:59	20:24 (WEA Z803_wpd)	19:50	18:44
6	04:48	20:09 (WEA Z803_wpd)	05:27	20:05 (WEA Z802_wpd)	06:19	07:09
7	21:29	20:21 (WEA Z803_wpd)	20:52	20:22 (WEA Z802_wpd)	19:48	18:37
8	04:48	20:09 (WEA Z803_wpd)	05:29	20:06 (WEA Z802_wpd)	06:20	07:11
9	21:29	20:23 (WEA Z803_wpd)	20:51	20:21 (WEA Z802_wpd)	19:45	18:34
10	04:49	20:08 (WEA Z803_wpd)	05:31	20:06 (WEA Z802_wpd)	06:22	07:12
11	21:28	20:23 (WEA Z803_wpd)	20:49	20:19 (WEA Z802_wpd)	19:43	18:32
12	04:50	20:07 (WEA Z803_wpd)	05:32	20:07 (WEA Z802_wpd)	06:24	07:14
13	21:28	20:23 (WEA Z803_wpd)	20:47	20:17 (WEA Z802_wpd)	19:41	18:30
14	04:51	20:07 (WEA Z803_wpd)	05:34	20:08 (WEA Z802_wpd)	06:25	07:16
15	21:27	20:24 (WEA Z803_wpd)	20:45	20:15 (WEA Z802_wpd)	19:38	18:28
16	04:52	20:07 (WEA Z803_wpd)	05:35	20:11 (WEA Z802_wpd)	06:27	07:18
17	21:26	20:25 (WEA Z803_wpd)	20:43	20:14 (WEA Z802_wpd)	19:36	18:25
18	04:53	20:06 (WEA Z803_wpd)	05:37	20:14 (WEA Z802_wpd)	06:29	07:20
19	21:25	20:26 (WEA Z803_wpd)	20:41	20:13	19:33	18:23
20	04:54	20:06 (WEA Z803_wpd)	05:39	20:13	19:31	18:21
21	21:25	20:26 (WEA Z803_wpd)	20:39	20:11	19:29	18:19
22	04:55	20:06 (WEA Z803_wpd)	05:40	20:12	19:27	18:17
23	21:24	20:27 (WEA Z803_wpd)	20:37	20:10	19:25	18:15
24	04:56	20:05 (WEA Z803_wpd)	05:42	20:10	19:23	18:13
25	21:23	20:27 (WEA Z803_wpd)	20:35	20:09	19:21	18:11
26	04:57	20:05 (WEA Z803_wpd)	05:44	20:09	19:19	18:10
27	21:22	20:28 (WEA Z803_wpd)	20:33	20:08	19:17	18:08
28	04:59	20:05 (WEA Z803_wpd)	05:45	20:08	19:15	18:07
29	21:21	20:28 (WEA Z803_wpd)	20:31	20:07	19:13	18:05
30	04:59	20:05 (WEA Z803_wpd)	05:47	20:07	19:11	18:04
31	21:20	20:29 (WEA Z803_wpd)	20:29	20:06	19:09	18:02
1	05:01	20:05 (WEA Z803_wpd)	05:49	20:06	19:07	18:01
2	21:19	20:29 (WEA Z803_wpd)	20:27	20:05	19:05	18:00
3	05:02	20:05 (WEA Z803_wpd)	05:50	20:05	19:03	17:59
4	21:18	20:30 (WEA Z803_wpd)	20:25	20:04	19:01	17:57
5	05:04	20:04 (WEA Z803_wpd)	05:52	20:04	19:00	17:56
6	21:17	20:30 (WEA Z803_wpd)	20:23	20:03	18:58	17:54
7	05:05	20:04 (WEA Z803_wpd)	05:54	20:03	18:57	17:53
8	21:15	20:30 (WEA Z803_wpd)	20:21	20:02	18:55	17:51
9	05:06	20:04 (WEA Z803_wpd)	05:55	20:02	18:54	17:50
10	21:14	20:30 (WEA Z803_wpd)	20:19	20:01	18:52	17:48
11	05:08	20:04 (WEA Z803_wpd)	05:57	20:01	18:51	17:47
12	21:13	20:30 (WEA Z803_wpd)	20:17	20:00	18:49	17:45
13	05:09	20:04 (WEA Z803_wpd)	05:59	20:00	18:48	17:44
14	21:11	20:30 (WEA Z803_wpd)	20:15	19:59	18:46	17:42
15	05:11	20:04 (WEA Z803_wpd)	06:00	19:58	18:45	17:41
16	21:10	20:31 (WEA Z803_wpd)	20:13	19:57	18:43	17:39
17	05:12	20:04 (WEA Z803_wpd)	06:02	19:57	18:42	17:38
18	21:09	20:31 (WEA Z803_wpd)	20:11	19:56	18:40	17:36
19	05:14	20:04 (WEA Z803_wpd)	06:04	19:56	18:39	17:35
20	21:07	20:31 (WEA Z803_wpd)	20:08	19:55	18:37	17:33
21	05:15	20:04 (WEA Z803_wpd)	06:05	19:54	18:36	17:32
22	21:06	20:30 (WEA Z803_wpd)	20:06	19:53	18:34	17:30
23	05:17	20:05 (WEA Z803_wpd)	06:07	19:53	18:33	17:29
24	21:04	20:29 (WEA Z803_wpd)	20:03	19:52	18:31	17:27
25	05:18	20:05 (WEA Z803_wpd)	06:09	19:51	18:30	17:26
26	21:03	20:29 (WEA Z803_wpd)	20:01	19:50	18:28	17:24
27	05:20	20:05 (WEA Z803_wpd)	06:10	19:49	18:27	17:23
28	21:02	20:29 (WEA Z803_wpd)	19:59	19:48	18:25	17:21
29	05:21	20:05 (WEA Z803_wpd)	06:12	19:48	18:24	17:20
30	20:59	20:29 (WEA Z803_wpd)	19:57	19:47	18:22	17:18
31	05:23	20:05 (WEA Z803_wpd)	06:13	19:47	18:21	17:17
Sonnenscheinstunden	165					
astrmax.mögl.Beschattung	645	412	260	496	264	764

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-08 - SR-08, Neumühler Straße 6, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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 08:15 08:53 (WEA 0802)	10:47	10:53	16:49 (WEA 2812_ErBW)	10:41	04:49 19:59 (WEA 2803_wpd)
2 16:00 23 09:16 (WEA 0802)	16:49	17:42	6 16:55 (WEA 2812_ErBW)	19:37	21:16 20:29 (WEA 2803_wpd)
3 08:15 08:53 (WEA 0802)	10:46	10:51	12 17:27 (WEA 2811_ErBW)	19:46	19:48 19:59 (WEA 2803_wpd)
4 16:00 24 09:18 (WEA 0802)	16:51	17:44	13 17:13 (WEA 2811_ErBW)	19:39	21:17 20:22 (WEA 2803_wpd)
5 08:15 08:53 (WEA 0802)	10:44	10:48	14 17:57 (WEA 2811_ErBW)	19:47	19:59 (WEA 2803_wpd)
6 16:00 25 09:19 (WEA 0802)	16:53	17:46	15 17:41 (WEA 2811_ErBW)	19:41	21:18 20:22 (WEA 2803_wpd)
7 08:15 08:53 (WEA 0802)	10:42	10:46	16 17:25 (WEA 2811_ErBW)	19:42	19:48 20:01 (WEA 2803_wpd)
8 16:00 26 09:18 (WEA 0802)	16:55	17:47	17 17:10 (WEA 2811_ErBW)	19:42	21:19 20:22 (WEA 2803_wpd)
9 08:14 08:54 (WEA 0802)	10:41	10:44	18 17:54 (WEA 2811_ErBW)	19:42	19:45 20:01 (WEA 2803_wpd)
10 16:00 27 09:21 (WEA 0802)	16:57	17:49	19 17:38 (WEA 2811_ErBW)	19:44	20:26 20:02 (WEA 2803_wpd)
11 08:13 08:54 (WEA 0802)	10:39	10:42	20 17:22 (WEA 2811_ErBW)	19:46	19:48 20:02 (WEA 2803_wpd)
12 16:00 28 09:21 (WEA 0802)	17:00	17:52	21 17:06 (WEA 2811_ErBW)	19:48	20:29 20:04 (WEA 2803_wpd)
13 08:13 08:54 (WEA 0802)	10:36	10:39	22 16:50 (WEA 2811_ErBW)	19:49	19:49 20:04 (WEA 2803_wpd)
14 16:00 29 09:21 (WEA 0802)	17:02	17:55	23 16:34 (WEA 2811_ErBW)	19:51	20:31 20:04 (WEA 2803_wpd)
15 08:12 08:55 (WEA 0802)	10:34	10:37	24 16:18 (WEA 2811_ErBW)	19:52	19:52 20:04 (WEA 2803_wpd)
16 16:00 30 09:22 (WEA 0802)	17:04	17:58	25 16:02 (WEA 2811_ErBW)	19:53	20:32 20:05 (WEA 2803_wpd)
17 08:11 08:55 (WEA 0802)	10:30	10:33	26 15:46 (WEA 2811_ErBW)	19:55	19:55 20:05 (WEA 2803_wpd)
18 16:00 31 09:22 (WEA 0802)	17:06	17:59	27 15:30 (WEA 2811_ErBW)	19:55	20:33 20:06 (WEA 2803_wpd)
19 08:11 08:56 (WEA 0802)	10:28	10:31	28 15:14 (WEA 2811_ErBW)	19:56	19:56 20:06 (WEA 2803_wpd)
20 16:00 01 09:23 (WEA 0802)	17:07	17:51	29 14:58 (WEA 2811_ErBW)	19:56	20:34 20:06 (WEA 2803_wpd)
21 08:10 08:56 (WEA 0802)	10:26	10:29	30 14:42 (WEA 2811_ErBW)	19:57	19:57 20:06 (WEA 2803_wpd)
22 16:00 02 09:23 (WEA 0802)	17:08	17:52	31 14:26 (WEA 2811_ErBW)	19:58	20:35 20:06 (WEA 2803_wpd)
23 08:10 08:56 (WEA 0802)	10:24	10:27	1 14:10 (WEA 2811_ErBW)	19:58	19:58 20:06 (WEA 2803_wpd)
24 16:00 03 09:23 (WEA 0802)	17:09	17:53	2 13:54 (WEA 2811_ErBW)	19:59	20:36 20:06 (WEA 2803_wpd)
25 08:09 08:56 (WEA 0802)	10:22	10:25	3 13:38 (WEA 2811_ErBW)	19:59	19:59 20:06 (WEA 2803_wpd)
26 16:00 04 09:24 (WEA 0802)	17:10	17:54	4 13:22 (WEA 2811_ErBW)	19:59	20:37 20:06 (WEA 2803_wpd)
27 08:09 08:57 (WEA 0802)	10:20	10:23	5 13:06 (WEA 2811_ErBW)	19:59	19:59 20:06 (WEA 2803_wpd)
28 16:00 05 09:24 (WEA 0802)	17:11	17:55	6 12:50 (WEA 2811_ErBW)	19:59	20:38 20:06 (WEA 2803_wpd)
29 08:09 08:57 (WEA 0802)	10:19	10:22	7 12:34 (WEA 2811_ErBW)	19:59	19:59 20:06 (WEA 2803_wpd)
30 16:00 06 09:24 (WEA 0802)	17:12	17:56	8 12:18 (WEA 2811_ErBW)	19:59	20:39 20:06 (WEA 2803_wpd)
31 08:09 08:57 (WEA 0802)	10:18	10:21	9 12:02 (WEA 2811_ErBW)	19:59	19:59 20:06 (WEA 2803_wpd)
			10 11:46 (WEA 2811_ErBW)	19:59	20:40 20:06 (WEA 2803_wpd)
			11 11:30 (WEA 2811_ErBW)	19:59	20:41 20:06 (WEA 2803_wpd)
			12 11:14 (WEA 2811_ErBW)	19:59	20:42 20:06 (WEA 2803_wpd)
			13 10:58 (WEA 2811_ErBW)	19:59	20:43 20:06 (WEA 2803_wpd)
			14 10:42 (WEA 2811_ErBW)	19:59	20:44 20:06 (WEA 2803_wpd)
			15 10:26 (WEA 2811_ErBW)	19:59	20:45 20:06 (WEA 2803_wpd)
			16 10:10 (WEA 2811_ErBW)	19:59	20:46 20:06 (WEA 2803_wpd)
			17 9:54 (WEA 2811_ErBW)	19:59	20:47 20:06 (WEA 2803_wpd)
			18 9:38 (WEA 2811_ErBW)	19:59	20:48 20:06 (WEA 2803_wpd)
			19 9:22 (WEA 2811_ErBW)	19:59	20:49 20:06 (WEA 2803_wpd)
			20 9:06 (WEA 2811_ErBW)	19:59	20:50 20:06 (WEA 2803_wpd)
			21 8:50 (WEA 2811_ErBW)	19:59	20:51 20:06 (WEA 2803_wpd)
			22 8:34 (WEA 2811_ErBW)	19:59	20:52 20:06 (WEA 2803_wpd)
			23 8:18 (WEA 2811_ErBW)	19:59	20:53 20:06 (WEA 2803_wpd)
			24 8:02 (WEA 2811_ErBW)	19:59	20:54 20:06 (WEA 2803_wpd)
			25 7:46 (WEA 2811_ErBW)	19:59	20:55 20:06 (WEA 2803_wpd)
			26 7:30 (WEA 2811_ErBW)	19:59	20:56 20:06 (WEA 2803_wpd)
			27 7:14 (WEA 2811_ErBW)	19:59	20:57 20:06 (WEA 2803_wpd)
			28 6:58 (WEA 2811_ErBW)	19:59	20:58 20:06 (WEA 2803_wpd)
			29 6:42 (WEA 2811_ErBW)	19:59	20:59 20:06 (WEA 2803_wpd)
			30 6:26 (WEA 2811_ErBW)	19:59	21:00 20:06 (WEA 2803_wpd)
			31 6:10 (WEA 2811_ErBW)	19:59	21:01 20:06 (WEA 2803_wpd)
Sonnenscheinstunden	256	276	367	417	488
astrmax.mögl.Beschattung	654	430	409	303	582

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

## SHADOW - Kalender

**Berechnung: WEA\_GB Schattenrezeptor:SR-08 - SR-08, Neumühler Straße 6, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:45 21:30	20:09 (WEA ZB03_wpd) 20:25 (WEA ZB03_wpd)	20:06 (WEA ZB02_wpd) 19:54	17:48 (WEA ZB01_ErbV) 18:44	07:27 (WEA A001) 07:55	07:51 08:38 (WEA A002)
2	04:46 21:30	20:09 (WEA ZB03_wpd) 20:25 (WEA ZB03_wpd)	20:06 (WEA ZB02_wpd) 19:54	17:48 (WEA ZB01_ErbV) 18:44	07:27 (WEA A001) 07:55	07:51 08:38 (WEA A002)
3	04:47 21:30	20:09 (WEA ZB03_wpd) 20:25 (WEA ZB03_wpd)	20:06 (WEA ZB02_wpd) 19:54	17:48 (WEA ZB01_ErbV) 18:44	07:27 (WEA A001) 07:55	07:51 08:38 (WEA A002)
4	04:48 21:29	20:08 (WEA ZB03_wpd) 20:24 (WEA ZB03_wpd)	20:05 (WEA ZB02_wpd) 19:53	17:47 (WEA ZB01_ErbV) 18:43	07:26 (WEA A001) 07:54	07:50 08:37 (WEA A002)
5	04:49 21:29	20:07 (WEA ZB03_wpd) 20:23 (WEA ZB03_wpd)	20:04 (WEA ZB02_wpd) 19:52	17:46 (WEA ZB01_ErbV) 18:42	07:25 (WEA A001) 07:53	07:49 08:36 (WEA A002)
6	04:50 21:28	20:06 (WEA ZB03_wpd) 20:22 (WEA ZB03_wpd)	20:03 (WEA ZB02_wpd) 19:51	17:45 (WEA ZB01_ErbV) 18:41	07:24 (WEA A001) 07:52	07:48 08:35 (WEA A002)
7	04:51 21:27	20:05 (WEA ZB03_wpd) 20:21 (WEA ZB03_wpd)	20:02 (WEA ZB02_wpd) 19:50	17:44 (WEA ZB01_ErbV) 18:40	07:23 (WEA A001) 07:51	07:47 08:34 (WEA A002)
8	04:51 21:27	20:04 (WEA ZB03_wpd) 20:20 (WEA ZB03_wpd)	20:01 (WEA ZB02_wpd) 19:49	17:43 (WEA ZB01_ErbV) 18:39	07:22 (WEA A001) 07:50	07:46 08:33 (WEA A002)
9	04:52 21:26	20:03 (WEA ZB03_wpd) 20:19 (WEA ZB03_wpd)	20:00 (WEA ZB02_wpd) 19:48	17:42 (WEA ZB01_ErbV) 18:38	07:21 (WEA A001) 07:49	07:45 08:32 (WEA A002)
10	04:53 21:25	20:02 (WEA ZB03_wpd) 20:18 (WEA ZB03_wpd)	19:59 (WEA ZB02_wpd) 19:47	17:41 (WEA ZB01_ErbV) 18:37	07:20 (WEA A001) 07:48	07:44 08:31 (WEA A002)
11	04:54 21:25	20:01 (WEA ZB03_wpd) 20:17 (WEA ZB03_wpd)	19:58 (WEA ZB02_wpd) 19:46	17:40 (WEA ZB01_ErbV) 18:36	07:19 (WEA A001) 07:47	07:43 08:30 (WEA A002)
12	04:55 21:24	20:00 (WEA ZB03_wpd) 20:16 (WEA ZB03_wpd)	19:57 (WEA ZB02_wpd) 19:45	17:39 (WEA ZB01_ErbV) 18:35	07:18 (WEA A001) 07:46	07:42 08:29 (WEA A002)
13	04:56 21:23	20:00 (WEA ZB03_wpd) 20:16 (WEA ZB03_wpd)	19:57 (WEA ZB02_wpd) 19:45	17:39 (WEA ZB01_ErbV) 18:35	07:18 (WEA A001) 07:46	07:42 08:29 (WEA A002)
14	04:57 21:22	20:01 (WEA ZB03_wpd) 20:17 (WEA ZB03_wpd)	19:58 (WEA ZB02_wpd) 19:46	17:40 (WEA ZB01_ErbV) 18:36	07:19 (WEA A001) 07:47	07:43 08:30 (WEA A002)
15	04:59 21:21	20:02 (WEA ZB03_wpd) 20:18 (WEA ZB03_wpd)	19:59 (WEA ZB02_wpd) 19:47	17:41 (WEA ZB01_ErbV) 18:37	07:20 (WEA A001) 07:48	07:44 08:31 (WEA A002)
16	05:00 21:20	20:03 (WEA ZB03_wpd) 20:19 (WEA ZB03_wpd)	20:00 (WEA ZB02_wpd) 19:48	17:42 (WEA ZB01_ErbV) 18:38	07:21 (WEA A001) 07:49	07:45 08:32 (WEA A002)
17	05:01 21:19	20:04 (WEA ZB03_wpd) 20:20 (WEA ZB03_wpd)	20:01 (WEA ZB02_wpd) 19:49	17:43 (WEA ZB01_ErbV) 18:39	07:22 (WEA A001) 07:50	07:46 08:33 (WEA A002)
18	05:02 21:18	20:05 (WEA ZB03_wpd) 20:21 (WEA ZB03_wpd)	20:02 (WEA ZB02_wpd) 19:50	17:44 (WEA ZB01_ErbV) 18:40	07:23 (WEA A001) 07:51	07:47 08:34 (WEA A002)
19	05:04 21:17	20:06 (WEA ZB03_wpd) 20:22 (WEA ZB03_wpd)	20:03 (WEA ZB02_wpd) 19:51	17:45 (WEA ZB01_ErbV) 18:41	07:24 (WEA A001) 07:52	07:48 08:35 (WEA A002)
20	05:05 21:16	20:06 (WEA ZB03_wpd) 20:22 (WEA ZB03_wpd)	20:03 (WEA ZB02_wpd) 19:51	17:45 (WEA ZB01_ErbV) 18:41	07:24 (WEA A001) 07:52	07:48 08:35 (WEA A002)
21	05:05 21:16	20:06 (WEA ZB03_wpd) 20:22 (WEA ZB03_wpd)	20:03 (WEA ZB02_wpd) 19:51	17:45 (WEA ZB01_ErbV) 18:41	07:24 (WEA A001) 07:52	07:48 08:35 (WEA A002)
22	05:06 21:15	20:07 (WEA ZB03_wpd) 20:23 (WEA ZB03_wpd)	20:04 (WEA ZB02_wpd) 19:52	17:46 (WEA ZB01_ErbV) 18:42	07:25 (WEA A001) 07:53	07:49 08:36 (WEA A002)
23	05:08 21:14	20:08 (WEA ZB03_wpd) 20:24 (WEA ZB03_wpd)	20:05 (WEA ZB02_wpd) 19:53	17:47 (WEA ZB01_ErbV) 18:43	07:26 (WEA A001) 07:54	07:50 08:37 (WEA A002)
24	05:11 21:13	20:09 (WEA ZB03_wpd) 20:25 (WEA ZB03_wpd)	20:06 (WEA ZB02_wpd) 19:54	17:48 (WEA ZB01_ErbV) 18:44	07:27 (WEA A001) 07:55	07:51 08:38 (WEA A002)
25	05:12 21:12	20:10 (WEA ZB03_wpd) 20:26 (WEA ZB03_wpd)	20:07 (WEA ZB02_wpd) 19:55	17:49 (WEA ZB01_ErbV) 18:45	07:28 (WEA A001) 07:56	07:52 08:39 (WEA A002)
26	05:14 21:11	20:11 (WEA ZB03_wpd) 20:27 (WEA ZB03_wpd)	20:08 (WEA ZB02_wpd) 19:56	17:50 (WEA ZB01_ErbV) 18:46	07:29 (WEA A001) 07:57	07:53 08:40 (WEA A002)
27	05:15 21:10	20:12 (WEA ZB03_wpd) 20:28 (WEA ZB03_wpd)	20:09 (WEA ZB02_wpd) 19:57	17:51 (WEA ZB01_ErbV) 18:47	07:30 (WEA A001) 07:58	07:54 08:41 (WEA A002)
28	05:17 21:09	20:13 (WEA ZB03_wpd) 20:29 (WEA ZB03_wpd)	20:10 (WEA ZB02_wpd) 19:58	17:52 (WEA ZB01_ErbV) 18:48	07:31 (WEA A001) 07:59	07:55 08:42 (WEA A002)
29	05:19 21:08	20:14 (WEA ZB03_wpd) 20:30 (WEA ZB03_wpd)	20:11 (WEA ZB02_wpd) 19:59	17:53 (WEA ZB01_ErbV) 18:49	07:32 (WEA A001) 08:00	07:56 08:43 (WEA A002)
30	05:21 21:07	20:15 (WEA ZB03_wpd) 20:31 (WEA ZB03_wpd)	20:12 (WEA ZB02_wpd) 20:00	17:54 (WEA ZB01_ErbV) 18:50	07:33 (WEA A001) 08:01	07:57 08:44 (WEA A002)
31	05:21 21:07	20:15 (WEA ZB03_wpd) 20:31 (WEA ZB03_wpd)	20:12 (WEA ZB02_wpd) 20:00	17:54 (WEA ZB01_ErbV) 18:50	07:33 (WEA A001) 08:01	07:57 08:44 (WEA A002)
Sonnenscheinstunden	795	765	745	731	716	701
astrmax.mögl.Beschattung	714	694	685	685	684	684

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
--------------	-----------------------	-------------------------	----------------------	-------------------	----------------	--------------



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-09 - SR-09, Hoppegartener Straße 18, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:30 (WEA V01)	06:53	06:41	1903 (WEA Z05_wpd)   05:35	1929 (WEA Z03_wpd)   04:49	20:17 (WEA Z01_wpd)					
2	16:00	16:49	16:49	17:42	10	17:16 (WEA Z01_EhW)	19:37	8	19:11 (WEA Z05_wpd)   20:29	21	19:50 (WEA Z03_wpd)   21:16	24	20:41 (WEA Z01_wpd)
3	08:15	07:46	06:31 (WEA V01)	06:51	17:04 (WEA Z01_EhW)	06:39	19:52 (WEA Z05_wpd)   05:33	19:52 (WEA Z05_wpd)   04:46	19:52 (WEA Z05_wpd)   05:33	20	19:49 (WEA Z03_wpd)   21:17	24	20:41 (WEA Z01_wpd)
4	16:00	16:51	16:51	17:44	13	17:17 (WEA Z01_EhW)	19:39	11	19:11 (WEA Z05_wpd)   20:31	18	19:48 (WEA Z03_wpd)   21:18	24	20:41 (WEA Z01_wpd)
5	08:15	07:44	06:32 (WEA V01)	06:48	17:04 (WEA Z01_EhW)	06:36	19:50 (WEA Z05_wpd)   05:31	19:50 (WEA Z05_wpd)   04:47	19:50 (WEA Z05_wpd)   05:31	19	19:32 (WEA Z03_wpd)   20:45	20:18 (WEA Z01_wpd)	
6	16:00	16:53	16:53	17:46	15	17:19 (WEA Z01_EhW)	19:41	14	19:11 (WEA Z05_wpd)   20:33	15	19:46 (WEA Z03_wpd)   21:19	24	20:41 (WEA Z01_wpd)
7	08:15	07:42	06:34 (WEA V01)	06:46	17:04 (WEA Z01_EhW)	06:34	19:52 (WEA Z05_wpd)   05:29	19:52 (WEA Z05_wpd)   04:46	19:52 (WEA Z05_wpd)   05:29	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
8	16:00	16:55	16:55	17:47	17:21 (WEA Z01_EhW)	19:42	19:16 (WEA Z05_wpd)   20:34	15	19:46 (WEA Z03_wpd)   21:19	8	19:43 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
9	08:14	07:39	06:27 (WEA V01)	06:42	17:03 (WEA Z01_EhW)	06:29	19:58 (WEA Z05_wpd)   05:28	19:58 (WEA Z05_wpd)   04:45	19:58 (WEA Z05_wpd)   05:28	21	21:21	24	20:42 (WEA Z01_wpd)
10	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
11	08:14	07:37	06:28 (WEA V01)	06:39	17:04 (WEA Z01_EhW)	06:27	19:58 (WEA Z05_wpd)   05:24	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:24	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
12	16:00	16:57	16:57	17:49	19	17:22 (WEA Z01_EhW)	19:44	19	19:18 (WEA Z05_wpd)   20:36	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
13	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	20	20:38	20:18 (WEA Z01_wpd)	
14	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
15	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
16	16:00	16:57	16:57	17:49	19	17:22 (WEA Z01_EhW)	19:44	19	19:18 (WEA Z05_wpd)   20:36	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
17	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	20	20:38	20:18 (WEA Z01_wpd)	
18	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
19	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
20	16:00	16:57	16:57	17:49	19	17:22 (WEA Z01_EhW)	19:44	19	19:18 (WEA Z05_wpd)   20:36	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
21	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	20	20:38	20:18 (WEA Z01_wpd)	
22	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
23	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
24	16:00	16:57	16:57	17:49	19	17:22 (WEA Z01_EhW)	19:44	19	19:18 (WEA Z05_wpd)   20:36	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
25	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	20	20:38	20:18 (WEA Z01_wpd)	
26	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
27	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
28	16:00	16:57	16:57	17:49	19	17:22 (WEA Z01_EhW)	19:44	19	19:18 (WEA Z05_wpd)   20:36	13	19:46 (WEA Z03_wpd)   21:20	24	20:41 (WEA Z01_wpd)
29	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	20	20:38	20:18 (WEA Z01_wpd)	
30	16:00	16:59	16:59	17:51	18	17:21 (WEA Z01_EhW)	19:46	20	19:18 (WEA Z05_wpd)   20:39	20	19:48 (WEA Z03_wpd)   20:38	20:18 (WEA Z01_wpd)	
31	08:13	07:36	06:27 (WEA V01)	06:37	17:04 (WEA Z01_EhW)	06:25	19:58 (WEA Z05_wpd)   05:23	19:58 (WEA Z05_wpd)   04:44	19:58 (WEA Z05_wpd)   05:23	19	19:43 (WEA Z03_wpd)   20:39	20:18 (WEA Z01_wpd)	
Sonnenscheinstunden	256	276		367	417	417	488	293	502	696			
astr.max.mögl.Beschattung	295	109	148	380	417	380	488	293	502	696			

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-09 - SR-09, Hoppegartener Straße 18, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:24 (WEA Z801_wpd)	05:23	06:14	07:04	07:51
2	21:30	20:47 (WEA Z801_wpd)	20:58	19:54	18:44	16:36
3	04:46	20:23 (WEA Z801_wpd)	05:24	06:15	07:05	07:52
4	21:30	20:46 (WEA Z801_wpd)	20:56	19:52	18:44	16:33
5	04:47	20:23 (WEA Z801_wpd)	05:26	06:17	07:07	07:54
6	21:30	20:47 (WEA Z801_wpd)	20:54	19:50	18:39	16:33
7	04:47	20:24 (WEA Z801_wpd)	05:27	06:19	07:09	07:55
8	21:29	20:47 (WEA Z801_wpd)	20:52	19:47	18:37	16:31
9	04:48	20:24 (WEA Z801_wpd)	05:29	06:20	07:11	07:56
10	21:29	20:48 (WEA Z801_wpd)	20:51	19:45	18:34	16:29
11	04:49	20:24 (WEA Z801_wpd)	05:31	06:22	07:14	07:58
12	21:28	20:47 (WEA Z801_wpd)	20:49	19:43	18:32	16:27
13	04:50	20:24 (WEA Z801_wpd)	05:32	06:24	07:14	07:59
14	21:28	20:48 (WEA Z801_wpd)	20:47	19:41	18:30	16:25
15	04:51	20:24 (WEA Z801_wpd)	05:34	06:25	07:16	07:59
16	21:27	20:48 (WEA Z801_wpd)	20:45	19:38	18:27	16:24
17	04:52	20:24 (WEA Z801_wpd)	05:35	06:27	07:18	08:00
18	21:26	20:48 (WEA Z801_wpd)	20:43	19:36	18:25	16:22
19	04:53	20:25 (WEA Z801_wpd)	05:37	06:29	07:21	08:01
20	21:25	20:48 (WEA Z801_wpd)	20:41	19:33	18:23	16:20
21	04:54	20:25 (WEA Z801_wpd)	05:39	06:30	07:21	08:01
22	21:25	20:48 (WEA Z801_wpd)	20:39	19:31	18:21	16:19
23	04:55	20:25 (WEA Z801_wpd)	05:40	06:32	07:23	08:01
24	21:24	20:48 (WEA Z801_wpd)	20:37	19:29	18:18	16:17
25	04:56	20:25 (WEA Z801_wpd)	05:42	06:34	07:25	08:01
26	21:23	20:48 (WEA Z801_wpd)	20:35	19:26	18:16	16:16
27	04:57	20:26 (WEA Z801_wpd)	05:44	06:35	07:26	08:01
28	21:22	20:48 (WEA Z801_wpd)	20:33	19:24	18:14	16:14
29	04:59	20:26 (WEA Z801_wpd)	05:45	06:37	07:28	08:01
30	21:21	20:48 (WEA Z801_wpd)	20:31	19:22	18:12	16:13
31	05:00	20:27 (WEA Z801_wpd)	05:47	06:39	07:30	08:01
1	21:20	20:48 (WEA Z801_wpd)	20:29	19:19	18:09	16:11
2	05:01	20:27 (WEA Z801_wpd)	05:49	06:40	07:32	08:02
3	21:19	20:47 (WEA Z801_wpd)	20:27	19:17	18:07	16:10
4	05:02	20:28 (WEA Z801_wpd)	05:50	06:42	07:33	08:03
5	21:18	20:45 (WEA Z801_wpd)	20:25	19:15	18:05	16:09
6	05:03	20:28 (WEA Z801_wpd)	05:52	06:44	07:35	08:03
7	21:17	20:44 (WEA Z801_wpd)	20:23	19:13	18:03	16:07
8	05:05	20:29 (WEA Z801_wpd)	05:54	06:45	07:37	08:04
9	21:15	20:43 (WEA Z801_wpd)	20:21	19:10	18:01	16:06
10	05:06	20:29 (WEA Z801_wpd)	05:55	06:47	07:39	08:05
11	21:14	20:42 (WEA Z801_wpd)	20:19	19:07	17:59	16:05
12	05:08	20:31 (WEA Z801_wpd)	05:57	06:49	07:41	08:06
13	21:13	20:41 (WEA Z801_wpd)	20:17	19:05	17:56	16:03
14	05:09	20:31 (WEA Z801_wpd)	05:59	06:50	07:42	08:07
15	21:11	20:39 (WEA Z801_wpd)	20:15	19:03	17:54	16:02
16	05:11	20:36 (WEA Z801_wpd)	06:00	06:52	07:44	08:07
17	21:10	20:38 (WEA Z801_wpd)	20:13	19:00	17:52	16:01
18	05:12	20:36 (WEA Z801_wpd)	06:02	06:54	07:46	08:08
19	21:09	20:36 (WEA Z801_wpd)	20:11	18:58	17:50	16:00
20	05:14	20:36 (WEA Z801_wpd)	06:04	06:55	07:48	08:09
21	21:07	20:36 (WEA Z801_wpd)	20:08	18:56	17:48	15:59
22	05:15	20:36 (WEA Z801_wpd)	06:05	06:57	07:50	08:10
23	21:06	20:36 (WEA Z801_wpd)	20:06	18:53	17:46	15:58
24	05:17	20:36 (WEA Z801_wpd)	06:07	06:59	07:52	08:11
25	21:04	20:36 (WEA Z801_wpd)	20:03	18:51	17:44	15:57
26	05:18	20:36 (WEA Z801_wpd)	06:09	07:00	07:54	08:12
27	21:03	20:36 (WEA Z801_wpd)	20:01	18:48	17:42	15:57
28	05:20	20:36 (WEA Z801_wpd)	06:10	07:02	07:56	08:13
29	21:01	20:36 (WEA Z801_wpd)	19:59	18:46	17:40	15:56
30	05:21	20:36 (WEA Z801_wpd)	06:12	07:03	07:57	08:15
31	20:59	20:36 (WEA Z801_wpd)	19:57	18:43	17:38	15:55
Sonnenscheinstunden	195	195	195	195	195	195
astr.max.mögl.Beschattung	467	306	183	154	264	65

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-10 - SR-10, Hoppegartener Straße 19, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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 08:15	07:47	06:53 (WEA V01)	06:41	05:35	04:49
2 08:15	07:46	06:53 (WEA V01)	06:41	05:35	04:49
3 08:15	07:46	06:53 (WEA V01)	06:41	05:35	04:49
4 08:15	07:46	06:53 (WEA V01)	06:41	05:35	04:49
5 08:14	07:41	06:44	06:32	05:27	04:46
6 08:14	07:38	06:42	06:29	05:25	04:45
7 08:14	07:37	06:42	06:29	05:25	04:45
8 08:13	07:36	06:42	06:29	05:25	04:45
9 08:13	07:36	06:42	06:29	05:25	04:45
10 08:12	07:32	06:33	06:20	05:18	04:42
11 08:12	07:32	06:33	06:20	05:18	04:42
12 08:11	07:28	06:28	06:16	05:15	04:42
13 08:10	07:26	06:28	06:16	05:15	04:42
14 08:09	07:24	06:28	06:16	05:15	04:42
15 08:08	07:23	06:28	06:16	05:15	04:42
16 08:08	07:23	06:28	06:16	05:15	04:42
17 08:07	07:18	06:16	06:07	05:08	04:41
18 08:06	07:16	06:14	06:02	05:05	04:41
19 08:05	07:14	06:12	06:00	05:04	04:41
20 08:04	07:12	06:10	05:58	05:03	04:41
21 08:03	07:10	06:07	05:56	05:01	04:41
22 08:01	07:08	06:05	05:54	05:00	04:41
23 08:00	07:06	06:02	05:51	04:58	04:42
24 07:59	07:04	06:00	05:49	04:57	04:42
25 07:58	07:02	05:57	05:47	04:56	04:42
26 07:56	07:00	05:55	05:45	04:55	04:42
27 07:55	06:57	05:53	05:43	04:54	04:42
28 07:53	06:55	05:50	05:41	04:53	04:44
29 07:52	06:52	05:48	05:39	04:52	04:44
30 07:50	06:50	05:46	05:37	04:50	04:45
31 07:49	06:48	05:44	05:35	04:49	04:45
32 07:49	06:48	05:44	05:35	04:49	04:45
Sonnenscheinstunden	256	276	367	417	488
ast.max.mögl.Beschattung	325	95	145	405	313

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-10 - SR-10, Hoppegartener Straße 19, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember	
1	04:45	20:21 (WEA ZB01_wpd)05:23	06:14	07:04	06:59	07:51	
2	21:30	22 20:43 (WEA ZB01_wpd)05:58	19:54	18:44	16:36	15:55	
3	04:46	20:20 (WEA ZB01_wpd)05:24	06:15	18:57 (WEA ZB05_wpd)07:05	07:01	07:52	
4	21:30	23 20:43 (WEA ZB01_wpd)05:56	19:52	10 19:07 (WEA ZB05_wpd)18:41	16:35	15:54	
5	04:47	20:20 (WEA ZB01_wpd)05:26	06:17	18:54 (WEA ZB05_wpd)07:07	07:02	07:54	
6	21:30	24 20:44 (WEA ZB01_wpd)05:54	19:50	14 19:08 (WEA ZB05_wpd)18:39	16:33	15:54	
7	04:47	20:21 (WEA ZB01_wpd)05:27	06:19	18:53 (WEA ZB05_wpd)07:09	07:04	07:55	
8	21:29	23 20:44 (WEA ZB01_wpd)05:52	19:47	17 19:10 (WEA ZB05_wpd)18:37	16:31	15:53	
9	04:48	20:21 (WEA ZB01_wpd)05:29	06:20	18:51 (WEA ZB05_wpd)07:11	17:42 (WEA ZB11_EnBW)07:06	07:57	
10	21:29	24 20:45 (WEA ZB01_wpd)05:51	19:45	18 19:09 (WEA ZB05_wpd)18:34	6 17:48 (WEA ZB11_EnBW)16:29	15:52	
11	04:49	20:20 (WEA ZB01_wpd)05:31	06:22	18:51 (WEA ZB05_wpd)07:12	17:39 (WEA ZB11_EnBW)07:08	08:11 (WEA VB01)07:58	
12	21:28	24 20:44 (WEA ZB01_wpd)05:49	19:43	19 19:10 (WEA ZB05_wpd)18:32	12 17:51 (WEA ZB11_EnBW)16:27	6 08:17 (WEA VB01)15:52	
13	04:50	20:21 (WEA ZB01_wpd)05:32	06:24	18:51 (WEA ZB05_wpd)07:14	17:37 (WEA ZB11_EnBW)07:10	08:08 (WEA VB01)07:59	
14	21:28	23 20:44 (WEA ZB01_wpd)05:47	19:41	19 19:10 (WEA ZB05_wpd)18:30	15 17:52 (WEA ZB11_EnBW)16:25	12 08:20 (WEA VB01)15:52	
15	04:51	20:21 (WEA ZB01_wpd)05:34	19:42 (WEA ZB03_wpd)06:25	18:49 (WEA ZB05_wpd)07:16	17:36 (WEA ZB11_EnBW)07:12	08:06 (WEA VB01)08:00	
16	21:27	24 20:45 (WEA ZB01_wpd)05:45	4 19:46 (WEA ZB03_wpd)19:38	21 19:10 (WEA ZB05_wpd)18:27	17 17:53 (WEA ZB11_EnBW)16:24	16 08:22 (WEA VB01)15:51	
17	04:52	20:21 (WEA ZB01_wpd)05:35	19:39 (WEA ZB03_wpd)06:27	18:50 (WEA ZB05_wpd)07:18	17:35 (WEA ZB11_EnBW)07:13	08:05 (WEA VB01)08:02	
18	21:26	24 20:45 (WEA ZB01_wpd)05:43	11 19:50 (WEA ZB03_wpd)19:36	19 19:09 (WEA ZB05_wpd)18:25	18 17:53 (WEA ZB11_EnBW)16:22	18 08:23 (WEA VB01)15:51	
19	04:53	20:21 (WEA ZB01_wpd)05:37	19:38 (WEA ZB03_wpd)06:29	18:50 (WEA ZB05_wpd)07:19	17:34 (WEA ZB11_EnBW)07:15	08:04 (WEA VB01)08:03	
20	21:25	24 20:45 (WEA ZB01_wpd)05:41	14 19:52 (WEA ZB03_wpd)19:33	17 19:07 (WEA ZB05_wpd)18:23	19 17:53 (WEA ZB11_EnBW)16:20	20 08:24 (WEA VB01)15:51	
21	04:54	20:21 (WEA ZB01_wpd)05:39	19:36 (WEA ZB03_wpd)06:30	18:50 (WEA ZB05_wpd)07:21	17:34 (WEA ZB11_EnBW)07:17	08:04 (WEA VB01)08:04	
22	21:25	24 20:45 (WEA ZB01_wpd)05:39	16 19:52 (WEA ZB03_wpd)19:31	14 19:04 (WEA ZB05_wpd)18:21	18 17:52 (WEA ZB11_EnBW)16:19	21 08:25 (WEA VB01)15:50	
23	04:55	20:21 (WEA ZB01_wpd)05:40	19:35 (WEA ZB03_wpd)06:32	18:51 (WEA ZB05_wpd)07:23	17:34 (WEA ZB11_EnBW)07:19	08:04 (WEA VB01)08:05	
24	21:24	24 20:45 (WEA ZB01_wpd)05:37	19 19:54 (WEA ZB03_wpd)19:29	11 19:02 (WEA ZB05_wpd)18:18	16 17:50 (WEA ZB11_EnBW)16:17	21 08:25 (WEA VB01)15:50	
25	04:56	20:22 (WEA ZB01_wpd)05:42	19:33 (WEA ZB03_wpd)06:34	18:51 (WEA ZB05_wpd)07:25	17:34 (WEA ZB11_EnBW)07:21	08:03 (WEA VB01)08:06	
26	21:23	23 20:45 (WEA ZB01_wpd)05:35	21 19:54 (WEA ZB03_wpd)19:26	8 18:59 (WEA ZB05_wpd)18:16	14 17:48 (WEA ZB11_EnBW)16:16	23 08:26 (WEA VB01)15:50	
27	04:57	20:22 (WEA ZB01_wpd)05:44	19:33 (WEA ZB03_wpd)06:35	18:54 (WEA ZB05_wpd)07:26	17:34 (WEA ZB11_EnBW)07:23	08:03 (WEA VB01)08:07	
28	21:22	23 20:45 (WEA ZB01_wpd)05:33	22 19:55 (WEA ZB03_wpd)19:24	3 18:57 (WEA ZB05_wpd)18:14	11 17:45 (WEA ZB11_EnBW)16:14	23 08:26 (WEA VB01)15:50	
29	04:59	20:22 (WEA ZB01_wpd)05:45	19:32 (WEA ZB03_wpd)06:37	18:54 (WEA ZB05_wpd)07:28	17:35 (WEA ZB11_EnBW)07:24	08:03 (WEA VB01)08:08	
30	21:21	23 20:45 (WEA ZB01_wpd)05:31	22 19:54 (WEA ZB03_wpd)19:22	18:52	8 17:43 (WEA ZB11_EnBW)16:13	24 08:27 (WEA VB01)15:50	
31	05:00	20:23 (WEA ZB01_wpd)05:47	19:32 (WEA ZB03_wpd)06:39	07:30	17:37 (WEA ZB11_EnBW)07:26	08:04 (WEA VB01)08:09	
1	21:20	23 20:46 (WEA ZB01_wpd)05:29	23 19:55 (WEA ZB03_wpd)19:19	18:09	4 17:41 (WEA ZB11_EnBW)16:11	23 08:27 (WEA VB01)15:50	
2	05:01	20:23 (WEA ZB01_wpd)05:49	19:31 (WEA ZB03_wpd)06:40	07:32	07:28	08:04 (WEA VB01)08:09	
3	21:19	23 20:46 (WEA ZB01_wpd)05:27	23 19:54 (WEA ZB03_wpd)19:17	18:07	16:10	23 08:27 (WEA VB01)15:51	
4	05:02	20:23 (WEA ZB01_wpd)05:50	19:31 (WEA ZB03_wpd)06:42	07:33	07:30	08:05 (WEA VB01)08:10	
5	21:18	22 20:45 (WEA ZB01_wpd)05:25	23 19:54 (WEA ZB03_wpd)19:15	18:05	16:09	23 08:27 (WEA VB01)15:51	
6	05:04	20:24 (WEA ZB01_wpd)05:52	19:32 (WEA ZB03_wpd)06:44	07:35	07:31	08:05 (WEA VB01)08:11	
7	21:17	20 20:44 (WEA ZB01_wpd)05:23	22 19:54 (WEA ZB03_wpd)19:12	18:03	16:07	23 08:28 (WEA VB01)15:51	
8	05:05	20:24 (WEA ZB01_wpd)05:54	19:31 (WEA ZB03_wpd)06:45	07:37	07:33	08:05 (WEA VB01)08:12	
9	21:15	19 20:43 (WEA ZB01_wpd)05:21	22 19:53 (WEA ZB03_wpd)19:10	18:01	16:06	22 08:27 (WEA VB01)15:51	
10	05:06	20:25 (WEA ZB01_wpd)05:55	19:32 (WEA ZB03_wpd)06:47	07:39	07:35	08:06 (WEA VB01)08:12	
11	21:14	17 20:42 (WEA ZB01_wpd)05:19	19 19:51 (WEA ZB03_wpd)19:07	17:59	16:05	20 08:26 (WEA VB01)15:52	
12	05:08	20:26 (WEA ZB01_wpd)05:57	19:32 (WEA ZB03_wpd)06:49	07:41	07:37	08:08 (WEA VB01)08:13	
13	21:13	15 20:41 (WEA ZB01_wpd)05:17	16 19:48 (WEA ZB03_wpd)19:05	17:56	16:03	18 08:26 (WEA VB01)15:52	
14	05:09	20:26 (WEA ZB01_wpd)05:59	19:34 (WEA ZB03_wpd)06:50	07:42	07:40	08:10 (WEA VB01)08:13	
15	21:11	13 20:39 (WEA ZB01_wpd)05:15	19 19:47 (WEA ZB03_wpd)19:03	17:54	16:02	16 08:26 (WEA VB01)15:53	
16	05:11	20:28 (WEA ZB01_wpd)06:00	19:34 (WEA ZB03_wpd)06:52	07:44	07:42	08:12 (WEA VB01)08:14	
17	21:10	11 20:39 (WEA ZB01_wpd)05:12	10 19:44 (WEA ZB03_wpd)19:00	17:52	16:01	14 08:26 (WEA VB01)15:53	
18	05:12	20:30 (WEA ZB01_wpd)06:02	19:36 (WEA ZB03_wpd)06:54	06:46	07:42	08:14 (WEA VB01)08:14	
19	21:09	7 20:37 (WEA ZB01_wpd)05:10	4 19:42 (WEA ZB03_wpd)18:58	16:50	16:00	12 08:26 (WEA VB01)15:54	
20	05:14	20:32 (WEA ZB01_wpd)06:04	06:55	06:48	07:43	08:15 (WEA VB01)08:14	
21	21:07	3 20:35 (WEA ZB01_wpd)05:08	19:56	16:48	15:59	9 08:24 (WEA VB01)15:55	
22	05:15	06:05	06:57	06:50	07:45	08:17 (WEA VB01)08:15	
23	21:06	20:06	18:53	16:46	15:58	6 08:23 (WEA VB01)15:56	
24	05:17	06:07	06:59	06:51	07:46	08:19 (WEA VB01)08:15	
25	21:04	20:03	18:51	16:44	15:57	3 08:22 (WEA VB01)15:56	
26	05:18	06:09	07:00	06:53	07:48	08:15	
27	21:03	20:01	18:48	16:42	15:56	15:57	
28	05:20	06:10	07:02	06:55	07:49	08:15	
29	21:01	19:59	18:46	16:40	15:56	15:58	
30	05:21	06:12	06:57	06:57	07:49	08:15	
31	20:59	19:57	16:38	16:38	15:59	15:59	
Sonnenscheinstunden		505	455	381	331	264	241
astr. max. mögl. Beschattung		525	304	190	158	396	

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-11 - SR-11, Hoppegartener Straße 20, 15518 Schönfelde  
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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

Januar	Februar	März	April	Mai	Juni	
1 08:15	07:47	06:53 (WEA V001)	06:41	05:54 (WEA Z005_wpd)	05:35	
2 08:15	16:49	17:42	18 17:16 (WEA Z011_EhW)	19:37	17 19:11 (WEA Z003_wpd)	
3 08:15	07:46	08:57 (WEA V001)	08:39	18:54 (WEA Z005_wpd)	05:33	
4 16:01	16:51	17:48	19 17:16 (WEA Z011_EhW)	19:39	19:11 (WEA Z003_wpd)	
5 08:15	07:44	06:48	16:58 (WEA Z011_EhW)	06:36	18:53 (WEA Z005_wpd)	
6 16:03	16:53	17:45	18 17:16 (WEA Z011_EhW)	19:41	20 19:11 (WEA Z003_wpd)	
7 08:15	07:42	06:46	16:58 (WEA Z011_EhW)	06:34	18:53 (WEA Z005_wpd)	
8 16:04	16:55	17:47	18 17:16 (WEA Z011_EhW)	19:42	20 19:11 (WEA Z003_wpd)	
9 08:14	07:41	06:44	16:58 (WEA Z011_EhW)	06:32	18:53 (WEA Z005_wpd)	
10 16:05	16:57	17:49	18 17:16 (WEA Z011_EhW)	19:44	20 19:11 (WEA Z003_wpd)	
11 08:14	07:39	06:42	17:00 (WEA Z011_EhW)	06:29	18:51 (WEA Z005_wpd)	
12 16:06	16:59	17:51	18 17:16 (WEA Z011_EhW)	19:46	20 19:11 (WEA Z003_wpd)	
13 08:14	07:37	06:39	17:00 (WEA Z011_EhW)	06:27	18:50 (WEA Z005_wpd)	
14 16:07	17:00	17:53	9 17:11 (WEA Z011_EhW)	19:48	16 19:10 (WEA Z003_wpd)	
15 08:13	07:36	06:37	06:25	18:51 (WEA Z005_wpd)	05:23	
16 16:09	17:02	17:55	19:49	14 19:09 (WEA Z005_wpd)	20:41	
17 08:13	07:34	06:35	06:22	18:56 (WEA Z005_wpd)	05:20	
18 16:10	17:04	17:56	19:51	20:43	21:24	
19 08:12	07:32	06:33	06:20	19:53	05:18	
20 16:12	17:06	17:58	19:53	20:44	21:25	
21 08:11	07:30	06:30	06:18	19:55	05:17	
22 16:13	17:08	18:00	19:55	20:46	21:26	
23 08:11	07:28	06:28	06:16	19:55	05:15	
24 16:15	17:10	18:02	19:56	20:48	21:26	
25 08:10	07:26	06:26	06:13	19:58	05:13	
26 16:16	17:12	18:04	19:58	20:49	21:27	
27 08:09	07:24	06:23	06:11	19:59	05:12	
28 16:18	17:14	18:05	20:00	20:51	21:28	
29 08:08	07:22	06:21	06:09	19:59	05:10	
30 16:19	17:16	18:07	20:01	20:52	21:28	
31 08:08	07:20	06:19	06:07	19:59	05:08	
1 16:21	17:18	18:09	20:03	20:54	21:29	
2 08:07	07:18	06:16	06:04	19:57	05:07	
3 16:22	17:19	18:11	20:05	7 19:58 (WEA Z003_wpd)	20:56	
4 08:06	07:16	06:14	06:02	19:58 (WEA Z003_wpd)	05:05	
5 16:24	17:21	18:13	20:07	11 19:41 (WEA Z003_wpd)	20:57	
6 08:05	07:14	06:12	06:00	19:57 (WEA Z003_wpd)	05:04	
7 16:26	17:23	18:14	20:08	14 19:41 (WEA Z003_wpd)	20:59	
8 08:04	07:12	06:09	05:56	19:57 (WEA Z003_wpd)	05:03	
9 16:27	17:25	18:15	20:10	17 19:41 (WEA Z003_wpd)	21:00	
10 08:03	07:10	06:07	05:56	19:59 (WEA Z003_wpd)	05:01	
11 16:29	17:27	18:18	20:12	20 19:41 (WEA Z003_wpd)	21:02	
12 08:01	07:08	06:05	05:54	19:58 (WEA Z003_wpd)	05:00	
13 16:31	17:29	18:20	20:14	22 19:41 (WEA Z003_wpd)	21:03	
14 08:00	07:06	06:02	05:51	19:57 (WEA Z003_wpd)	04:58	
15 16:33	17:31	18:21	20:15	24 19:41 (WEA Z003_wpd)	21:04	
16 07:59	07:04	06:00	05:49	19:52 (WEA Z003_wpd)	04:57	
17 16:34	17:33	18:22	20:17	26 19:41 (WEA Z003_wpd)	21:05	
18 07:58	07:02	05:57	05:47	19:52 (WEA Z003_wpd)	04:56	
19 16:36	17:34	18:23	20:19	28 19:41 (WEA Z003_wpd)	21:07	
20 07:56	06:59	05:55	05:45	19:51 (WEA Z003_wpd)	04:55	
21 16:38	17:36	18:27	20:21	30 19:41 (WEA Z003_wpd)	21:09	
22 07:55	06:57	05:53	05:43	19:50 (WEA Z003_wpd)	04:54	
23 16:40	17:38	18:28	20:22	22 19:41 (WEA Z003_wpd)	21:10	
24 07:53	06:55	05:51	05:41	19:49 (WEA Z003_wpd)	04:53	
25 16:42	17:40	18:30	20:24	24 19:41 (WEA Z003_wpd)	21:11	
26 07:52	06:53	05:49	05:39	19:48 (WEA Z003_wpd)	04:52	
27 16:43	17:42	18:32	20:26	26 19:41 (WEA Z003_wpd)	21:13	
28 07:50	06:51	05:47	05:37	19:47 (WEA Z003_wpd)	04:50	
29 16:45	17:44	18:34	20:27	28 19:41 (WEA Z003_wpd)	21:14	
30 07:49	06:49	05:45	05:35	19:46 (WEA Z003_wpd)	04:49	
31 16:47	17:46	18:35	20:29	30 19:41 (WEA Z003_wpd)	21:15	
Sonnenscheinstunden	1 256	1 367	1 417	1 488	1 502	
ast.max.mögl.Beschattung	339	95	146	419	328	662

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-11 - SR-11, Hoppegartener Straße 20, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:19 (WEA ZB01_wpd)05:23	06:14	07:04	06:59	07:51
2	21:30	22 20:41 (WEA ZB01_wpd)05:58	19:54	18:44	16:36	15:55
3	04:46	20:18 (WEA ZB01_wpd)05:24	06:15	07:06	07:01	07:52
4	21:30	23 20:41 (WEA ZB01_wpd)05:56	19:52	18:41	16:35	15:54
5	04:47	20:19 (WEA ZB01_wpd)05:26	06:17	18:54 (WEA ZB05_wpd)07:07	07:02	07:53
6	21:30	22 20:41 (WEA ZB01_wpd)05:54	19:50	10 19:04 (WEA ZB05_wpd)08:39	16:33	15:54
7	04:47	20:19 (WEA ZB01_wpd)05:27	06:19	06:19	18:52 (WEA ZB05_wpd)07:09	07:04
8	21:29	23 20:42 (WEA ZB01_wpd)05:52	19:47	14 19:06 (WEA ZB05_wpd)08:37	16:31	15:53
9	04:48	20:19 (WEA ZB01_wpd)05:29	06:20	18:50 (WEA ZB05_wpd)07:11	07:06	07:57
10	21:29	23 20:42 (WEA ZB01_wpd)05:51	19:45	16 19:06 (WEA ZB05_wpd)08:34	16:29	15:52
11	04:49	20:18 (WEA ZB01_wpd)05:31	06:22	18:49 (WEA ZB05_wpd)07:12	17:40 (WEA ZB11_EnBW)07:08	07:58
12	21:28	24 20:42 (WEA ZB01_wpd)05:49	19:43	18 19:07 (WEA ZB05_wpd)08:32	5 17:45 (WEA ZB11_EnBW)06:27	15:52
13	04:50	20:19 (WEA ZB01_wpd)05:32	06:24	18:48 (WEA ZB05_wpd)07:14	17:37 (WEA ZB11_EnBW)07:10	08:06 (WEA VBO1)08:03
14	21:28	23 20:42 (WEA ZB01_wpd)05:47	19:41	20 19:08 (WEA ZB05_wpd)08:30	11 17:48 (WEA ZB11_EnBW)06:25	6 08:18 (WEA VBO1)15:52
15	04:51	20:19 (WEA ZB01_wpd)05:34	06:25	18:47 (WEA ZB05_wpd)07:16	17:35 (WEA ZB11_EnBW)07:12	08:09 (WEA VBO1)08:00
16	21:27	24 20:43 (WEA ZB01_wpd)05:45	19:38	20 19:07 (WEA ZB05_wpd)08:27	14 17:49 (WEA ZB11_EnBW)06:24	12 08:21 (WEA VBO1)15:51
17	04:52	20:19 (WEA ZB01_wpd)05:35	06:27	18:47 (WEA ZB05_wpd)07:18	17:33 (WEA ZB11_EnBW)07:13	08:08 (WEA VBO1)08:02
18	21:26	24 20:43 (WEA ZB01_wpd)05:43	19:36	20 19:07 (WEA ZB05_wpd)08:25	16 17:49 (WEA ZB11_EnBW)06:22	15 08:23 (WEA VBO1)15:51
19	04:53	20:19 (WEA ZB01_wpd)05:37	10 19:37 (WEA ZB03_wpd)06:29	18:47 (WEA ZB05_wpd)07:19	17:32 (WEA ZB11_EnBW)07:15	08:06 (WEA VBO1)08:03
20	21:25	24 20:43 (WEA ZB01_wpd)05:41	19:37	20 19:07 (WEA ZB05_wpd)08:23	18 17:50 (WEA ZB11_EnBW)06:20	18 08:24 (WEA VBO1)15:51
21	04:54	20:19 (WEA ZB01_wpd)05:39	19:35	18:47 (WEA ZB05_wpd)07:21	17:31 (WEA ZB11_EnBW)07:17	08:06 (WEA VBO1)08:04
22	21:25	24 20:43 (WEA ZB01_wpd)05:39	19:34	19:04 (WEA ZB05_wpd)08:21	19 17:50 (WEA ZB11_EnBW)06:19	19 08:25 (WEA VBO1)15:50
23	04:55	20:19 (WEA ZB01_wpd)05:40	19:34	18:47 (WEA ZB05_wpd)07:23	17:31 (WEA ZB11_EnBW)07:19	08:05 (WEA VBO1)08:05
24	21:24	25 20:44 (WEA ZB01_wpd)05:37	16 19:50 (WEA ZB03_wpd)06:29	15 19:02 (WEA ZB05_wpd)08:18	19 17:50 (WEA ZB11_EnBW)06:17	21 08:26 (WEA VBO1)15:50
25	04:56	20:19 (WEA ZB01_wpd)05:42	19:32	18:47 (WEA ZB05_wpd)07:25	17:31 (WEA ZB11_EnBW)07:21	08:05 (WEA VBO1)08:06
26	21:23	25 20:44 (WEA ZB01_wpd)05:35	18 19:50 (WEA ZB03_wpd)06:26	12 18:59 (WEA ZB05_wpd)08:16	17 17:48 (WEA ZB11_EnBW)06:16	12 08:27 (WEA VBO1)15:50
27	04:57	20:19 (WEA ZB01_wpd)05:44	19:31	18:49 (WEA ZB05_wpd)07:26	17:31 (WEA ZB11_EnBW)07:23	08:05 (WEA VBO1)08:07
28	21:22	25 20:44 (WEA ZB01_wpd)05:33	20 19:51 (WEA ZB03_wpd)06:24	8 18:57 (WEA ZB05_wpd)08:14	14 17:45 (WEA ZB11_EnBW)06:14	22 08:27 (WEA VBO1)15:50
29	04:59	20:19 (WEA ZB01_wpd)05:45	19:30	18:51 (WEA ZB05_wpd)07:28	17:31 (WEA ZB11_EnBW)07:24	08:05 (WEA VBO1)08:08
30	21:21	25 20:44 (WEA ZB01_wpd)05:31	21 19:51 (WEA ZB03_wpd)06:22	4 18:55 (WEA ZB05_wpd)08:12	12 17:43 (WEA ZB11_EnBW)06:13	23 08:28 (WEA VBO1)15:50
31	05:00	20:20 (WEA ZB01_wpd)05:47	19:30	07:30	17:32 (WEA ZB11_EnBW)07:26	08:05 (WEA VBO1)08:09
1	21:20	24 20:44 (WEA ZB01_wpd)05:29	22 19:52 (WEA ZB03_wpd)06:19	18:09	9 17:41 (WEA ZB11_EnBW)06:11	23 08:28 (WEA VBO1)15:50
2	05:01	20:21 (WEA ZB01_wpd)05:49	19:29	07:32	17:34 (WEA ZB11_EnBW)07:28	08:05 (WEA VBO1)08:09
3	21:19	23 20:44 (WEA ZB01_wpd)05:27	22 19:51 (WEA ZB03_wpd)06:17	18:07	4 17:38 (WEA ZB11_EnBW)06:10	23 08:28 (WEA VBO1)15:51
4	05:02	20:21 (WEA ZB01_wpd)05:50	19:29	07:33	08:06 (WEA VBO1)08:10	08:06 (WEA VBO1)08:10
5	21:18	23 20:44 (WEA ZB01_wpd)05:25	23 19:52 (WEA ZB03_wpd)06:15	18:05	16:09	23 08:29 (WEA VBO1)15:51
6	05:04	20:21 (WEA ZB01_wpd)05:52	19:29	07:35	07:31	08:06 (WEA VBO1)08:11
7	21:17	22 20:43 (WEA ZB01_wpd)05:23	23 19:52 (WEA ZB03_wpd)06:12	18:03	16:07	23 08:29 (WEA VBO1)15:51
8	05:05	20:21 (WEA ZB01_wpd)05:54	19:28	07:37	07:33	08:06 (WEA VBO1)08:12
9	21:15	22 20:43 (WEA ZB01_wpd)05:21	23 19:51 (WEA ZB03_wpd)06:10	18:01	16:06	22 08:28 (WEA VBO1)15:51
10	05:06	20:22 (WEA ZB01_wpd)05:55	19:29	07:39	07:35	08:06 (WEA VBO1)08:12
11	21:14	20 20:42 (WEA ZB01_wpd)05:19	22 19:51 (WEA ZB03_wpd)06:07	17:59	16:05	22 08:28 (WEA VBO1)15:52
12	05:08	20:23 (WEA ZB01_wpd)05:57	19:29	07:41	07:37	08:08 (WEA VBO1)08:13
13	21:13	18 20:41 (WEA ZB01_wpd)05:17	19 19:48 (WEA ZB03_wpd)06:05	17:56	16:03	20 08:28 (WEA VBO1)15:52
14	05:09	20:23 (WEA ZB01_wpd)05:59	19:30	07:42	07:38	08:10 (WEA VBO1)08:13
15	21:11	16 20:39 (WEA ZB01_wpd)05:15	17 19:47 (WEA ZB03_wpd)06:03	17:54	16:02	18 08:28 (WEA VBO1)15:53
16	05:11	20:25 (WEA ZB01_wpd)06:00	19:30	07:44	08:12	18 (WEA VBO1)08:14
17	21:10	14 20:39 (WEA ZB01_wpd)05:12	14 19:44 (WEA ZB03_wpd)06:00	17:52	16:01	16 08:28 (WEA VBO1)15:53
18	05:12	20:25 (WEA ZB01_wpd)06:02	19:32	07:46	07:42	08:14 (WEA VBO1)08:14
19	21:09	12 20:37 (WEA ZB01_wpd)05:10	10 19:42 (WEA ZB03_wpd)05:58	16:50	16:00	14 08:28 (WEA VBO1)15:54
20	05:14	20:27 (WEA ZB01_wpd)06:04	19:35	06:48	07:43	08:15 (WEA VBO1)08:14
21	21:07	8 20:35 (WEA ZB01_wpd)05:08	6 19:41 (WEA ZB03_wpd)05:56	16:48	16:59	11 08:26 (WEA VBO1)15:55
22	05:15	20:30 (WEA ZB01_wpd)06:05	06:57	06:50	07:45	08:17 (WEA VBO1)08:15
23	21:06	5 20:35 (WEA ZB01_wpd)05:06	18:53	16:46	15:58	9 08:26 (WEA VBO1)15:56
24	05:17	21:04	20:03	06:59	07:46	08:19 (WEA VBO1)08:15
25	21:03	06:09	07:00	16:44	15:57	6 08:25 (WEA VBO1)15:56
26	05:20	21:01	18:48	06:55	07:48	08:21 (WEA VBO1)08:15
27	21:01	19:59	18:46	16:40	15:56	3 08:24 (WEA VBO1)15:57
28	05:21	20:59	06:12	06:57	07:49	08:15
29	20:59	19:57	16:38	16:38	15:59	15:59
30	Sonnenscheinstunden	505	455	381	331	264
31	astr. max. mögl. Beschattung	563	299	194	158	91

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-12 - SR-12, Hoppegartener Straße 20a, 15518 Schönefelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:53 (WEA V001)	06:41	06:35	04:49
2	16:00	16:49	17:42 18 17:11 (WEA ZB11_ErW)	19:37 20 19:08 (WEA ZB05_wpd)	20:29	21:16 24 20:31 (WEA ZB01_wpd)
3	08:15	07:46	06:51 (WEA V001)	06:39	06:33	04:48
4	16:00	16:51	17:44 16 17:09 (WEA ZB11_ErW)	19:39 20 19:09 (WEA ZB05_wpd)	20:31	21:17 24 20:31 (WEA ZB01_wpd)
5	08:14	07:44	06:48 (WEA V001)	06:36	06:31	04:47
6	16:00	16:53	17:45 14 17:08 (WEA ZB11_ErW)	19:41 19 19:07 (WEA ZB05_wpd)	20:33	21:18 23 20:30 (WEA ZB01_wpd)
7	08:15	07:42	06:46	06:34	06:29	04:46
8	16:00	16:55	17:47 10 17:08 (WEA ZB11_ErW)	19:42 18 19:08 (WEA ZB05_wpd)	20:34	21:19 23 20:31 (WEA ZB01_wpd)
9	08:14	07:41	06:44	06:32	06:27	04:45
10	16:00	16:57	17:49 4 17:12 (WEA ZB11_ErW)	19:44 15 19:05 (WEA ZB05_wpd)	20:36	21:20 22 20:30 (WEA ZB01_wpd)
11	08:14	07:39	06:42	06:29	06:25	04:45
12	16:00	16:59	17:51	19:46 12 19:02 (WEA ZB05_wpd)	20:38	21:21 23 20:31 (WEA ZB01_wpd)
13	08:14	07:37	06:39	06:27	06:24	04:44
14	16:00	17:00	17:53	19:48 5 18:59 (WEA ZB05_wpd)	20:39	21:22 22 20:30 (WEA ZB01_wpd)
15	08:13	07:36	06:37	06:25	06:22	04:44
16	16:00	17:02	17:55	19:49	20:41	21:23 22 20:31 (WEA ZB01_wpd)
17	08:13	07:34	06:35	06:22	06:20	04:43
18	16:00	17:04	17:56	19:51	20:43	21:24 21 20:30 (WEA ZB01_wpd)
19	08:12	07:32	06:33	06:20	06:18	04:43
20	16:12 2 08:45 (WEA V001)	17:06	17:58	19:53	20:44	21:25 20 20:30 (WEA ZB01_wpd)
21	08:11	07:30	06:30	06:18	06:17	04:42
22	16:13 5 08:47 (WEA V001)	17:08	18:00	19:55	20:46	21:26 20 20:31 (WEA ZB01_wpd)
23	08:11	07:28	06:28	06:16	06:15	04:42
24	16:15 7 08:48 (WEA V001)	17:10	18:02	19:56	20:48	21:26 20 20:30 (WEA ZB01_wpd)
25	08:10	07:26	06:26	06:13	06:12	04:42
26	16:16 9 08:49 (WEA V001)	17:12	18:04	19:58	20:49	21:27 19 20:30 (WEA ZB01_wpd)
27	08:09	07:24	06:23	06:11	06:10	04:41
28	16:18 11 08:50 (WEA V001)	17:14	18:05	20:00	20:51	21:28 19 20:30 (WEA ZB01_wpd)
29	08:08	07:22	06:21	06:09	06:08	04:41
30	16:19 14 08:52 (WEA V001)	17:16	18:07	20:01	20:52	21:28 18 20:30 (WEA ZB01_wpd)
31	08:08	07:20	06:19	06:07	06:06	04:41
1	16:21 16 08:53 (WEA V001)	17:18	18:09	20:03	20:54	21:29 18 20:30 (WEA ZB01_wpd)
2	08:07	07:18	06:16	06:04	06:03	04:41
3	16:22 18 08:54 (WEA V001)	17:19	18:11	20:05	20:56	21:29 18 20:31 (WEA ZB01_wpd)
4	08:06	07:16	06:14	06:02	06:01	04:41
5	16:24 19 08:54 (WEA V001)	17:21	18:13	20:07	20:57	21:30 18 20:31 (WEA ZB01_wpd)
6	08:05	07:14	06:12	06:00	05:59	04:41
7	16:25 21 08:54 (WEA V001)	17:23	18:14	20:08	20:59	21:30 18 20:31 (WEA ZB01_wpd)
8	08:04	07:12	06:09	05:58	05:57	04:41
9	16:27 22 08:55 (WEA V001)	17:25	18:16	20:10	21:00	21:30 18 20:31 (WEA ZB01_wpd)
10	08:03	07:10	06:07	05:56	05:55	04:41
11	16:29 22 08:56 (WEA V001)	17:27	18:18	20:12	21:02	21:31 18 20:31 (WEA ZB01_wpd)
12	08:01	07:08	06:05	05:54	05:53	04:41
13	16:31 23 08:57 (WEA V001)	17:29	18:20	20:14	21:03	21:31 18 20:32 (WEA ZB01_wpd)
14	08:00	07:06	06:02	05:51	05:50	04:42
15	16:33 23 08:57 (WEA V001)	17:31	18:21	20:15	21:04	21:31 18 20:32 (WEA ZB01_wpd)
16	07:59	07:04	06:00	05:49	05:47	04:42
17	16:34 24 08:57 (WEA V001)	17:33	18:23	20:17	21:06	21:31 18 20:32 (WEA ZB01_wpd)
18	07:58	07:02	05:57	05:47	05:46	04:42
19	16:36 22 08:57 (WEA V001)	17:34	18:25	20:19	21:07	21:31 18 20:32 (WEA ZB01_wpd)
20	07:56	06:59	05:55	05:45	05:44	04:43
21	16:38 21 08:57 (WEA V001)	17:36	18:27	20:21	21:09	21:31 17 20:32 (WEA ZB01_wpd)
22	07:55	06:57	05:53	05:43	05:42	04:43
23	16:40 21 08:57 (WEA V001)	17:38	18:28	20:22	21:10	21:31 18 20:32 (WEA ZB01_wpd)
24	07:53	06:55	05:50	05:41	05:40	04:44
25	16:42 20 08:57 (WEA V001)	17:40	18:30	20:24	21:11	21:31 18 20:33 (WEA ZB01_wpd)
26	07:52	06:53	05:48	05:39	05:38	04:44
27	16:43 19 08:56 (WEA V001)	17:42	18:32	20:26	21:13	21:31 19 20:33 (WEA ZB01_wpd)
28	07:50	06:51	05:46	05:37	05:36	04:45
29	16:45 17 08:55 (WEA V001)	17:44	18:34	20:27	21:14	21:31 19 20:34 (WEA ZB01_wpd)
30	07:49	06:49	05:43	05:35	05:34	04:45
31	16:47 17 08:55 (WEA V001)	17:46	18:36	20:29	21:15	21:31 19 20:34 (WEA ZB01_wpd)
Sonnenscheinstunden	256	276	307	417	488	502
ast.max.mögl.Beschattung	369	412	448	436	382	391

**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)	Zeitpunkt (SS:MM)	Schattenanfang	Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-12 - SR-12, Hoppegartener Straße 20a, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember	
1	04:45	20:15 (WEA Z801_wpd)	05:22	06:14	07:04	06:59	07:51
2	21:30	20:26 (WEA Z801_wpd)	20:58	19:54	18:44	16:36	15:25
3	04:46	20:24 (WEA Z801_wpd)	05:24	06:15	07:06	07:01	07:52
4	04:47	20:14 (WEA Z801_wpd)	05:26	06:17	07:07	07:02	07:54
5	21:30	20:25 (WEA Z801_wpd)	20:54	19:50	18:39	16:33	15:24
6	04:47	20:15 (WEA Z801_wpd)	05:27	06:19	07:09	07:04	07:55
7	21:29	20:26 (WEA Z801_wpd)	20:52	19:47	18:37	16:31	15:23
8	04:48	20:15 (WEA Z801_wpd)	05:29	06:20	07:11	07:06	07:57
9	21:29	20:26 (WEA Z801_wpd)	20:51	19:45	18:34	16:29	15:22
10	04:49	20:14 (WEA Z801_wpd)	05:31	06:22	07:12	07:07	07:58
11	21:28	20:26 (WEA Z801_wpd)	20:49	19:43	18:31	16:27	15:21
12	04:50	20:14 (WEA Z801_wpd)	05:32	06:24	07:14	07:09	07:59
13	21:28	20:27 (WEA Z801_wpd)	20:47	19:41	18:29	16:25	15:20
14	04:51	20:14 (WEA Z801_wpd)	05:34	06:25	07:16	07:12	08:00
15	21:27	20:27 (WEA Z801_wpd)	20:45	19:38	18:27	16:24	15:19
16	04:52	20:14 (WEA Z801_wpd)	05:35	06:27	07:18	07:13	08:02
17	21:26	20:27 (WEA Z801_wpd)	20:43	19:36	18:25	16:22	15:18
18	04:53	20:14 (WEA Z801_wpd)	05:37	06:29	07:19	07:15	08:03
19	21:25	20:28 (WEA Z801_wpd)	20:41	19:33	18:23	16:20	15:17
20	04:54	20:14 (WEA Z801_wpd)	05:39	06:30	07:21	07:17	08:04
21	21:25	20:28 (WEA Z801_wpd)	20:39	19:31	18:21	16:19	15:16
22	04:55	20:14 (WEA Z801_wpd)	05:40	06:32	07:23	07:19	08:05
23	21:24	20:28 (WEA Z801_wpd)	20:37	19:29	18:19	16:17	15:15
24	04:56	20:14 (WEA Z801_wpd)	05:42	06:34	07:25	07:20	08:09
25	21:23	20:29 (WEA Z801_wpd)	20:35	19:26	18:16	16:16	15:14
26	04:57	20:14 (WEA Z801_wpd)	05:44	06:35	07:26	07:23	08:09
27	21:22	20:29 (WEA Z801_wpd)	20:33	19:24	18:14	16:14	15:13
28	04:59	20:14 (WEA Z801_wpd)	05:45	06:37	07:28	07:24	08:08
29	21:21	20:29 (WEA Z801_wpd)	20:31	19:23	18:12	16:13	15:12
30	04:59	20:15 (WEA Z801_wpd)	05:47	06:38	07:30	07:26	08:09
31	21:20	20:29 (WEA Z801_wpd)	20:29	19:21	18:10	16:11	15:11
1	05:01	20:15 (WEA Z801_wpd)	05:48	06:40	07:32	07:28	08:09
2	21:19	20:30 (WEA Z801_wpd)	20:27	19:19	18:07	16:10	15:11
3	05:02	20:15 (WEA Z801_wpd)	05:50	06:42	07:33	07:25	08:09
4	21:18	20:30 (WEA Z801_wpd)	20:25	19:18	18:05	16:09	15:11
5	05:03	20:15 (WEA Z801_wpd)	05:52	06:44	07:35	07:23	08:09
6	21:17	20:30 (WEA Z801_wpd)	20:23	19:16	18:03	16:07	15:11
7	05:05	20:15 (WEA Z801_wpd)	05:54	06:45	07:37	07:23	08:11
8	21:15	20:30 (WEA Z801_wpd)	20:21	19:14	18:01	16:06	15:11
9	05:06	20:15 (WEA Z801_wpd)	05:55	06:47	07:39	07:25	08:12
10	21:14	20:30 (WEA Z801_wpd)	20:19	19:13	17:59	16:05	15:12
11	05:08	20:15 (WEA Z801_wpd)	05:57	06:49	07:41	07:27	08:13
12	21:13	20:30 (WEA Z801_wpd)	20:17	19:11	17:56	16:03	15:12
13	05:09	20:16 (WEA Z801_wpd)	05:59	06:50	07:42	07:28	08:13
14	21:12	20:30 (WEA Z801_wpd)	20:15	19:09	17:54	16:02	15:11
15	05:11	20:17 (WEA Z801_wpd)	06:00	06:52	07:44	07:30	08:14
16	21:11	20:30 (WEA Z801_wpd)	20:13	19:07	17:52	16:01	15:11
17	05:12	20:17 (WEA Z801_wpd)	06:02	06:54	07:46	07:32	08:14
18	21:10	20:30 (WEA Z801_wpd)	20:11	19:05	17:50	16:00	15:11
19	05:14	20:18 (WEA Z801_wpd)	06:04	06:55	07:48	07:34	08:15
20	21:07	20:30 (WEA Z801_wpd)	20:08	19:04	17:48	15:59	15:11
21	05:15	20:19 (WEA Z801_wpd)	06:05	06:57	07:50	07:36	08:15
22	21:06	20:30 (WEA Z801_wpd)	20:06	19:03	17:46	15:58	15:11
23	05:17	20:20 (WEA Z801_wpd)	06:07	06:59	07:51	07:38	08:15
24	21:04	20:33 (WEA Z801_wpd)	20:03	19:01	17:44	15:57	15:11
25	05:18	20:22 (WEA Z801_wpd)	06:09	07:00	07:53	07:40	08:15
26	21:03	20:32 (WEA Z801_wpd)	20:01	19:00	17:42	15:56	15:11
27	05:20	20:24 (WEA Z801_wpd)	06:10	07:02	07:55	07:42	08:15
28	21:02	20:32 (WEA Z801_wpd)	20:00	18:58	17:40	15:55	15:11
29	05:21	20:25 (WEA Z801_wpd)	06:12	07:04	07:57	07:44	08:15
30	20:59		06:13		07:58	07:46	08:15
31	20:59		06:13		07:58	07:46	08:15
Sonnenscheinstunden						264	159
strmax.mögl.Beschattung	637	409	331	200	162	7	241

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-13 - SR-13, Hoppegartener Straße 21, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:53	16:50 (WEA ZB11_EhBW)	06:41	18:44 (WEA ZB05_wpd)	05:35	04:49	20:02 (WEA ZB05_wpd)	
2	08:00	07:30	17:42	17:02 (WEA ZB11_EhBW)	19:37	18	18:02 (WEA ZB05_wpd)	20:29	21:16	20:25 (WEA ZB05_wpd)
3	08:15	07:46	06:51	16:52 (WEA ZB11_EhBW)	06:39	18:05 (WEA ZB05_wpd)	05:33	04:46	20:03 (WEA ZB05_wpd)	
4	08:00	07:30	17:44	16:59 (WEA ZB11_EhBW)	19:39	18	18:05 (WEA ZB05_wpd)	20:31	21:17	20:25 (WEA ZB05_wpd)
5	08:15	07:42	06:46	16:46	06:36	18:05 (WEA ZB05_wpd)	05:31	04:47	20:03 (WEA ZB05_wpd)	
6	08:04	07:38	17:45	16:46	19:41	13	18:05 (WEA ZB05_wpd)	20:33	21:18	20:24 (WEA ZB05_wpd)
7	08:14	07:41	06:44	16:44	06:34	18:48 (WEA ZB05_wpd)	05:29	04:46	20:04 (WEA ZB05_wpd)	
8	08:05	07:37	17:49	16:44	06:32	18:56 (WEA ZB05_wpd)	05:27	04:45	20:07 (WEA ZB05_wpd)	
9	08:13	07:36	17:51	16:43	06:29	19:44	20:36	21:20	20:24 (WEA ZB05_wpd)	
10	08:12	07:34	17:52	16:42	06:27	19:46	20:38	21:21	20:24 (WEA ZB05_wpd)	
11	08:12	07:32	17:53	16:41	06:25	19:46	20:38	21:21	20:24 (WEA ZB05_wpd)	
12	08:11	07:30	17:54	16:40	06:23	19:49	20:39	21:22	20:24 (WEA ZB05_wpd)	
13	08:10	07:28	17:55	16:39	06:21	19:51	20:40	21:23	20:24 (WEA ZB05_wpd)	
14	08:09	07:26	17:56	16:38	06:19	19:52	20:41	21:24	20:24 (WEA ZB05_wpd)	
15	08:08	07:24	17:57	16:37	06:17	19:53	20:42	21:25	20:24 (WEA ZB05_wpd)	
16	08:07	07:22	17:58	16:36	06:15	19:54	20:43	21:26	20:24 (WEA ZB05_wpd)	
17	08:06	07:20	17:59	16:35	06:13	19:55	20:44	21:27	20:24 (WEA ZB05_wpd)	
18	08:05	07:18	18:00	16:34	06:11	19:56	20:45	21:28	20:24 (WEA ZB05_wpd)	
19	08:04	07:16	18:01	16:33	06:09	19:57	20:46	21:29	20:24 (WEA ZB05_wpd)	
20	08:03	07:14	18:02	16:32	06:07	19:58	20:47	21:30	20:24 (WEA ZB05_wpd)	
21	08:02	07:12	18:03	16:31	06:05	19:59	20:48	21:31	20:24 (WEA ZB05_wpd)	
22	08:01	07:10	18:04	16:30	06:03	20:00	20:49	21:32	20:24 (WEA ZB05_wpd)	
23	08:00	07:08	18:05	16:29	06:01	20:01	20:50	21:33	20:24 (WEA ZB05_wpd)	
24	07:59	07:06	18:06	16:28	05:59	20:02	20:51	21:34	20:24 (WEA ZB05_wpd)	
25	07:58	07:04	18:07	16:27	05:57	20:03	20:52	21:35	20:24 (WEA ZB05_wpd)	
26	07:57	07:02	18:08	16:26	05:55	20:04	20:53	21:36	20:24 (WEA ZB05_wpd)	
27	07:56	07:00	18:09	16:25	05:53	20:05	20:54	21:37	20:24 (WEA ZB05_wpd)	
28	07:55	06:58	18:10	16:24	05:51	20:06	20:55	21:38	20:24 (WEA ZB05_wpd)	
29	07:54	06:56	18:11	16:23	05:49	20:07	20:56	21:39	20:24 (WEA ZB05_wpd)	
30	07:53	06:54	18:12	16:22	05:47	20:08	20:57	21:40	20:24 (WEA ZB05_wpd)	
31	07:52	06:52	18:13	16:21	05:45	20:09	20:58	21:41	20:24 (WEA ZB05_wpd)	
Sonnenscheinstunden	256	276	307	367	417	468	488	502	502	
akt.max.mögl.Beschattung	373	443	514	599	677	743	793	827	843	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:** SR-13 - SR-13, Hoppegartener Straße 21, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:13 (WEA ZBLI_wpd)	15:23	20:16 (WEA ZBLI_wpd)	06:14	19:21 (WEA ZBLI_wpd)
2	21:30	20:48 (WEA 13)	20:58	19:54	6	19:27 (WEA ZBLI_wpd)
3	09:47	20:22 (WEA ZBLI_wpd)	15:24	20:18 (WEA ZBLI_wpd)	06:15	19:28
4	21:30	20:27 (WEA ZBLI_wpd)	15:26	20:20 (WEA ZBLI_wpd)	15:52	18:54
5	09:47	20:12 (WEA ZBLI_wpd)	15:26	19:17	07:07	19:29
6	21:30	20:28 (WEA ZBLI_wpd)	15:24	19:50	18:39	19:33
7	09:47	20:12 (WEA ZBLI_wpd)	15:27	19:19	07:09	19:37
8	21:29	20:29 (WEA ZBLI_wpd)	15:26	19:48	18:39	19:31
9	09:48	20:12 (WEA ZBLI_wpd)	15:29	19:20	07:11	19:36
10	21:29	20:30 (WEA ZBLI_wpd)	15:31	19:45	18:34	19:32
11	09:49	20:11 (WEA ZBLI_wpd)	15:31	19:22	07:12	19:38
12	21:28	20:29 (WEA ZBLI_wpd)	15:32	19:43	18:32	19:27
13	09:49	20:11 (WEA ZBLI_wpd)	15:32	19:24	07:14	19:39
14	21:28	20:30 (WEA ZBLI_wpd)	15:37	19:41	18:30	19:25
15	09:51	20:11 (WEA ZBLI_wpd)	15:34	19:25	07:16	19:30
16	21:27	20:31 (WEA ZBLI_wpd)	15:45	19:38	7	18:40 (WEA ZBLI_wpd)
17	09:52	20:10 (WEA ZBLI_wpd)	15:35	19:27	18:40 (WEA ZBLI_wpd)	18:27
18	21:28	20:31 (WEA ZBLI_wpd)	15:43	19:36	18:52 (WEA ZBLI_wpd)	18:25
19	09:53	20:10 (WEA ZBLI_wpd)	15:37	19:29	18:38 (WEA ZBLI_wpd)	18:25
20	21:25	20:32 (WEA ZBLI_wpd)	15:41	19:33	18:54 (WEA ZBLI_wpd)	18:23
21	09:54	20:10 (WEA ZBLI_wpd)	15:40	19:30	18:36 (WEA ZBLI_wpd)	18:21
22	21:25	20:32 (WEA ZBLI_wpd)	15:40	19:31	18:54 (WEA ZBLI_wpd)	18:21
23	09:55	20:10 (WEA ZBLI_wpd)	15:40	19:32	18:35 (WEA ZBLI_wpd)	18:23
24	21:24	20:33 (WEA ZBLI_wpd)	15:37	19:29	20	18:55 (WEA ZBLI_wpd)
25	09:56	20:11 (WEA ZBLI_wpd)	15:42	19:34	18:34 (WEA ZBLI_wpd)	18:25
26	21:23	20:33 (WEA ZBLI_wpd)	15:36	19:30	20	18:54 (WEA ZBLI_wpd)
27	09:57	20:09 (WEA ZBLI_wpd)	15:44	19:35	18:34 (WEA ZBLI_wpd)	18:24
28	21:22	20:34 (WEA ZBLI_wpd)	15:33	19:24	20	18:54 (WEA ZBLI_wpd)
29	09:59	20:09 (WEA ZBLI_wpd)	15:45	19:37	18:34 (WEA ZBLI_wpd)	18:24
30	21:21	20:34 (WEA ZBLI_wpd)	15:37	19:34	18:34 (WEA ZBLI_wpd)	18:24
31	09:59	20:09 (WEA ZBLI_wpd)	15:45	19:37	18:34 (WEA ZBLI_wpd)	18:24
Sommerschneidung	156	160	162	163	163	163
astr.mögl.Beschattung	671	658	638	628	613	603

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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-14 - SR-14, Hoppegartener Straße 22, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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 08:15	07:47	06:53	06:41	05:35	04:49
2 16:00	16:49	17:42	18:42 (WEA ZB05_wpd)	20:29	21:16
3 08:15	07:46	06:51	06:39	05:31	04:46
4 16:00	16:51	17:44	18:39	20:31	21:17
5 08:15	07:44	06:48	06:36	05:28	04:47
6 16:00	16:53	17:46	18:41	20:33	21:18
7 08:15	07:42	06:46	06:34	05:29	04:46
8 16:04	16:55	17:47	18:42	20:34	21:19
9 08:14	08:46 (WEA V01)	07:41	06:32	05:27	04:45
10 16:05	1 08:47 (WEA V01)	16:57	17:49	18:46	20:36
11 08:14	08:45 (WEA V01)	07:39	06:42	05:25	04:45
12 16:06	3 08:48 (WEA V01)	16:59	17:51	18:46	20:38
13 08:14	08:45 (WEA V01)	07:37	06:39	05:24	04:44
14 16:07	5 08:50 (WEA V01)	17:00	17:53	18:48	20:39
15 08:13	08:44 (WEA V01)	07:36	06:37	05:23	04:44
16 16:09	7 08:51 (WEA V01)	17:02	17:55	18:49	20:41
17 08:12	08:43 (WEA V01)	07:34	06:36	05:22	04:44
18 16:10	8 08:51 (WEA V01)	17:04	17:56	18:51	20:42
19 08:12	08:43 (WEA V01)	07:32	06:33	05:18	04:43
20 16:12	10 08:53 (WEA V01)	17:06	17:58	18:53	20:44
21 08:11	08:42 (WEA V01)	07:30	06:30	05:17	04:42
22 16:13	12 08:54 (WEA V01)	17:08	18:00	18:55	20:46
23 08:11	08:41 (WEA V01)	07:28	06:28	05:15	04:42
24 16:15	14 08:55 (WEA V01)	17:10	18:02	18:56	20:48
25 08:10	08:40 (WEA V01)	07:26	06:26	05:13	04:42
26 16:16	15 08:55 (WEA V01)	17:12	18:04	18:58	20:49
27 08:09	08:39 (WEA V01)	07:24	06:23	05:11	04:41
28 16:18	17 08:56 (WEA V01)	17:14	18:05	18:59	20:51
29 08:08	08:38 (WEA V01)	07:22	06:21	05:10	04:41
30 16:19	19 08:57 (WEA V01)	17:16	4 16:47 (WEA ZB01_EH01)	18:07	19:01
31 08:08	08:37 (WEA V01)	07:20	16:42 (WEA ZB01_EH01)	18:09	19:03
1 16:21	20 08:57 (WEA V01)	17:18	7 16:49 (WEA ZB01_EH01)	18:09	19:03
2 08:07	08:37 (WEA V01)	07:18	16:41 (WEA ZB01_EH01)	18:04	19:01
3 16:22	21 08:58 (WEA V01)	17:19	11 16:52 (WEA ZB01_EH01)	18:11	19:05
4 08:06	08:37 (WEA V01)	07:16	16:40 (WEA ZB01_EH01)	18:04	19:01
5 16:24	21 08:58 (WEA V01)	17:21	16:54 (WEA ZB01_EH01)	18:13	19:07
6 08:05	08:37 (WEA V01)	07:14	16:40 (WEA ZB01_EH01)	18:02	19:00
7 16:26	21 08:59 (WEA V01)	17:23	16:56 (WEA ZB01_EH01)	18:14	19:08
8 08:04	08:37 (WEA V01)	07:12	16:40 (WEA ZB01_EH01)	18:05	19:01
9 16:27	22 08:59 (WEA V01)	17:25	16:58 (WEA ZB01_EH01)	18:16	19:10
10 08:03	08:36 (WEA V01)	07:10	16:38 (WEA ZB01_EH01)	18:07	19:01
11 16:29	21 08:59 (WEA V01)	17:27	16:58 (WEA ZB01_EH01)	18:18	19:11
12 08:01	08:36 (WEA V01)	07:08	16:39 (WEA ZB01_EH01)	18:05	19:01
13 16:31	20 08:59 (WEA V01)	17:29	16:58 (WEA ZB01_EH01)	18:20	19:12
14 08:00	08:36 (WEA V01)	07:06	16:40 (WEA ZB01_EH01)	18:02	19:01
15 16:33	20 08:59 (WEA V01)	17:31	16:57 (WEA ZB01_EH01)	18:21	19:13
16 07:59	08:40 (WEA V01)	07:04	16:40 (WEA ZB01_EH01)	18:00	19:01
17 16:34	19 08:59 (WEA V01)	17:33	16:57 (WEA ZB01_EH01)	18:23	19:14
18 08:00	08:41 (WEA V01)	07:02	16:42 (WEA ZB01_EH01)	18:01	19:01
19 16:36	17 08:58 (WEA V01)	17:34	16:56 (WEA ZB01_EH01)	18:25	19:16
20 07:56	08:42 (WEA V01)	06:59	16:43 (WEA ZB01_EH01)	18:05	19:01
21 16:38	16 08:58 (WEA V01)	17:36	16:53 (WEA ZB01_EH01)	18:27	19:18
22 07:55	08:41 (WEA V01)	06:57	16:40 (WEA ZB01_EH01)	18:03	19:01
23 16:40	14 08:57 (WEA V01)	17:38	16:53 (WEA ZB01_EH01)	18:28	19:19
24 07:53	08:45 (WEA V01)	06:55	16:50 (WEA ZB01_EH01)	18:04	19:01
25 16:42	11 08:56 (WEA V01)	17:40	16:50 (WEA ZB01_EH01)	18:30	19:24
26 07:52	08:46 (WEA V01)	06:53	16:48 (WEA ZB01_EH01)	18:02	19:01
27 16:43	4 08:52 (WEA V01)	17:42	16:52 (WEA ZB01_EH01)	18:32	19:26
28 07:50	08:47 (WEA V01)	06:51	16:46 (WEA ZB01_EH01)	18:01	19:01
29 16:45	11 08:56 (WEA V01)	17:44	16:54 (WEA ZB01_EH01)	18:34	19:28
30 07:49	08:48 (WEA V01)	06:49	16:43 (WEA ZB01_EH01)	18:00	19:01
31 16:47	12 08:57 (WEA V01)	17:46	16:55 (WEA ZB01_EH01)	18:36	19:31
Sonnenscheinstunden	1 256	276	367	417	488
akt.max.mögl.Beschattung	358	166	205	266	358

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang (WEA mit erstem Schatten)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-14 - SR-14, Hoppegartener Straße 22, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:13 (WEA2801_wpd)	05:23	20:06 (WEA2801_wpd)	06:14	19:07 (WEA2802_wpd)
2	21:30	20:50 (WEA13)	20:58	21	20:27 (WEA2801_wpd)	19:54
3	04:47	20:10 (WEA2801_wpd)	05:26	20:08 (WEA2801_wpd)	06:17	19:09 (WEA2803_wpd)
4	21:29	20:49 (WEA13)	20:56	20:24 (WEA2801_wpd)	19:50	19:22 (WEA2803_wpd)
5	04:48	20:09 (WEA2801_wpd)	05:27	20:09 (WEA2801_wpd)	06:19	19:11 (WEA2803_wpd)
6	21:29	20:49 (WEA13)	20:52	20:22 (WEA2801_wpd)	19:48	19:37
7	04:49	20:07 (WEA2801_wpd)	05:29	20:11 (WEA2801_wpd)	06:20	19:37
8	21:28	20:45 (WEA13)	20:49	20:21 (WEA2801_wpd)	19:45	19:37
9	04:50	20:07 (WEA2801_wpd)	05:32	20:11 (WEA2801_wpd)	06:22	19:37
10	21:28	20:45 (WEA13)	20:47	20:21 (WEA2801_wpd)	19:41	19:37
11	04:51	20:07 (WEA2801_wpd)	05:34	20:11 (WEA2801_wpd)	06:25	19:37
12	21:27	20:43 (WEA13)	20:45	20:21 (WEA2801_wpd)	19:38	19:37
13	04:52	20:06 (WEA2801_wpd)	05:35	20:11 (WEA2801_wpd)	06:27	19:37
14	21:26	20:24 (WEA2801_wpd)	20:43	20:21 (WEA2801_wpd)	19:36	19:37
15	04:53	20:06 (WEA2801_wpd)	05:37	20:11 (WEA2801_wpd)	06:29	19:37
16	21:25	20:25 (WEA2801_wpd)	20:41	20:21 (WEA2801_wpd)	19:33	19:37
17	04:54	20:05 (WEA2801_wpd)	05:39	20:11 (WEA2801_wpd)	06:30	19:37
18	21:25	20:25 (WEA2801_wpd)	20:39	20:21 (WEA2801_wpd)	19:31	19:37
19	04:55	20:05 (WEA2801_wpd)	05:40	20:11 (WEA2801_wpd)	06:32	19:37
20	21:24	20:26 (WEA2801_wpd)	20:37	20:21 (WEA2801_wpd)	19:29	19:37
21	04:56	20:05 (WEA2801_wpd)	05:42	20:11 (WEA2801_wpd)	06:34	19:37
22	21:23	20:27 (WEA2801_wpd)	20:33	20:21 (WEA2801_wpd)	19:26	19:37
23	04:57	20:04 (WEA2801_wpd)	05:44	20:11 (WEA2801_wpd)	06:35	19:37
24	21:22	20:27 (WEA2801_wpd)	20:33	20:21 (WEA2801_wpd)	19:24	19:37
25	04:59	20:04 (WEA2801_wpd)	05:45	20:11 (WEA2801_wpd)	06:37	19:37
26	21:21	20:27 (WEA2801_wpd)	20:31	20:21 (WEA2801_wpd)	19:22	19:37
27	05:00	20:04 (WEA2801_wpd)	05:47	20:11 (WEA2801_wpd)	06:39	19:37
28	21:20	20:29 (WEA2801_wpd)	20:29	20:21 (WEA2801_wpd)	19:19	19:37
29	05:01	20:04 (WEA2801_wpd)	05:49	20:11 (WEA2801_wpd)	06:40	19:37
30	21:19	20:29 (WEA2801_wpd)	20:27	20:21 (WEA2801_wpd)	19:17	19:37
31	05:02	20:04 (WEA2801_wpd)	05:50	20:11 (WEA2801_wpd)	06:42	19:37
1	21:18	20:29 (WEA2801_wpd)	20:25	20:21 (WEA2801_wpd)	19:15	19:37
2	05:04	20:04 (WEA2801_wpd)	05:52	20:11 (WEA2801_wpd)	06:44	19:37
3	21:17	20:29 (WEA2801_wpd)	20:23	20:21 (WEA2801_wpd)	19:12	19:37
4	05:05	20:04 (WEA2801_wpd)	05:54	20:11 (WEA2801_wpd)	06:45	19:37
5	21:16	20:29 (WEA2801_wpd)	20:21	20:21 (WEA2801_wpd)	19:10	19:37
6	05:06	20:04 (WEA2801_wpd)	05:55	20:11 (WEA2801_wpd)	06:47	19:37
7	21:15	20:30 (WEA2801_wpd)	20:19	20:21 (WEA2801_wpd)	19:07	19:37
8	05:08	20:04 (WEA2801_wpd)	05:57	20:11 (WEA2801_wpd)	06:49	19:37
9	21:14	20:30 (WEA2801_wpd)	20:17	20:21 (WEA2801_wpd)	19:05	19:37
10	05:09	20:04 (WEA2801_wpd)	05:59	20:11 (WEA2801_wpd)	06:50	19:37
11	21:13	20:30 (WEA2801_wpd)	20:15	20:21 (WEA2801_wpd)	19:03	19:37
12	05:11	20:04 (WEA2801_wpd)	06:00	20:11 (WEA2801_wpd)	06:52	19:37
13	21:12	20:30 (WEA2801_wpd)	20:13	20:21 (WEA2801_wpd)	19:01	19:37
14	05:12	20:04 (WEA2801_wpd)	06:02	20:11 (WEA2801_wpd)	06:54	19:37
15	21:11	20:30 (WEA2801_wpd)	20:11	20:21 (WEA2801_wpd)	18:59	19:37
16	05:14	20:04 (WEA2801_wpd)	06:04	20:11 (WEA2801_wpd)	06:55	19:37
17	21:10	20:30 (WEA2801_wpd)	20:09	20:21 (WEA2801_wpd)	18:56	19:37
18	05:15	20:04 (WEA2801_wpd)	06:05	20:11 (WEA2801_wpd)	06:57	19:37
19	21:09	20:30 (WEA2801_wpd)	20:06	20:21 (WEA2801_wpd)	18:53	19:37
20	05:17	20:04 (WEA2801_wpd)	06:07	20:11 (WEA2801_wpd)	06:59	19:37
21	21:08	20:29 (WEA2801_wpd)	20:03	20:21 (WEA2801_wpd)	18:51	19:37
22	05:18	20:04 (WEA2801_wpd)	06:09	20:11 (WEA2801_wpd)	07:00	19:37
23	21:07	20:29 (WEA2801_wpd)	20:01	20:21 (WEA2801_wpd)	18:48	19:37
24	05:20	20:04 (WEA2801_wpd)	06:10	20:11 (WEA2801_wpd)	07:02	19:37
25	21:06	20:29 (WEA2801_wpd)	19:59	20:21 (WEA2801_wpd)	18:46	19:37
26	05:21	20:04 (WEA2801_wpd)	06:12	20:11 (WEA2801_wpd)	07:03	19:37
27	21:05	20:29 (WEA2801_wpd)	19:57	20:21 (WEA2801_wpd)	18:43	19:37
28	05:23	20:04 (WEA2801_wpd)	06:13	20:11 (WEA2801_wpd)	07:04	19:37
29	21:04	20:29 (WEA2801_wpd)	19:55	20:21 (WEA2801_wpd)	18:41	19:37
30	05:24	20:04 (WEA2801_wpd)	06:14	20:11 (WEA2801_wpd)	07:05	19:37
31	21:03	20:29 (WEA2801_wpd)	19:53	20:21 (WEA2801_wpd)	18:39	19:37
1	05:25	20:04 (WEA2801_wpd)	06:15	20:11 (WEA2801_wpd)	07:06	19:37
2	21:02	20:29 (WEA2801_wpd)	19:51	20:21 (WEA2801_wpd)	18:37	19:37
3	05:26	20:04 (WEA2801_wpd)	06:16	20:11 (WEA2801_wpd)	07:07	19:37
4	21:01	20:29 (WEA2801_wpd)	19:49	20:21 (WEA2801_wpd)	18:35	19:37
5	05:27	20:04 (WEA2801_wpd)	06:17	20:11 (WEA2801_wpd)	07:08	19:37
6	20:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
7	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
8	20:57	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
9	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
10	20:55	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
11	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
12	20:53	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
13	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
14	20:51	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
15	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
16	20:49	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
17	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
18	20:47	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
19	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
20	20:45	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
21	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
22	20:43	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
23	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
24	20:41	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
25	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
26	20:39	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
27	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
28	20:37	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
29	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
30	20:35	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
31	04:59	20:07 (WEA2801_wpd)	05:31	20:11 (WEA2801_wpd)	06:52	19:37
Sonnenscheitelpunkt						
astr.max.mögl.Beschattung	750	405	273	172	264	47

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-15 - SR-15, Am Maxsee 4, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:08 (WEA ZB01_wpd)   07:48	08:34 (WEA 13)   06:53	06:41	05:35	04:49
	16:00	26 09:34 (WEA ZB01_wpd)   16:49	22 08:56 (WEA 13)   17:42	19:37	20:29	21:16
2	08:15	09:08 (WEA ZB01_wpd)   07:46	08:35 (WEA 13)   06:51	06:39	05:33	04:48
	16:01	26 09:34 (WEA ZB01_wpd)   16:51	21 08:56 (WEA 13)   17:44	19:39	20:31	21:18
3	08:15	09:09 (WEA ZB01_wpd)   07:44	08:36 (WEA 13)   06:49	06:36	05:31	04:47
	16:03	26 09:35 (WEA ZB01_wpd)   16:53	20 08:56 (WEA 13)   17:46	19:41	20:33	21:19
4	08:15	09:09 (WEA ZB01_wpd)   07:43	08:37 (WEA 13)   06:46	06:34	05:29	04:46
	16:04	26 09:35 (WEA ZB01_wpd)   16:55	18 08:55 (WEA 13)   17:47	19:42	20:35	21:20
5	08:15	09:09 (WEA ZB01_wpd)   07:41	08:38 (WEA 13)   06:44	06:32	05:27	04:45
	16:05	28 09:37 (WEA ZB01_wpd)   16:57	16 08:54 (WEA 13)   17:49	19:44	20:36	21:21
6	08:14	09:09 (WEA ZB01_wpd)   07:39	08:40 (WEA 13)   06:42	06:29	05:26	04:45
	16:06	28 09:37 (WEA ZB01_wpd)   16:59	12 08:52 (WEA 13)   17:51	19:46	20:38	21:22
7	08:14	09:10 (WEA ZB01_wpd)   07:37	08:42 (WEA 13)   06:40	06:27	05:24	04:44
	16:08	28 09:38 (WEA ZB01_wpd)   17:01	8 08:50 (WEA 13)   17:53	19:48	20:40	21:23
8	08:13	09:10 (WEA ZB01_wpd)   07:36	06:37	06:25	05:22	04:44
	16:09	28 09:38 (WEA ZB01_wpd)   17:02	17:55	19:49	20:41	21:24
9	08:13	09:11 (WEA ZB01_wpd)   07:34	06:35	06:23	05:20	04:43
	16:10	28 09:39 (WEA ZB01_wpd)   17:04	17:57	19:51	20:43	21:24
10	08:12	09:11 (WEA ZB01_wpd)   07:32	06:33	06:20	05:18	04:43
	16:12	28 09:39 (WEA ZB01_wpd)   17:06	17:58	19:53	20:45	21:25
11	08:12	09:11 (WEA ZB01_wpd)   07:30	06:30	06:18	05:17	04:42
	16:13	29 09:40 (WEA ZB01_wpd)   17:08	18:00	19:55	20:46	21:26
12	08:11	09:11 (WEA ZB01_wpd)   07:28	06:28	06:16	05:15	04:42
	16:15	29 09:40 (WEA ZB01_wpd)   17:10	18:02	19:56	20:48	21:27
13	08:10	09:11 (WEA ZB01_wpd)   07:26	06:26	06:13	05:13	04:42
	16:16	29 09:40 (WEA ZB01_wpd)   17:12	18:04	19:58	20:49	21:27
14	08:09	09:12 (WEA ZB01_wpd)   07:24	06:23	06:11	05:12	04:41
	16:18	29 09:41 (WEA ZB01_wpd)   17:14	18:06	20:00	20:51	21:28
15	08:09	09:12 (WEA ZB01_wpd)   07:22	06:21	06:09	05:10	04:41
	16:19	29 09:41 (WEA ZB01_wpd)   17:16	18:07	20:02	20:53	21:29
16	08:08	09:13 (WEA ZB01_wpd)   07:21	06:19	06:07	05:08	04:41
	16:21	28 09:41 (WEA ZB01_wpd)   17:18	18:09	20:03	20:54	21:29
17	08:07	09:13 (WEA ZB01_wpd)   07:18	06:16	06:05	05:07	04:41
	16:22	29 09:42 (WEA ZB01_wpd)   17:20	18:11	20:05	20:56	21:30
18	08:06	08:41 (WEA 13)   07:16	06:14	06:02	05:05	04:41
	16:24	31 09:42 (WEA ZB01_wpd)   17:21	18:13	20:07	20:57	21:30
19	08:05	08:38 (WEA 13)   07:14	06:12	06:00	05:04	04:41
	16:26	36 09:42 (WEA ZB01_wpd)   17:23	18:14	20:09	20:59	21:30
20	08:04	08:36 (WEA 13)   07:12	06:09	05:58	05:03	04:41
	16:27	39 09:41 (WEA ZB01_wpd)   17:25	18:16	20:10	21:00	21:31
21	08:03	08:35 (WEA 13)   07:10	06:07	05:56	05:01	04:41
	16:29	40 09:41 (WEA ZB01_wpd)   17:27	18:18	20:12	21:02	21:31
22	08:01	08:35 (WEA 13)   07:08	06:05	05:54	05:00	04:41
	16:31	42 09:42 (WEA ZB01_wpd)   17:29	18:20	20:14	21:03	21:31
23	08:00	08:34 (WEA 13)   07:06	06:02	05:52	04:58	04:42
	16:33	42 09:41 (WEA ZB01_wpd)   17:31	18:21	20:16	21:05	21:31
24	07:59	08:34 (WEA 13)   07:04	06:00	05:49	04:57	04:42
	16:34	41 09:40 (WEA ZB01_wpd)   17:33	18:23	20:17	21:06	21:31
25	07:58	08:33 (WEA 13)   07:02	05:58	05:47	04:56	04:42
	16:36	41 09:39 (WEA ZB01_wpd)   17:35	18:25	20:19	21:07	21:31
26	07:56	08:33 (WEA 13)   07:00	05:55	05:45	04:55	04:43
	16:38	38 09:38 (WEA ZB01_wpd)   17:36	18:27	20:21	21:09	21:31
27	07:55	08:33 (WEA 13)   06:57	05:53	05:43	04:54	04:43
	16:40	35 09:36 (WEA ZB01_wpd)   17:38	18:28	20:22	21:10	21:31
28	07:54	08:34 (WEA 13)   06:55	05:51	05:41	04:53	04:44
	16:42	29 09:34 (WEA ZB01_wpd)   17:40	18:30	20:24	21:11	21:31
29	07:52	08:33 (WEA 13)   06:53	06:48	05:39	04:52	04:44
	16:44	23 08:56 (WEA 13)   06:51	19:32	20:26	21:13	21:31
30	07:51	08:34 (WEA 13)   06:50	06:46	05:37	04:50	04:45
	16:45	23 08:57 (WEA 13)   06:48	19:34	20:28	21:14	21:31
31	07:49	08:34 (WEA 13)   06:47	06:43	05:35	04:50	04:45
	16:47	23 08:57 (WEA 13)   06:45	19:35	20:29	21:15	21:31
	Sonnenscheinstunden   256	276	367	417	488	502
	astr.max.mögl.Beschattung   957	117				

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-15 - SR-15, Am Maxsee 4, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:36	07:51 15:55	08:53 (WEA ZB01_wpd) 29 09:22 (WEA ZB01_wpd)		
2	04:46 21:30	05:24 20:56	06:15 19:52	07:06 18:42	07:01 16:35	07:53 15:54	08:54 (WEA ZB01_wpd) 29 09:23 (WEA ZB01_wpd)		
3	04:47 21:30	05:26 20:54	06:17 19:50	07:07 18:39	07:03 16:33	07:54 15:54	08:54 (WEA ZB01_wpd) 28 09:22 (WEA ZB01_wpd)		
4	04:48 21:29	05:27 20:53	06:19 19:48	07:09 18:37	07:04 16:31	08:11 (WEA 13) 08:20 (WEA 13)	07:55 15:53	08:55 (WEA ZB01_wpd) 28 09:23 (WEA ZB01_wpd)	
5	04:48 21:29	05:29 20:51	06:20 19:45	07:11 18:35	07:06 16:29	08:09 (WEA 13) 08:22 (WEA 13)	07:57 15:53	08:55 (WEA ZB01_wpd) 28 09:23 (WEA ZB01_wpd)	
6	04:49 21:28	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:27	08:08 (WEA 13) 08:24 (WEA 13)	07:58 15:52	08:55 (WEA ZB01_wpd) 28 09:23 (WEA ZB01_wpd)	
7	04:50 21:28	05:32 20:47	06:24 19:41	07:14 18:30	07:10 16:26	08:07 (WEA 13) 08:25 (WEA 13)	07:59 15:52	08:56 (WEA ZB01_wpd) 28 09:24 (WEA ZB01_wpd)	
8	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:28	07:12 16:24	08:06 (WEA 13) 08:26 (WEA 13)	08:01 15:51	08:57 (WEA ZB01_wpd) 27 09:24 (WEA ZB01_wpd)	
9	04:52 21:26	05:36 20:43	06:27 19:36	07:18 18:25	07:14 16:22	08:05 (WEA 13) 08:27 (WEA 13)	08:02 15:51	08:57 (WEA ZB01_wpd) 27 09:24 (WEA ZB01_wpd)	
10	04:53 21:26	05:37 20:42	06:29 19:34	07:19 18:23	07:15 16:21	08:05 (WEA 13) 08:27 (WEA 13)	08:03 15:51	08:57 (WEA ZB01_wpd) 27 09:24 (WEA ZB01_wpd)	
11	04:54 21:25	05:39 20:40	06:30 19:31	07:21 18:21	07:17 16:19	08:05 (WEA 13) 08:28 (WEA 13)	08:04 15:51	08:59 (WEA ZB01_wpd) 26 09:25 (WEA ZB01_wpd)	
12	04:55 21:24	05:40 20:38	06:32 19:29	07:23 18:18	07:19 16:17	08:05 (WEA 13) 08:28 (WEA 13)	08:05 15:50	08:59 (WEA ZB01_wpd) 26 09:25 (WEA ZB01_wpd)	
13	04:56 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:05 (WEA 13) 08:28 (WEA 13)	08:06 15:50	09:00 (WEA ZB01_wpd) 25 09:25 (WEA ZB01_wpd)	
14	04:58 21:22	05:44 20:34	06:35 19:24	07:26 18:14	07:23 16:14	08:05 (WEA 13) 09:06 (WEA ZB01_wpd)	08:07 15:50	09:01 (WEA ZB01_wpd) 24 09:25 (WEA ZB01_wpd)	
15	04:59 21:21	05:45 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:06 (WEA 13) 09:09 (WEA ZB01_wpd)	08:08 15:50	09:01 (WEA ZB01_wpd) 25 09:26 (WEA ZB01_wpd)	
16	05:00 21:20	05:47 20:30	06:39 19:19	07:30 18:10	07:26 16:11	08:06 (WEA 13) 09:11 (WEA ZB01_wpd)	08:09 15:50	09:01 (WEA ZB01_wpd) 24 09:25 (WEA ZB01_wpd)	
17	05:01 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:28 16:10	08:07 (WEA 13) 09:13 (WEA ZB01_wpd)	08:10 15:51	09:02 (WEA ZB01_wpd) 24 09:26 (WEA ZB01_wpd)	
18	05:02 21:18	05:50 20:25	06:42 19:15	07:34 18:05	07:30 16:09	08:08 (WEA 13) 09:14 (WEA ZB01_wpd)	08:10 15:51	09:03 (WEA ZB01_wpd) 23 09:26 (WEA ZB01_wpd)	
19	05:04 21:17	05:52 20:23	06:44 19:12	07:35 18:03	07:32 16:07	08:09 (WEA 13) 09:16 (WEA ZB01_wpd)	08:11 15:51	09:04 (WEA ZB01_wpd) 23 09:27 (WEA ZB01_wpd)	
20	05:05 21:16	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	08:10 (WEA 13) 09:17 (WEA ZB01_wpd)	08:12 15:52	09:03 (WEA ZB01_wpd) 24 09:27 (WEA ZB01_wpd)	
21	05:06 21:14	05:55 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:11 (WEA 13) 09:17 (WEA ZB01_wpd)	08:12 15:52	09:04 (WEA ZB01_wpd) 24 09:28 (WEA ZB01_wpd)	
22	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:12 (WEA 13) 09:17 (WEA ZB01_wpd)	08:13 15:52	09:04 (WEA ZB01_wpd) 24 09:28 (WEA ZB01_wpd)	
23	05:09 21:12	05:59 20:15	06:50 19:03	07:43 17:54	07:38 16:02	08:14 (WEA 13) 09:18 (WEA ZB01_wpd)	08:13 15:53	09:05 (WEA ZB01_wpd) 24 09:29 (WEA ZB01_wpd)	
24	05:11 21:10	06:00 20:13	06:52 19:00	07:44 17:52	07:40 16:01	08:17 (WEA 13) 09:19 (WEA ZB01_wpd)	08:14 15:53	09:05 (WEA ZB01_wpd) 24 09:29 (WEA ZB01_wpd)	
25	05:12 21:09	06:02 20:10	06:54 18:58	07:46 16:50	07:42 16:00	08:51 (WEA ZB01_wpd) 09:20 (WEA ZB01_wpd)	08:14 15:54	09:06 (WEA ZB01_wpd) 23 09:29 (WEA ZB01_wpd)	
26	05:14 21:07	06:04 20:08	06:55 18:56	07:48 16:48	07:43 15:59	08:52 (WEA ZB01_wpd) 09:20 (WEA ZB01_wpd)	08:15 15:55	09:07 (WEA ZB01_wpd) 24 09:31 (WEA ZB01_wpd)	
27	05:15 21:06	06:05 20:06	06:57 18:53	07:50 16:46	07:45 15:58	08:51 (WEA ZB01_wpd) 09:20 (WEA ZB01_wpd)	08:15 15:56	09:07 (WEA ZB01_wpd) 24 09:31 (WEA ZB01_wpd)	
28	05:17 21:04	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:57	08:52 (WEA ZB01_wpd) 09:21 (WEA ZB01_wpd)	08:15 15:56	09:07 (WEA ZB01_wpd) 25 09:32 (WEA ZB01_wpd)	
29	05:18 21:03	06:09 20:01	07:01 18:49	07:53 16:42	07:48 15:57	08:52 (WEA ZB01_wpd) 09:21 (WEA ZB01_wpd)	08:15 15:57	09:08 (WEA ZB01_wpd) 24 09:32 (WEA ZB01_wpd)	
30	05:20 21:01	06:10 19:59	07:02 18:46	07:55 16:40	07:50 15:56	08:52 (WEA ZB01_wpd) 09:21 (WEA ZB01_wpd)	08:15 15:58	09:08 (WEA ZB01_wpd) 25 09:33 (WEA ZB01_wpd)	
31	05:21 21:00	06:12 19:57	07:03 18:44	07:56 16:38	07:51 16:38	08:53 (WEA ZB01_wpd) 09:22 (WEA ZB01_wpd)	08:16 15:59	09:09 (WEA ZB01_wpd) 26 09:34 (WEA ZB01_wpd)	
	Sonnenscheinstunden	505	455	381	331	264	780	241	790
	astr.max.mögl.Beschattung								

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattende	WEA mit erstem Schatten	WEA mit letztem Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-16 - SR-16, Am Fuchsbau 9, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:51 (WEA ZB07_vpd)	07:48	06:53	06:41	05:35	04:49		
	16:01	15 09:06 (WEA ZB07_vpd)	16:49	17:42	19:37	20:29	21:16		
2	08:15	08:51 (WEA ZB07_vpd)	07:46	06:51	07:15 (WEA ZB04_vpd)	06:39	05:33	04:48	
	16:02	16 09:07 (WEA ZB07_vpd)	16:51	17:44	6 07:21 (WEA ZB04_vpd)	19:39	20:31	21:18	
3	08:15	08:51 (WEA ZB07_vpd)	07:44	06:49	07:12 (WEA ZB04_vpd)	06:37	05:31	04:47	
	16:03	17 09:08 (WEA ZB07_vpd)	16:53	17:46	12 07:24 (WEA ZB04_vpd)	19:41	20:33	21:19	
4	08:15	08:50 (WEA ZB07_vpd)	07:43	06:46	07:10 (WEA ZB04_vpd)	06:34	05:29	04:46	
	16:04	19 09:09 (WEA ZB07_vpd)	16:55	17:48	15 07:25 (WEA ZB04_vpd)	19:43	20:35	21:20	
5	08:15	08:51 (WEA ZB07_vpd)	07:41	06:44	07:09 (WEA ZB04_vpd)	06:32	05:28	04:46	
	16:05	19 09:10 (WEA ZB07_vpd)	16:57	17:49	18 07:27 (WEA ZB04_vpd)	19:44	20:36	21:21	
6	08:14	08:51 (WEA ZB07_vpd)	07:39	06:42	07:07 (WEA ZB04_vpd)	06:30	05:26	04:45	
	16:06	20 09:11 (WEA ZB07_vpd)	16:59	7 08:10 (WEA ZB06_vpd)	19 07:26 (WEA ZB04_vpd)	19:46	20:38	21:22	
7	08:14	08:51 (WEA ZB07_vpd)	07:38	06:40	07:07 (WEA ZB04_vpd)	06:27	05:24	04:44	
	16:08	21 09:12 (WEA ZB07_vpd)	17:01	13 08:20 (WEA ZB06_vpd)	20 07:27 (WEA ZB04_vpd)	19:48	20:40	21:23	
8	08:13	08:51 (WEA ZB07_vpd)	07:36	06:37	08:05 (WEA ZB06_vpd)	06:25	05:22	04:44	
	16:09	21 09:12 (WEA ZB07_vpd)	17:03	17 08:22 (WEA ZB06_vpd)	20 07:27 (WEA ZB04_vpd)	19:50	20:41	21:24	
9	08:13	08:51 (WEA ZB07_vpd)	07:34	06:35	08:04 (WEA ZB06_vpd)	06:23	05:20	04:43	
	16:10	23 09:14 (WEA ZB07_vpd)	17:04	19 08:23 (WEA ZB06_vpd)	20 07:26 (WEA ZB04_vpd)	19:51	20:43	21:24	
10	08:12	08:51 (WEA ZB07_vpd)	07:32	06:33	08:04 (WEA ZB06_vpd)	06:20	05:18	04:43	
	16:12	23 09:14 (WEA ZB07_vpd)	17:06	21 08:25 (WEA ZB06_vpd)	20 07:26 (WEA ZB04_vpd)	19:53	20:45	21:25	
11	08:12	08:51 (WEA ZB07_vpd)	07:30	06:30	08:03 (WEA ZB06_vpd)	06:18	05:17	04:42	
	16:13	24 09:15 (WEA ZB07_vpd)	17:08	23 08:26 (WEA ZB06_vpd)	19 07:26 (WEA ZB04_vpd)	19:55	20:46	21:26	
12	08:11	08:51 (WEA ZB07_vpd)	07:28	06:28	08:03 (WEA ZB06_vpd)	06:16	05:15	04:42	
	16:15	24 09:15 (WEA ZB07_vpd)	17:10	24 08:27 (WEA ZB06_vpd)	18:02	17 07:24 (WEA ZB04_vpd)	19:57	20:48	21:27
13	08:10	08:51 (WEA ZB07_vpd)	07:26	06:26	08:02 (WEA ZB06_vpd)	06:14	05:13	04:42	
	16:16	25 09:16 (WEA ZB07_vpd)	17:12	25 08:27 (WEA ZB06_vpd)	18:04	14 07:22 (WEA ZB04_vpd)	19:58	20:50	21:27
14	08:10	08:51 (WEA ZB07_vpd)	07:25	06:24	08:01 (WEA ZB06_vpd)	06:11	05:12	04:42	
	16:18	25 09:16 (WEA ZB07_vpd)	17:14	25 08:26 (WEA ZB06_vpd)	18:06	9 07:20 (WEA ZB04_vpd)	20:00	20:51	21:28
15	08:09	08:51 (WEA ZB07_vpd)	07:23	06:21	08:01 (WEA ZB06_vpd)	06:09	05:10	04:41	
	16:19	26 09:17 (WEA ZB07_vpd)	17:16	25 08:26 (WEA ZB06_vpd)	18:07	20:02	20:53	21:29	
16	08:08	08:52 (WEA ZB07_vpd)	07:21	06:19	08:01 (WEA ZB06_vpd)	06:07	05:09	04:41	
	16:21	26 09:18 (WEA ZB07_vpd)	17:18	25 08:26 (WEA ZB06_vpd)	18:09	20:03	20:54	21:29	
17	08:07	08:52 (WEA ZB07_vpd)	07:19	06:17	08:01 (WEA ZB06_vpd)	06:05	05:07	04:41	
	16:23	26 09:18 (WEA ZB07_vpd)	17:20	25 08:26 (WEA ZB06_vpd)	18:11	20:05	20:56	21:30	
18	08:06	08:53 (WEA ZB07_vpd)	07:17	06:14	08:02 (WEA ZB06_vpd)	06:02	05:06	04:41	
	16:24	26 09:19 (WEA ZB07_vpd)	17:22	24 08:26 (WEA ZB06_vpd)	18:13	20:07	20:57	21:30	
19	08:05	08:53 (WEA ZB07_vpd)	07:15	06:12	08:03 (WEA ZB06_vpd)	06:00	05:04	04:41	
	16:26	26 09:19 (WEA ZB07_vpd)	17:23	22 08:25 (WEA ZB06_vpd)	18:15	20:09	20:59	21:30	
20	08:04	08:53 (WEA ZB07_vpd)	07:12	06:09	08:04 (WEA ZB06_vpd)	06:09	05:08	04:41	
	16:28	26 09:19 (WEA ZB07_vpd)	17:25	20 08:24 (WEA ZB06_vpd)	18:16	20:10	21:00	21:31	
21	08:03	08:54 (WEA ZB07_vpd)	07:10	06:07	08:05 (WEA ZB06_vpd)	06:07	05:06	04:41	
	16:29	25 09:19 (WEA ZB07_vpd)	17:27	18 08:23 (WEA ZB06_vpd)	18:18	20:12	21:02	21:31	
22	08:02	08:54 (WEA ZB07_vpd)	07:08	06:05	08:06 (WEA ZB06_vpd)	06:05	05:04	04:42	
	16:31	25 09:19 (WEA ZB07_vpd)	17:29	15 08:21 (WEA ZB06_vpd)	18:20	20:14	21:03	21:31	
23	08:00	08:54 (WEA ZB07_vpd)	07:06	06:02	08:08 (WEA ZB06_vpd)	06:02	05:02	04:42	
	16:33	25 09:19 (WEA ZB07_vpd)	17:31	10 08:18 (WEA ZB06_vpd)	18:22	20:16	21:05	21:31	
24	07:59	08:56 (WEA ZB07_vpd)	07:04	06:00		05:50	04:57	04:42	
	16:35	23 09:19 (WEA ZB07_vpd)	17:33	18:23		20:17	21:06	21:31	
25	07:58	08:57 (WEA ZB07_vpd)	07:02	05:58		05:47	04:56	04:42	
	16:36	22 09:19 (WEA ZB07_vpd)	17:35	18:25		20:19	21:08	21:32	
26	07:56	08:57 (WEA ZB07_vpd)	07:00	05:55		05:45	04:55	04:43	
	16:38	21 09:18 (WEA ZB07_vpd)	17:37	18:27		20:21	21:09	21:32	
27	07:55	08:58 (WEA ZB07_vpd)	06:58	05:53		05:43	04:54	04:43	
	16:40	19 09:17 (WEA ZB07_vpd)	17:38	18:29		20:23	21:10	21:31	
28	07:54	09:00 (WEA ZB07_vpd)	06:55	05:51		05:41	04:53	04:44	
	16:42	17 09:17 (WEA ZB07_vpd)	17:40	18:30		20:24	21:12	21:31	
29	07:52	09:01 (WEA ZB07_vpd)		06:48		05:39	04:52	04:44	
	16:44	14 09:15 (WEA ZB07_vpd)		19:32		20:26	21:13	21:31	
30	07:51	09:05 (WEA ZB07_vpd)		06:46		05:37	04:51	04:45	
	16:46	8 09:13 (WEA ZB07_vpd)		19:34		20:28	21:14	21:31	
31	07:49			06:44			04:50		
	16:47			19:36			21:15		
Sonnenscheinstunden	256		276	367		417	488	502	
astr.max.mögl.Beschattung	647		358	209					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-16 - SR-16, Am Fuchsbau 9, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober	November	Dezember	
1	04:45	05:23	06:14	07:04	07:47 (WEA ZB04_wpd)06:59	07:33 (WEA ZB06_wpd)07:51	08:33 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16 08:03 (WEA ZB04_wpd)16:37	21 07:54 (WEA ZB06_wpd)15:55	24 08:57 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:45 (WEA ZB04_wpd)07:01	07:34 (WEA ZB06_wpd)07:53	08:34 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	18 08:03 (WEA ZB04_wpd)16:35	19 07:53 (WEA ZB06_wpd)15:54	23 08:57 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:44 (WEA ZB04_wpd)07:03	07:35 (WEA ZB06_wpd)07:54	08:34 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	20 08:04 (WEA ZB04_wpd)16:33	16 07:51 (WEA ZB06_wpd)15:54	23 08:57 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:44 (WEA ZB04_wpd)07:05	07:37 (WEA ZB06_wpd)07:55	08:36 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	20 08:04 (WEA ZB04_wpd)16:31	13 07:50 (WEA ZB06_wpd)15:53	21 08:57 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:44 (WEA ZB04_wpd)07:06	07:40 (WEA ZB06_wpd)07:57	08:36 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	20 08:04 (WEA ZB04_wpd)16:29	7 07:47 (WEA ZB06_wpd)15:53	21 08:57 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:43 (WEA ZB04_wpd)07:08	07:58	08:36 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	20 08:03 (WEA ZB04_wpd)16:27	15:52	21 08:57 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:43 (WEA ZB04_wpd)07:10	07:59	08:38 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	20 08:03 (WEA ZB04_wpd)16:26	15:52	19 08:57 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:44 (WEA ZB04_wpd)07:12	08:01	08:39 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	18 08:02 (WEA ZB04_wpd)16:24	15:51	18 08:57 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:44 (WEA ZB04_wpd)07:14	08:02	08:39 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	17 08:01 (WEA ZB04_wpd)16:22	15:51	18 08:57 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB04_wpd)07:16	08:03	08:41 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	14 07:59 (WEA ZB04_wpd)16:21	15:51	16 08:57 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:47 (WEA ZB04_wpd)07:17	08:04	08:42 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	10 07:57 (WEA ZB04_wpd)16:19	15:51	15 08:57 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:49	08:35 (WEA ZB07_wpd)08:05	08:42 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	9 08:44 (WEA ZB07_wpd)15:51	15 08:57 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	9 08:33 (WEA ZB07_wpd)08:06	08:43 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	14 08:47 (WEA ZB07_wpd)15:50	14 08:57 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	08:32 (WEA ZB07_wpd)08:07	08:44 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	17 08:49 (WEA ZB07_wpd)15:50	13 08:57 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	08:31 (WEA ZB07_wpd)08:08	08:45 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	19 08:50 (WEA ZB07_wpd)15:51	12 08:57 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:30 (WEA ZB07_wpd)08:09	08:46 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	21 08:51 (WEA ZB07_wpd)15:51	11 08:57 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:30 (WEA ZB07_wpd)08:10	08:46 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	22 08:52 (WEA ZB07_wpd)15:51	10 08:56 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:43 (WEA ZB06_wpd)07:30	08:30 (WEA ZB07_wpd)08:10	08:48 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	3 08:46 (WEA ZB06_wpd)16:09	23 08:53 (WEA ZB07_wpd)15:51	9 08:57 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:39 (WEA ZB06_wpd)07:32	08:29 (WEA ZB07_wpd)08:11	08:49 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	12 08:51 (WEA ZB06_wpd)16:07	25 08:54 (WEA ZB07_wpd)15:51	8 08:57 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:36 (WEA ZB06_wpd)07:33	08:29 (WEA ZB07_wpd)08:12	08:49 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	17 08:53 (WEA ZB06_wpd)16:06	25 08:54 (WEA ZB07_wpd)15:52	8 08:57 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	08:35 (WEA ZB06_wpd)07:35	08:30 (WEA ZB07_wpd)08:12	08:50 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	19 08:54 (WEA ZB06_wpd)16:05	25 08:55 (WEA ZB07_wpd)15:52	8 08:58 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	08:34 (WEA ZB06_wpd)07:37	08:30 (WEA ZB07_wpd)08:13	08:50 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	21 08:55 (WEA ZB06_wpd)16:04	26 08:56 (WEA ZB07_wpd)15:53	8 08:58 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	08:33 (WEA ZB06_wpd)07:38	08:29 (WEA ZB07_wpd)08:14	08:51 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	23 08:56 (WEA ZB06_wpd)16:03	26 08:55 (WEA ZB07_wpd)15:53	8 08:59 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	08:32 (WEA ZB06_wpd)07:40	08:30 (WEA ZB07_wpd)08:14	08:51 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	24 08:56 (WEA ZB06_wpd)16:01	26 08:56 (WEA ZB07_wpd)15:54	8 08:59 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:32 (WEA ZB06_wpd)07:42	08:30 (WEA ZB07_wpd)08:14	08:51 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	25 07:57 (WEA ZB06_wpd)16:00	26 08:56 (WEA ZB07_wpd)15:54	9 09:00 (WEA ZB07_wpd)
26	05:14	06:04	06:56	06:48	07:32 (WEA ZB06_wpd)07:43	08:31 (WEA ZB07_wpd)08:15	08:51 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	25 07:57 (WEA ZB06_wpd)15:59	26 08:57 (WEA ZB07_wpd)15:55	10 09:01 (WEA ZB07_wpd)
27	05:15	06:06	06:57	06:50	07:31 (WEA ZB06_wpd)07:45	08:30 (WEA ZB07_wpd)08:15	08:51 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	25 07:56 (WEA ZB06_wpd)15:58	26 08:56 (WEA ZB07_wpd)15:56	11 09:02 (WEA ZB07_wpd)
28	05:17	06:07	06:59	06:52	07:31 (WEA ZB06_wpd)07:47	08:31 (WEA ZB07_wpd)08:15	08:51 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	25 07:56 (WEA ZB06_wpd)15:58	26 08:57 (WEA ZB07_wpd)15:57	12 09:03 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:52 (WEA ZB04_wpd)06:54	07:31 (WEA ZB06_wpd)07:48	08:32 (WEA ZB07_wpd)08:15	08:51 (WEA ZB07_wpd)
	21:03	20:01	18:49	7 07:59 (WEA ZB04_wpd)16:42	25 07:56 (WEA ZB06_wpd)15:57	25 08:57 (WEA ZB07_wpd)15:57	13 09:04 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:49 (WEA ZB04_wpd)06:55	07:31 (WEA ZB06_wpd)07:50	08:32 (WEA ZB07_wpd)08:15	08:51 (WEA ZB07_wpd)
	21:01	19:59	18:46	13 08:02 (WEA ZB04_wpd)16:40	24 07:55 (WEA ZB06_wpd)15:56	24 08:56 (WEA ZB07_wpd)15:58	14 09:05 (WEA ZB07_wpd)
31	05:21	06:12		06:57	07:32 (WEA ZB06_wpd)		08:15
	21:00	19:57		16:39	23 07:55 (WEA ZB06_wpd)		15:59
	Sonnenscheinstunden	505	465	381	331	264	241
	astr. max.mögl. Beschattung			20	484	507	435

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-17 - SR-17, Am Fuchsbau 8, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:50 (WEA ZB07_vpd)	07:48		06:53		07:17 (WEA ZB04_vpd)	06:41	05:35		04:49
	16:01	18 09:08 (WEA ZB07_vpd)	16:49		17:42	6	07:23 (WEA ZB04_vpd)	19:37	20:29		21:16
2	08:15	08:50 (WEA ZB07_vpd)	07:46		06:51		07:15 (WEA ZB04_vpd)	06:39	05:33		04:48
	16:02	19 09:09 (WEA ZB07_vpd)	16:51		17:44	11	07:26 (WEA ZB04_vpd)	19:39	20:31		21:18
3	08:15	08:50 (WEA ZB07_vpd)	07:44		06:49		07:12 (WEA ZB04_vpd)	06:37	05:31		04:47
	16:03	20 09:10 (WEA ZB07_vpd)	16:53		17:46	15	07:27 (WEA ZB04_vpd)	19:41	20:33		21:19
4	08:15	08:50 (WEA ZB07_vpd)	07:43		06:46		07:10 (WEA ZB04_vpd)	06:34	05:29		04:46
	16:04	21 09:11 (WEA ZB07_vpd)	16:55		17:48	18	07:28 (WEA ZB04_vpd)	19:43	20:35		21:20
5	08:15	08:50 (WEA ZB07_vpd)	07:41		06:44		07:09 (WEA ZB04_vpd)	06:32	05:28		04:46
	16:05	22 09:12 (WEA ZB07_vpd)	16:57	11	08:20 (WEA ZB06_vpd)	17:49	20 07:29 (WEA ZB04_vpd)	19:44	20:36		21:21
6	08:14	08:51 (WEA ZB07_vpd)	07:39		06:42		07:08 (WEA ZB04_vpd)	06:30	05:26		04:45
	16:06	22 09:13 (WEA ZB07_vpd)	16:59	15	08:22 (WEA ZB06_vpd)	17:51	20 07:28 (WEA ZB04_vpd)	19:46	20:38		21:22
7	08:14	08:51 (WEA ZB07_vpd)	07:38		06:40		07:08 (WEA ZB04_vpd)	06:27	05:24		04:44
	16:08	22 09:13 (WEA ZB07_vpd)	17:01	18	08:24 (WEA ZB06_vpd)	17:53	20 07:28 (WEA ZB04_vpd)	19:48	20:40		21:23
8	08:13	08:51 (WEA ZB07_vpd)	07:36		06:37		07:08 (WEA ZB04_vpd)	06:25	05:22		04:44
	16:09	23 09:14 (WEA ZB07_vpd)	17:03	20	08:25 (WEA ZB06_vpd)	17:55	20 07:28 (WEA ZB04_vpd)	19:50	20:41		21:24
9	08:13	08:51 (WEA ZB07_vpd)	07:34		06:35		07:08 (WEA ZB04_vpd)	06:23	05:20		04:43
	16:10	24 09:15 (WEA ZB07_vpd)	17:04	22	08:27 (WEA ZB06_vpd)	17:57	19 07:27 (WEA ZB04_vpd)	19:51	20:43		21:24
10	08:12	08:51 (WEA ZB07_vpd)	07:32		06:33		07:08 (WEA ZB04_vpd)	06:20	05:18		04:43
	16:12	24 09:15 (WEA ZB07_vpd)	17:06	23	08:27 (WEA ZB06_vpd)	17:58	19 07:27 (WEA ZB04_vpd)	19:53	20:45		21:25
11	08:12	08:51 (WEA ZB07_vpd)	07:30		06:30		07:09 (WEA ZB04_vpd)	06:18	05:17		04:42
	16:13	25 09:16 (WEA ZB07_vpd)	17:08	24	08:28 (WEA ZB06_vpd)	18:00	17 07:26 (WEA ZB04_vpd)	19:55	20:46		21:26
12	08:11	08:51 (WEA ZB07_vpd)	07:28		06:28		07:10 (WEA ZB04_vpd)	06:16	05:15		04:42
	16:15	25 09:16 (WEA ZB07_vpd)	17:10	25	08:28 (WEA ZB06_vpd)	18:02	13 07:23 (WEA ZB04_vpd)	19:57	20:48		21:27
13	08:10	08:51 (WEA ZB07_vpd)	07:26		06:26		07:13 (WEA ZB04_vpd)	06:14	05:13		04:42
	16:16	26 09:17 (WEA ZB07_vpd)	17:12	25	08:28 (WEA ZB06_vpd)	18:04	8 07:21 (WEA ZB04_vpd)	19:58	20:50		21:27
14	08:10	08:52 (WEA ZB07_vpd)	07:25		06:24			06:11	05:12		04:42
	16:18	25 09:17 (WEA ZB07_vpd)	17:14	25	08:27 (WEA ZB06_vpd)	18:06		20:00	20:51		21:28
15	08:09	08:52 (WEA ZB07_vpd)	07:23		06:21			06:09	05:10		04:41
	16:19	26 09:18 (WEA ZB07_vpd)	17:16	25	08:27 (WEA ZB06_vpd)	18:07		20:02	20:53		21:29
16	08:08	08:52 (WEA ZB07_vpd)	07:21		06:19			06:07	05:09		04:41
	16:21	26 09:18 (WEA ZB07_vpd)	17:18	24	08:27 (WEA ZB06_vpd)	18:09		20:03	20:54		21:29
17	08:07	08:53 (WEA ZB07_vpd)	07:19		06:17			06:05	05:07		04:41
	16:23	26 09:19 (WEA ZB07_vpd)	17:20	24	08:27 (WEA ZB06_vpd)	18:11		20:05	20:56		21:30
18	08:06	08:53 (WEA ZB07_vpd)	07:17		06:14			06:02	05:06		04:41
	16:24	26 09:19 (WEA ZB07_vpd)	17:22	22	08:26 (WEA ZB06_vpd)	18:13		20:07	20:57		21:30
19	08:05	08:54 (WEA ZB07_vpd)	07:15		06:12			06:00	05:04		04:41
	16:26	25 09:19 (WEA ZB07_vpd)	17:23	20	08:25 (WEA ZB06_vpd)	18:15		20:09	20:59		21:30
20	08:04	08:54 (WEA ZB07_vpd)	07:12		06:09			05:58	05:03		04:41
	16:28	25 09:19 (WEA ZB07_vpd)	17:25	17	08:24 (WEA ZB06_vpd)	18:16		20:10	21:00		21:31
21	08:03	08:55 (WEA ZB07_vpd)	07:10		06:07			05:56	05:01		04:41
	16:29	24 09:19 (WEA ZB07_vpd)	17:27	14	08:22 (WEA ZB06_vpd)	18:18		20:12	21:02		21:31
22	08:02	08:56 (WEA ZB07_vpd)	07:08		06:05			05:54	05:00		04:42
	16:31	23 09:19 (WEA ZB07_vpd)	17:29	7	08:18 (WEA ZB06_vpd)	18:20		20:14	21:03		21:31
23	08:00	08:56 (WEA ZB07_vpd)	07:06		06:02			05:52	04:59		04:42
	16:33	22 09:18 (WEA ZB07_vpd)	17:31		18:22			20:16	21:05		21:31
24	07:59	08:57 (WEA ZB07_vpd)	07:04		06:00			05:50	04:57		04:42
	16:35	21 09:18 (WEA ZB07_vpd)	17:33		18:23			20:17	21:06		21:31
25	07:58	08:59 (WEA ZB07_vpd)	07:02		05:58			05:47	04:56		04:42
	16:36	19 09:18 (WEA ZB07_vpd)	17:35		18:25			20:19	21:08		21:32
26	07:56	08:59 (WEA ZB07_vpd)	07:00		05:55			05:45	04:55		04:43
	16:38	18 09:17 (WEA ZB07_vpd)	17:37		18:27			20:21	21:09		21:32
27	07:55	09:01 (WEA ZB07_vpd)	06:58		05:53			05:43	04:54		04:43
	16:40	15 09:16 (WEA ZB07_vpd)	17:38		18:29			20:23	21:10		21:31
28	07:54	09:03 (WEA ZB07_vpd)	06:55		05:51			05:41	04:53		04:44
	16:42	11 09:14 (WEA ZB07_vpd)	17:40		18:30			20:24	21:12		21:31
29	07:52	09:06 (WEA ZB07_vpd)			06:48			05:39	04:52		04:44
	16:44	5 09:11 (WEA ZB07_vpd)			19:32			20:26	21:13		21:31
30	07:51				06:46			05:37	04:51		04:45
	16:46				19:34			20:28	21:14		21:31
31	07:49				06:44				04:50		
	16:47				19:36				21:15		
	Sonnenscheinstunden										
	astr.max.mögl.Beschattung	256	276	361	367	206		417	488		502

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-17 - SR-17, Am Fuchsbau 8, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

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

- Die Sonne scheint täglich von Sonnenauf- bis -untergang
- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	July	August	September	Oktober	November	Dezember
1	04:45	05:23	06:14	07:04	07:51 (WEA ZB04_wpd) 06:59	07:33 (WEA ZB06_wpd) 07:51
	21:31	20:58	19:55	18:44	11 08:02 (WEA ZB04_wpd) 16:37	23 07:56 (WEA ZB06_wpd) 15:55
2	04:46	05:24	06:16	07:06	07:48 (WEA ZB04_wpd) 07:01	07:33 (WEA ZB06_wpd) 07:53
	21:30	20:56	19:52	18:42	15 08:03 (WEA ZB04_wpd) 16:35	22 07:55 (WEA ZB06_wpd) 15:54
3	04:47	05:26	06:17	07:07	07:47 (WEA ZB04_wpd) 07:03	07:34 (WEA ZB06_wpd) 07:54
	21:30	20:55	19:50	18:39	17 08:04 (WEA ZB04_wpd) 16:33	20 07:54 (WEA ZB06_wpd) 15:54
4	04:48	05:28	06:19	07:09	07:46 (WEA ZB04_wpd) 07:05	07:36 (WEA ZB06_wpd) 07:55
	21:30	20:53	19:48	18:37	19 08:05 (WEA ZB04_wpd) 16:31	17 07:53 (WEA ZB06_wpd) 15:53
5	04:49	05:29	06:21	07:11	07:45 (WEA ZB04_wpd) 07:06	07:37 (WEA ZB06_wpd) 07:57
	21:29	20:51	19:45	18:35	20 08:05 (WEA ZB04_wpd) 16:29	15 07:52 (WEA ZB06_wpd) 15:53
6	04:49	05:31	06:22	07:13	07:44 (WEA ZB04_wpd) 07:08	07:40 (WEA ZB06_wpd) 07:58
	21:28	20:49	19:43	18:32	20 08:04 (WEA ZB04_wpd) 16:27	9 07:49 (WEA ZB06_wpd) 15:52
7	04:50	05:32	06:24	07:14	07:44 (WEA ZB04_wpd) 07:10	07:59
	21:28	20:47	19:41	18:30	20 08:04 (WEA ZB04_wpd) 16:26	15:52
8	04:51	05:34	06:26	07:16	07:44 (WEA ZB04_wpd) 07:12	08:01
	21:27	20:45	19:38	18:28	20 08:04 (WEA ZB04_wpd) 16:24	15:51
9	04:52	05:36	06:27	07:18	07:45 (WEA ZB04_wpd) 07:14	08:02
	21:27	20:44	19:36	18:25	18 08:03 (WEA ZB04_wpd) 16:22	15:51
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB04_wpd) 07:16	08:03
	21:26	20:42	19:34	18:23	16 08:01 (WEA ZB04_wpd) 16:21	15:51
11	04:54	05:39	06:31	07:21	07:47 (WEA ZB04_wpd) 07:17	08:04
	21:25	20:40	19:31	18:21	13 08:00 (WEA ZB04_wpd) 16:19	15:51
12	04:55	05:41	06:32	07:23	07:49 (WEA ZB04_wpd) 07:19	08:05
	21:24	20:38	19:29	18:19	9 07:58 (WEA ZB04_wpd) 16:17	15:51
13	04:57	05:42	06:34	07:25	07:51 (WEA ZB04_wpd) 07:21	08:38 (WEA ZB07_wpd) 08:06
	21:23	20:36	19:27	18:16	3 07:54 (WEA ZB04_wpd) 16:16	5 08:43 (WEA ZB07_wpd) 15:50
14	04:58	05:44	06:35	07:27	07:51	08:35 (WEA ZB07_wpd) 08:07
	21:22	20:34	19:24	18:14	12 08:47 (WEA ZB07_wpd) 15:50	16 08:59 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:52	08:33 (WEA ZB07_wpd) 08:08
	21:21	20:32	19:22	18:12	16 08:49 (WEA ZB07_wpd) 15:51	16 09:00 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:53	08:32 (WEA ZB07_wpd) 08:09
	21:20	20:30	19:20	18:10	16 08:50 (WEA ZB07_wpd) 15:51	15 09:00 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:54	08:32 (WEA ZB07_wpd) 08:10
	21:19	20:28	19:17	18:07	16 08:51 (WEA ZB07_wpd) 15:51	14 08:59 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:55	08:31 (WEA ZB07_wpd) 08:10
	21:18	20:25	19:15	18:05	16 08:52 (WEA ZB07_wpd) 15:51	15 09:00 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:56	08:31 (WEA ZB07_wpd) 08:11
	21:17	20:23	19:12	18:03	16 08:53 (WEA ZB07_wpd) 15:51	15 09:01 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:41 (WEA ZB06_wpd) 07:33	08:31 (WEA ZB07_wpd) 08:12
	21:16	20:21	19:10	18:01	9 08:50 (WEA ZB06_wpd) 16:06	23 08:54 (WEA ZB07_wpd) 15:52
21	05:07	05:56	06:47	07:39	08:38 (WEA ZB06_wpd) 07:35	08:31 (WEA ZB07_wpd) 08:12
	21:14	20:19	19:08	17:59	15 08:53 (WEA ZB06_wpd) 16:05	24 08:55 (WEA ZB07_wpd) 15:52
22	05:08	05:57	06:49	07:41	08:36 (WEA ZB06_wpd) 07:37	08:31 (WEA ZB07_wpd) 08:13
	21:13	20:17	19:05	17:57	19 08:55 (WEA ZB06_wpd) 16:04	25 08:56 (WEA ZB07_wpd) 15:53
23	05:09	05:59	06:51	07:43	08:35 (WEA ZB06_wpd) 07:38	08:30 (WEA ZB07_wpd) 08:14
	21:12	20:15	19:03	17:55	21 08:56 (WEA ZB06_wpd) 16:03	25 08:55 (WEA ZB07_wpd) 15:53
24	05:11	06:01	06:52	07:44	08:34 (WEA ZB06_wpd) 07:40	08:30 (WEA ZB07_wpd) 08:14
	21:10	20:13	19:01	17:53	23 08:57 (WEA ZB06_wpd) 16:01	26 08:56 (WEA ZB07_wpd) 15:54
25	05:12	06:02	06:54	07:46	08:34 (WEA ZB06_wpd) 07:42	08:31 (WEA ZB07_wpd) 08:14
	21:09	20:10	18:58	18:50	23 07:57 (WEA ZB06_wpd) 16:00	26 08:57 (WEA ZB07_wpd) 15:54
26	05:14	06:04	06:56	07:48	08:48	08:31 (WEA ZB07_wpd) 08:15
	21:07	20:08	18:56	18:48	25 07:58 (WEA ZB06_wpd) 15:59	26 08:57 (WEA ZB07_wpd) 15:55
27	05:15	06:06	06:57	07:50	08:49	08:31 (WEA ZB07_wpd) 08:15
	21:06	20:06	18:53	18:46	25 07:57 (WEA ZB06_wpd) 15:58	26 08:57 (WEA ZB07_wpd) 15:56
28	05:17	06:07	06:59	07:52	08:50	08:32 (WEA ZB07_wpd) 08:15
	21:04	20:04	18:51	18:44	25 07:57 (WEA ZB06_wpd) 15:58	25 08:57 (WEA ZB07_wpd) 15:57
29	05:18	06:09	07:01	07:54	08:51	08:32 (WEA ZB07_wpd) 08:15
	21:03	20:01	18:49	18:42	25 07:57 (WEA ZB06_wpd) 15:57	26 08:58 (WEA ZB07_wpd) 15:57
30	05:20	06:11	07:02	07:56	08:52	08:32 (WEA ZB07_wpd) 08:15
	21:01	19:59	18:46	18:40	25 07:57 (WEA ZB06_wpd) 15:56	25 08:57 (WEA ZB07_wpd) 15:58
31	05:21	06:12	07:03	07:57	08:53	08:32 (WEA ZB07_wpd) 08:15
	21:00	19:57	18:44	18:39	24 07:56 (WEA ZB06_wpd)	15:59
Sonnenscheinstunden		505	465	381	311	241
astr. max. mögl. Beschattung				5	460	496

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-18 - SR-18, Am Fuchsbau 7, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:49 (WEA ZB07_vpd)	07:48		06:53		07:17 (WEA ZB04_vpd)	06:41	05:35		04:49
	16:01	18 09:07 (WEA ZB07_vpd)	16:49		17:42	8	07:25 (WEA ZB04_vpd)	19:37	20:29		21:16
2	08:15	08:50 (WEA ZB07_vpd)	07:46		06:51		07:15 (WEA ZB04_vpd)	06:39	05:33		04:48
	16:02	18 09:08 (WEA ZB07_vpd)	16:51		17:44	12	07:27 (WEA ZB04_vpd)	19:39	20:31		21:18
3	08:15	08:50 (WEA ZB07_vpd)	07:44		06:49		07:12 (WEA ZB04_vpd)	06:37	05:31		04:47
	16:03	19 09:09 (WEA ZB07_vpd)	16:53		17:46	16	07:28 (WEA ZB04_vpd)	19:41	20:33		21:19
4	08:15	08:49 (WEA ZB07_vpd)	07:43		06:46		07:10 (WEA ZB04_vpd)	06:34	05:29		04:46
	16:04	20 09:09 (WEA ZB07_vpd)	16:55		17:48	19	07:29 (WEA ZB04_vpd)	19:43	20:35		21:20
5	08:15	08:50 (WEA ZB07_vpd)	07:41		06:44		07:10 (WEA ZB04_vpd)	06:32	05:28		04:46
	16:05	21 09:11 (WEA ZB07_vpd)	16:57	11	08:20 (WEA ZB06_vpd)	17:49	19 07:29 (WEA ZB04_vpd)	19:44	20:36		21:21
6	08:14	08:51 (WEA ZB07_vpd)	07:39		06:42		07:09 (WEA ZB04_vpd)	06:30	05:26		04:45
	16:06	21 09:12 (WEA ZB07_vpd)	16:59	15	08:22 (WEA ZB06_vpd)	17:51	20 07:29 (WEA ZB04_vpd)	19:46	20:38		21:22
7	08:14	08:50 (WEA ZB07_vpd)	07:38		06:40		07:09 (WEA ZB04_vpd)	06:27	05:24		04:44
	16:08	22 09:12 (WEA ZB07_vpd)	17:01	18	08:24 (WEA ZB06_vpd)	17:53	20 07:29 (WEA ZB04_vpd)	19:48	20:40		21:23
8	08:13	08:50 (WEA ZB07_vpd)	07:36		06:37		07:09 (WEA ZB04_vpd)	06:25	05:22		04:44
	16:09	23 09:13 (WEA ZB07_vpd)	17:03	20	08:25 (WEA ZB06_vpd)	17:55	20 07:29 (WEA ZB04_vpd)	19:50	20:41		21:24
9	08:13	08:51 (WEA ZB07_vpd)	07:34		06:35		07:09 (WEA ZB04_vpd)	06:23	05:20		04:43
	16:10	23 09:14 (WEA ZB07_vpd)	17:04	21	08:26 (WEA ZB06_vpd)	17:57	18 07:27 (WEA ZB04_vpd)	19:51	20:43		21:24
10	08:12	08:51 (WEA ZB07_vpd)	07:32		06:33		07:09 (WEA ZB04_vpd)	06:20	05:18		04:43
	16:12	23 09:14 (WEA ZB07_vpd)	17:06	23	08:27 (WEA ZB06_vpd)	17:58	18 07:27 (WEA ZB04_vpd)	19:53	20:45		21:25
11	08:12	08:51 (WEA ZB07_vpd)	07:30		06:30		07:11 (WEA ZB04_vpd)	06:18	05:17		04:42
	16:13	24 09:15 (WEA ZB07_vpd)	17:08	24	08:28 (WEA ZB06_vpd)	18:00	15 07:26 (WEA ZB04_vpd)	19:55	20:46		21:26
12	08:11	08:51 (WEA ZB07_vpd)	07:28		06:28		07:11 (WEA ZB04_vpd)	06:16	05:15		04:42
	16:15	24 09:15 (WEA ZB07_vpd)	17:10	25	08:28 (WEA ZB06_vpd)	18:02	12 07:23 (WEA ZB04_vpd)	19:57	20:48		21:27
13	08:10	08:51 (WEA ZB07_vpd)	07:26		06:26		07:15 (WEA ZB04_vpd)	06:14	05:13		04:42
	16:16	25 09:16 (WEA ZB07_vpd)	17:12	25	08:28 (WEA ZB06_vpd)	18:04	4 07:19 (WEA ZB04_vpd)	19:58	20:50		21:27
14	08:10	08:51 (WEA ZB07_vpd)	07:25		06:24			06:11	05:12		04:42
	16:18	25 09:16 (WEA ZB07_vpd)	17:14	25	08:27 (WEA ZB06_vpd)	18:06		20:00	20:51		21:28
15	08:09	08:51 (WEA ZB07_vpd)	07:23		06:21			06:09	05:10		04:41
	16:19	26 09:17 (WEA ZB07_vpd)	17:16	24	08:27 (WEA ZB06_vpd)	18:07		20:02	20:53		21:29
16	08:08	08:52 (WEA ZB07_vpd)	07:21		06:19			06:07	05:09		04:41
	16:21	25 09:17 (WEA ZB07_vpd)	17:18	24	08:27 (WEA ZB06_vpd)	18:09		20:03	20:54		21:29
17	08:07	08:52 (WEA ZB07_vpd)	07:19		06:17			06:05	05:07		04:41
	16:23	26 09:18 (WEA ZB07_vpd)	17:20	22	08:26 (WEA ZB06_vpd)	18:11		20:05	20:56		21:30
18	08:06	08:53 (WEA ZB07_vpd)	07:17		06:14			06:02	05:06		04:41
	16:24	25 09:18 (WEA ZB07_vpd)	17:22	22	08:26 (WEA ZB06_vpd)	18:13		20:07	20:57		21:30
19	08:05	08:53 (WEA ZB07_vpd)	07:15		06:12			06:00	05:04		04:41
	16:26	25 09:18 (WEA ZB07_vpd)	17:23	20	08:25 (WEA ZB06_vpd)	18:15		20:09	20:59		21:30
20	08:04	08:53 (WEA ZB07_vpd)	07:12		06:09			05:58	05:03		04:41
	16:28	25 09:18 (WEA ZB07_vpd)	17:25	16	08:23 (WEA ZB06_vpd)	18:16		20:10	21:00		21:31
21	08:03	08:54 (WEA ZB07_vpd)	07:10		06:07			05:56	05:01		04:41
	16:29	24 09:18 (WEA ZB07_vpd)	17:27	12	08:21 (WEA ZB06_vpd)	18:18		20:12	21:02		21:31
22	08:02	08:55 (WEA ZB07_vpd)	07:08		06:05			05:54	05:00		04:42
	16:31	23 09:18 (WEA ZB07_vpd)	17:29	2	08:15 (WEA ZB06_vpd)	18:20		20:14	21:03		21:31
23	08:00	08:55 (WEA ZB07_vpd)	07:06		06:02			05:52	04:59		04:42
	16:33	22 09:17 (WEA ZB07_vpd)	17:31		18:22			20:16	21:05		21:31
24	07:59	08:56 (WEA ZB07_vpd)	07:04		06:00			05:50	04:57		04:42
	16:35	22 09:18 (WEA ZB07_vpd)	17:33		18:23			20:17	21:06		21:31
25	07:58	08:58 (WEA ZB07_vpd)	07:02		05:58			05:47	04:56		04:42
	16:36	19 09:17 (WEA ZB07_vpd)	17:35		18:25			20:19	21:08		21:32
26	07:56	08:59 (WEA ZB07_vpd)	07:00		05:55			05:45	04:55		04:43
	16:38	17 09:16 (WEA ZB07_vpd)	17:37		18:27			20:21	21:09		21:32
27	07:55	09:00 (WEA ZB07_vpd)	06:58		05:53			05:43	04:54		04:43
	16:40	15 09:15 (WEA ZB07_vpd)	17:38		18:29			20:23	21:10		21:31
28	07:54	09:02 (WEA ZB07_vpd)	06:55		05:51			05:41	04:53		04:44
	16:42	12 09:14 (WEA ZB07_vpd)	17:40		18:30			20:24	21:12		21:31
29	07:52	09:05 (WEA ZB07_vpd)			06:48			05:39	04:52		04:44
	16:44	5 09:10 (WEA ZB07_vpd)			19:32			20:26	21:13		21:31
30	07:51				06:46			05:37	04:51		04:45
	16:46				19:34			20:28	21:14		21:31
31	07:49				06:44				04:50		
	16:47				19:36				21:15		
	Sonnenscheinstunden		276		367			417	488		502
	astr.max.mögl.Beschattung	617		349		201					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-18 - SR-18, Am Fuchsbau 7, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober		November		Dezember		
1	04:45	05:23	06:14	07:04		07:52 (WEA ZB04_wpd)	06:59	07:33 (WEA ZB06_wpd)	07:51	08:33 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	10	08:02 (WEA ZB04_wpd)	16:37	23 07:56 (WEA ZB06_wpd)	15:55	24 08:57 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06		07:49 (WEA ZB04_wpd)	07:01	07:34 (WEA ZB06_wpd)	07:53	08:34 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	14	08:03 (WEA ZB04_wpd)	16:35	21 07:55 (WEA ZB06_wpd)	15:54	23 08:57 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07		07:48 (WEA ZB04_wpd)	07:03	07:34 (WEA ZB06_wpd)	07:54	08:34 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16	08:04 (WEA ZB04_wpd)	16:33	20 07:54 (WEA ZB06_wpd)	15:54	23 08:57 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09		07:47 (WEA ZB04_wpd)	07:05	07:36 (WEA ZB06_wpd)	07:55	08:35 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	18	08:05 (WEA ZB04_wpd)	16:31	17 07:53 (WEA ZB06_wpd)	15:53	23 08:58 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11		07:46 (WEA ZB04_wpd)	07:06	07:37 (WEA ZB06_wpd)	07:57	08:35 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	20	08:06 (WEA ZB04_wpd)	16:29	15 07:52 (WEA ZB06_wpd)	15:53	22 08:57 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13		07:45 (WEA ZB04_wpd)	07:08	07:39 (WEA ZB06_wpd)	07:58	08:36 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	20	08:05 (WEA ZB04_wpd)	16:27	10 07:49 (WEA ZB06_wpd)	15:52	21 08:57 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14		07:45 (WEA ZB04_wpd)	07:10		07:59	08:37 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	20	08:05 (WEA ZB04_wpd)	16:26		15:52	21 08:58 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16		07:45 (WEA ZB04_wpd)	07:12		08:01	08:38 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	20	08:05 (WEA ZB04_wpd)	16:24		15:51	19 08:57 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18		07:45 (WEA ZB04_wpd)	07:14		08:02	08:38 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	19	08:04 (WEA ZB04_wpd)	16:22		15:51	19 08:57 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20		07:45 (WEA ZB04_wpd)	07:16		08:03	08:40 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	17	08:02 (WEA ZB04_wpd)	16:21		15:51	18 08:58 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21		07:47 (WEA ZB04_wpd)	07:17		08:04	08:40 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	14	08:01 (WEA ZB04_wpd)	16:19		15:51	18 08:58 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23		07:49 (WEA ZB04_wpd)	07:19		08:05	08:41 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	10	07:59 (WEA ZB04_wpd)	16:17		15:51	17 08:58 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25		07:51 (WEA ZB04_wpd)	07:21	5 08:37 (WEA ZB07_wpd)	08:06	08:42 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	5	07:56 (WEA ZB04_wpd)	16:16	5 08:42 (WEA ZB07_wpd)	15:50	16 08:58 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27			07:23	08:34 (WEA ZB07_wpd)	08:07	08:43 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14			16:14	12 08:46 (WEA ZB07_wpd)	15:50	15 08:58 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28			07:25	08:33 (WEA ZB07_wpd)	08:08	08:43 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	15		16:13	08:49 (WEA ZB07_wpd)	15:51	15 08:58 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30			07:26	08:32 (WEA ZB07_wpd)	08:09	08:44 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10			16:11	17 08:49 (WEA ZB07_wpd)	15:51	15 08:59 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32			07:28	08:31 (WEA ZB07_wpd)	08:10	08:44 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07			16:10	19 08:50 (WEA ZB07_wpd)	15:51	14 08:58 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34			07:30	08:30 (WEA ZB07_wpd)	08:10	08:45 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05			16:09	22 08:52 (WEA ZB07_wpd)	15:51	13 08:58 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35			07:32	08:30 (WEA ZB07_wpd)	08:11	08:46 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03			16:07	22 08:52 (WEA ZB07_wpd)	15:51	13 08:59 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37		08:42 (WEA ZB06_wpd)	07:33	08:30 (WEA ZB07_wpd)	08:12	08:46 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	7	08:49 (WEA ZB06_wpd)	16:06	23 08:53 (WEA ZB07_wpd)	15:52	13 08:59 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39		08:39 (WEA ZB06_wpd)	07:35	08:30 (WEA ZB07_wpd)	08:12	08:47 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	13	08:52 (WEA ZB06_wpd)	16:05	24 08:54 (WEA ZB07_wpd)	15:52	13 09:00 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41		08:37 (WEA ZB06_wpd)	07:37	08:30 (WEA ZB07_wpd)	08:13	08:47 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	17	08:54 (WEA ZB06_wpd)	16:04	25 08:55 (WEA ZB07_wpd)	15:53	13 09:00 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43		08:36 (WEA ZB06_wpd)	07:38	08:29 (WEA ZB07_wpd)	08:14	08:48 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	19	08:55 (WEA ZB06_wpd)	16:03	25 08:54 (WEA ZB07_wpd)	15:53	13 09:01 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44		08:35 (WEA ZB06_wpd)	07:40	08:30 (WEA ZB07_wpd)	08:14	08:48 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	21	08:56 (WEA ZB06_wpd)	16:01	25 08:55 (WEA ZB07_wpd)	15:54	13 09:01 (WEA ZB07_wpd)
25	05:12	06:02	06:54	06:46		07:34 (WEA ZB06_wpd)	07:42	08:30 (WEA ZB07_wpd)	08:14	08:48 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	23	07:57 (WEA ZB06_wpd)	16:00	26 08:56 (WEA ZB07_wpd)	15:54	13 09:01 (WEA ZB07_wpd)
26	05:14	06:04	06:56	06:48		07:33 (WEA ZB06_wpd)	07:43	08:31 (WEA ZB07_wpd)	08:15	08:49 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	24	07:57 (WEA ZB06_wpd)	15:59	25 08:56 (WEA ZB07_wpd)	15:55	14 09:03 (WEA ZB07_wpd)
27	05:15	06:06	06:57	06:50		07:32 (WEA ZB06_wpd)	07:45	08:30 (WEA ZB07_wpd)	08:15	08:49 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	25	07:57 (WEA ZB06_wpd)	15:58	26 08:56 (WEA ZB07_wpd)	15:56	14 09:03 (WEA ZB07_wpd)
28	05:17	06:07	06:59	06:52		07:32 (WEA ZB06_wpd)	07:47	08:31 (WEA ZB07_wpd)	08:15	08:49 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	25	07:57 (WEA ZB06_wpd)	15:58	25 08:56 (WEA ZB07_wpd)	15:57	15 09:04 (WEA ZB07_wpd)
29	05:18	06:09	07:01	06:54		07:32 (WEA ZB06_wpd)	07:48	08:32 (WEA ZB07_wpd)	08:15	08:50 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	25	07:57 (WEA ZB06_wpd)	15:57	25 08:57 (WEA ZB07_wpd)	15:57	15 09:05 (WEA ZB07_wpd)
30	05:20	06:11	07:02	06:55		07:32 (WEA ZB06_wpd)	07:50	08:32 (WEA ZB07_wpd)	08:15	08:50 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	24	07:56 (WEA ZB06_wpd)	15:56	24 08:56 (WEA ZB07_wpd)	15:58	16 09:06 (WEA ZB07_wpd)
31	05:21	06:12		06:57		07:32 (WEA ZB06_wpd)			08:15	08:50 (WEA ZB07_wpd)
	21:00	19:57		16:39	24	07:56 (WEA ZB06_wpd)			15:59	17 09:07 (WEA ZB07_wpd)
	Sonnenscheinstunden	505	455	381	311		264		241	
	astr.max.mögl.Beschattung				450		491		518	

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-19 - SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:50 (WEA ZB07_wpd)   07:48	06:53	07:17 (WEA ZB04_wpd)   06:41	05:35	04:49
	16:01	20 09:10 (WEA ZB07_wpd)   16:49	17:42	14 07:31 (WEA ZB04_wpd)   19:37	20:29	21:16
2	08:15	08:51 (WEA ZB07_wpd)   07:46	06:51	07:15 (WEA ZB04_wpd)   06:39	05:33	04:48
	16:02	20 09:11 (WEA ZB07_wpd)   16:51	17:44	17 07:32 (WEA ZB04_wpd)   19:39	20:31	21:18
3	08:15	08:51 (WEA ZB07_wpd)   07:44	06:49	07:13 (WEA ZB04_wpd)   06:37	05:31	04:47
	16:03	21 09:12 (WEA ZB07_wpd)   16:53	9 08:22 (WEA ZB06_wpd)   17:46	19 07:32 (WEA ZB04_wpd)   19:41	20:33	21:19
4	08:15	08:51 (WEA ZB07_wpd)   07:43	06:46	07:13 (WEA ZB04_wpd)   06:34	05:29	04:46
	16:04	21 09:12 (WEA ZB07_wpd)   16:55	14 08:25 (WEA ZB06_wpd)   17:48	20 07:33 (WEA ZB04_wpd)   19:43	20:35	21:20
5	08:15	08:51 (WEA ZB07_wpd)   07:41	06:44	07:13 (WEA ZB04_wpd)   06:32	05:28	04:46
	16:05	22 09:13 (WEA ZB07_wpd)   16:57	17 08:26 (WEA ZB06_wpd)   17:49	20 07:33 (WEA ZB04_wpd)   19:44	20:36	21:21
6	08:14	08:52 (WEA ZB07_wpd)   07:39	06:42	07:12 (WEA ZB04_wpd)   06:30	05:26	04:45
	16:06	22 09:14 (WEA ZB07_wpd)   16:59	19 08:27 (WEA ZB06_wpd)   17:51	20 07:32 (WEA ZB04_wpd)   19:46	20:38	21:22
7	08:14	08:52 (WEA ZB07_wpd)   07:38	06:40	07:13 (WEA ZB04_wpd)   06:27	05:24	04:44
	16:08	22 09:14 (WEA ZB07_wpd)   17:01	21 08:28 (WEA ZB06_wpd)   17:53	19 07:32 (WEA ZB04_wpd)   19:48	20:40	21:23
8	08:13	08:51 (WEA ZB07_wpd)   07:36	06:37	07:14 (WEA ZB04_wpd)   06:25	05:22	04:44
	16:09	24 09:15 (WEA ZB07_wpd)   17:03	22 08:29 (WEA ZB06_wpd)   17:55	17 07:31 (WEA ZB04_wpd)   19:50	20:41	21:24
9	08:13	08:52 (WEA ZB07_wpd)   07:34	06:35	07:14 (WEA ZB04_wpd)   06:23	05:20	04:43
	16:10	24 09:16 (WEA ZB07_wpd)   17:04	23 08:30 (WEA ZB06_wpd)   17:57	15 07:29 (WEA ZB04_wpd)   19:51	20:43	21:24
10	08:12	08:52 (WEA ZB07_wpd)   07:32	06:33	07:15 (WEA ZB04_wpd)   06:20	05:18	04:43
	16:12	24 09:16 (WEA ZB07_wpd)   17:06	24 08:31 (WEA ZB06_wpd)   17:58	12 07:27 (WEA ZB04_wpd)   19:53	20:45	21:25
11	08:12	08:52 (WEA ZB07_wpd)   07:30	06:30	07:19 (WEA ZB04_wpd)   06:18	05:17	04:42
	16:13	25 09:17 (WEA ZB07_wpd)   17:08	24 08:31 (WEA ZB06_wpd)   18:00	6 07:25 (WEA ZB04_wpd)   19:55	20:46	21:26
12	08:11	08:52 (WEA ZB07_wpd)   07:28	06:28	07:14 (WEA ZB04_wpd)   06:16	05:15	04:42
	16:15	25 09:17 (WEA ZB07_wpd)   17:10	24 08:31 (WEA ZB06_wpd)   18:02	19:57	20:48	21:27
13	08:10	08:53 (WEA ZB07_wpd)   07:26	06:26	07:14 (WEA ZB04_wpd)   06:14	05:13	04:42
	16:16	24 09:17 (WEA ZB07_wpd)   17:12	24 08:31 (WEA ZB06_wpd)   18:04	19:58	20:50	21:27
14	08:10	08:53 (WEA ZB07_wpd)   07:25	06:24	07:14 (WEA ZB04_wpd)   06:11	05:12	04:42
	16:18	25 09:18 (WEA ZB07_wpd)   17:14	24 08:30 (WEA ZB06_wpd)   18:06	20:00	20:51	21:28
15	08:09	08:53 (WEA ZB07_wpd)   07:23	06:21	07:15 (WEA ZB04_wpd)   06:09	05:10	04:41
	16:19	25 09:18 (WEA ZB07_wpd)   17:16	22 08:29 (WEA ZB06_wpd)   18:07	20:02	20:53	21:29
16	08:08	08:54 (WEA ZB07_wpd)   07:21	06:19	07:15 (WEA ZB04_wpd)   06:07	05:09	04:41
	16:21	24 09:18 (WEA ZB07_wpd)   17:18	21 08:28 (WEA ZB06_wpd)   18:09	20:03	20:54	21:29
17	08:07	08:54 (WEA ZB07_wpd)   07:19	06:17	07:16 (WEA ZB04_wpd)   06:05	05:07	04:41
	16:23	25 09:19 (WEA ZB07_wpd)   17:20	19 08:27 (WEA ZB06_wpd)   18:11	20:05	20:56	21:30
18	08:06	08:55 (WEA ZB07_wpd)   07:17	06:14	07:16 (WEA ZB04_wpd)   06:02	05:06	04:41
	16:24	24 09:19 (WEA ZB07_wpd)   17:22	16 08:26 (WEA ZB06_wpd)   18:13	20:07	20:57	21:30
19	08:05	08:56 (WEA ZB07_wpd)   07:15	06:12	07:17 (WEA ZB04_wpd)   06:00	05:04	04:41
	16:26	23 09:19 (WEA ZB07_wpd)   17:23	12 08:24 (WEA ZB06_wpd)   18:15	20:09	20:59	21:30
20	08:04	08:56 (WEA ZB07_wpd)   07:12	06:09	07:18 (WEA ZB04_wpd)   05:58	05:03	04:41
	16:28	23 09:19 (WEA ZB07_wpd)   17:25	5 08:21 (WEA ZB06_wpd)   18:16	20:10	21:00	21:31
21	08:03	08:57 (WEA ZB07_wpd)   07:10	06:07	07:19 (WEA ZB04_wpd)   05:56	05:01	04:41
	16:29	22 09:19 (WEA ZB07_wpd)   17:27	18:18	20:12	21:02	21:31
22	08:02	08:58 (WEA ZB07_wpd)   07:08	06:05	07:20 (WEA ZB04_wpd)   05:54	05:00	04:42
	16:31	21 09:19 (WEA ZB07_wpd)   17:29	18:20	20:14	21:03	21:31
23	08:00	08:58 (WEA ZB07_wpd)   07:06	06:02	07:21 (WEA ZB04_wpd)   05:52	04:59	04:42
	16:33	20 09:18 (WEA ZB07_wpd)   17:31	18:22	20:16	21:05	21:31
24	07:59	09:00 (WEA ZB07_wpd)   07:04	06:00	07:22 (WEA ZB04_wpd)   05:50	04:57	04:42
	16:35	18 09:18 (WEA ZB07_wpd)   17:33	18:23	20:17	21:06	21:31
25	07:58	09:02 (WEA ZB07_wpd)   07:02	05:58	07:23 (WEA ZB04_wpd)   05:47	04:56	04:42
	16:36	15 09:17 (WEA ZB07_wpd)   17:35	18:25	20:19	21:08	21:32
26	07:56	09:03 (WEA ZB07_wpd)   07:00	05:55	07:24 (WEA ZB04_wpd)   05:45	04:55	04:43
	16:38	13 09:16 (WEA ZB07_wpd)   17:37	18:27	20:21	21:09	21:32
27	07:55	09:05 (WEA ZB07_wpd)   06:58	05:53	07:25 (WEA ZB04_wpd)   05:43	04:54	04:43
	16:40	8 09:13 (WEA ZB07_wpd)   17:38	6 07:27 (WEA ZB04_wpd)   18:29	20:23	21:10	21:31
28	07:54	06:55	05:51	07:26 (WEA ZB04_wpd)   05:41	04:53	04:44
	16:42	17:40	11 07:30 (WEA ZB04_wpd)   18:30	20:24	21:12	21:31
29	07:52		06:48	07:27 (WEA ZB04_wpd)   05:39	04:52	04:44
	16:44		19:32	20:26	21:13	21:31
30	07:51		06:46	07:28 (WEA ZB04_wpd)   05:37	04:51	04:45
	16:46		19:34	20:28	21:14	21:31
31	07:49		06:44		04:50	
	16:47		19:36		21:15	
	Sonnenscheinstunden   256	276	367	417	488	502
	astr.max.mögl.Beschattung   580	357	179			

**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)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-19 - SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober		November		Dezember			
1	04:45	05:23	06:14	07:04		06:59	07:35 (WEA ZB06_wpd)	07:51	08:34 (WEA ZB07_wpd)		
	21:31	20:58	19:55	18:44		16:37	24 07:59 (WEA ZB06_wpd)	15:55	25 08:59 (WEA ZB07_wpd)		
2	04:46	05:24	06:16	07:06		07:01	07:36 (WEA ZB06_wpd)	07:53	08:35 (WEA ZB07_wpd)		
	21:30	20:56	19:52	18:42		16:35	23 07:59 (WEA ZB06_wpd)	15:54	24 08:59 (WEA ZB07_wpd)		
3	04:47	05:26	06:17	07:07		07:03	07:36 (WEA ZB06_wpd)	07:54	08:35 (WEA ZB07_wpd)		
	21:30	20:55	19:50	18:39	10	08:04 (WEA ZB04_wpd)	16:33	07:58 (WEA ZB06_wpd)	15:54	24 08:59 (WEA ZB07_wpd)	
4	04:48	05:28	06:19	07:09		07:52 (WEA ZB04_wpd)	07:05	07:37 (WEA ZB06_wpd)	07:55	08:37 (WEA ZB07_wpd)	
	21:30	20:53	19:48	18:37	14	08:06 (WEA ZB04_wpd)	16:31	21 07:58 (WEA ZB06_wpd)	15:53	23 09:00 (WEA ZB07_wpd)	
5	04:49	05:29	06:21	07:11		07:51 (WEA ZB04_wpd)	07:06	07:38 (WEA ZB06_wpd)	07:57	08:37 (WEA ZB07_wpd)	
	21:29	20:51	19:45	18:35	17	08:08 (WEA ZB04_wpd)	16:29	19 07:57 (WEA ZB06_wpd)	15:53	22 08:59 (WEA ZB07_wpd)	
6	04:49	05:31	06:22	07:13		07:49 (WEA ZB04_wpd)	07:08	07:39 (WEA ZB06_wpd)	07:58	08:37 (WEA ZB07_wpd)	
	21:28	20:49	19:43	18:32	18	08:07 (WEA ZB04_wpd)	16:27	17 07:56 (WEA ZB06_wpd)	15:52	22 08:59 (WEA ZB07_wpd)	
7	04:50	05:32	06:24	07:14		07:49 (WEA ZB04_wpd)	07:10	07:41 (WEA ZB06_wpd)	07:59	08:38 (WEA ZB07_wpd)	
	21:28	20:47	19:41	18:30	19	08:08 (WEA ZB04_wpd)	16:26	13 07:54 (WEA ZB06_wpd)	15:52	22 09:00 (WEA ZB07_wpd)	
8	04:51	05:34	06:26	07:16		07:48 (WEA ZB04_wpd)	07:12	07:43 (WEA ZB06_wpd)	08:01	08:39 (WEA ZB07_wpd)	
	21:27	20:45	19:38	18:28	20	08:08 (WEA ZB04_wpd)	16:24	9 07:52 (WEA ZB06_wpd)	15:51	21 09:00 (WEA ZB07_wpd)	
9	04:52	05:36	06:27	07:18		07:48 (WEA ZB04_wpd)	07:14		08:02	08:39 (WEA ZB07_wpd)	
	21:27	20:44	19:36	18:25	20	08:08 (WEA ZB04_wpd)	16:22		15:51	21 09:00 (WEA ZB07_wpd)	
10	04:53	05:37	06:29	07:20		07:47 (WEA ZB04_wpd)	07:16		08:03	08:41 (WEA ZB07_wpd)	
	21:26	20:42	19:34	18:23	20	08:07 (WEA ZB04_wpd)	16:21		15:51	20 09:01 (WEA ZB07_wpd)	
11	04:54	05:39	06:31	07:21		07:48 (WEA ZB04_wpd)	07:17		08:04	08:41 (WEA ZB07_wpd)	
	21:25	20:40	19:31	18:21	18	08:06 (WEA ZB04_wpd)	16:19		15:51	20 09:01 (WEA ZB07_wpd)	
12	04:55	05:41	06:32	07:23		07:49 (WEA ZB04_wpd)	07:19		08:05	08:42 (WEA ZB07_wpd)	
	21:24	20:38	19:29	18:19	16	08:05 (WEA ZB04_wpd)	16:17		15:51	19 09:01 (WEA ZB07_wpd)	
13	04:57	05:42	06:34	07:25		07:51 (WEA ZB04_wpd)	07:21		08:06	08:43 (WEA ZB07_wpd)	
	21:23	20:36	19:27	18:16	13	08:04 (WEA ZB04_wpd)	16:16		15:50	18 09:01 (WEA ZB07_wpd)	
14	04:58	05:44	06:35	07:27		07:53 (WEA ZB04_wpd)	07:23		08:07	08:43 (WEA ZB07_wpd)	
	21:22	20:34	19:24	18:14	9	08:02 (WEA ZB04_wpd)	16:14		15:50	18 09:01 (WEA ZB07_wpd)	
15	04:59	05:46	06:37	07:28		07:55 (WEA ZB04_wpd)	07:25		08:08	08:44 (WEA ZB07_wpd)	
	21:21	20:32	19:22	18:12	3	07:58 (WEA ZB04_wpd)	07:26	8	08:38 (WEA ZB07_wpd)	08:08	17 09:01 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30			07:26		08:36 (WEA ZB07_wpd)	08:09	17 09:02 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10			16:11	13	08:49 (WEA ZB07_wpd)	15:51	17 09:02 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32			07:28		08:35 (WEA ZB07_wpd)	08:10	17 09:02 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07			16:10	15	08:50 (WEA ZB07_wpd)	15:51	16 09:01 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34			07:30		08:34 (WEA ZB07_wpd)	08:10	16 09:02 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05			16:09	18	08:52 (WEA ZB07_wpd)	15:51	16 09:02 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35			07:32		08:32 (WEA ZB07_wpd)	08:11	16 09:02 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03			16:07	20	08:53 (WEA ZB07_wpd)	15:51	15 09:02 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37			07:33		08:33 (WEA ZB07_wpd)	08:12	16 09:02 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01			16:06	21	08:54 (WEA ZB07_wpd)	15:52	16 09:02 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39			07:35		08:33 (WEA ZB07_wpd)	08:12	16 09:02 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59			16:05	22	08:55 (WEA ZB07_wpd)	15:52	16 09:03 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41		08:44 (WEA ZB06_wpd)	07:37		08:33 (WEA ZB07_wpd)	08:13	16 09:03 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	9	08:53 (WEA ZB06_wpd)	16:04	23	08:56 (WEA ZB07_wpd)	15:53	16 09:03 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43		08:42 (WEA ZB06_wpd)	07:39		08:32 (WEA ZB07_wpd)	08:14	16 09:04 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	13	08:55 (WEA ZB06_wpd)	16:03	23	08:55 (WEA ZB07_wpd)	15:53	16 09:04 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44		08:40 (WEA ZB06_wpd)	07:40		08:32 (WEA ZB07_wpd)	08:14	16 09:04 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	17	08:57 (WEA ZB06_wpd)	16:01	24	08:56 (WEA ZB07_wpd)	15:54	15 09:04 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46		07:39 (WEA ZB06_wpd)	07:42		08:32 (WEA ZB07_wpd)	08:14	16 09:04 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	19	07:58 (WEA ZB06_wpd)	16:00	25	08:57 (WEA ZB07_wpd)	15:54	16 09:05 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48		07:38 (WEA ZB06_wpd)	07:43		08:33 (WEA ZB07_wpd)	08:15	16 09:05 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	21	07:59 (WEA ZB06_wpd)	15:59	25	08:58 (WEA ZB07_wpd)	15:55	16 09:06 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50		07:36 (WEA ZB06_wpd)	07:45		08:32 (WEA ZB07_wpd)	08:15	16 09:06 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	23	07:59 (WEA ZB06_wpd)	15:58	25	08:57 (WEA ZB07_wpd)	15:56	16 09:06 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52		07:36 (WEA ZB06_wpd)	07:47		08:33 (WEA ZB07_wpd)	08:15	16 09:06 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	23	07:59 (WEA ZB06_wpd)	15:58	25	08:58 (WEA ZB07_wpd)	15:57	17 09:07 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54		07:35 (WEA ZB06_wpd)	07:48		08:34 (WEA ZB07_wpd)	08:15	16 09:07 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	24	07:59 (WEA ZB06_wpd)	15:57	24	08:58 (WEA ZB07_wpd)	15:57	18 09:08 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55		07:35 (WEA ZB06_wpd)	07:50		08:34 (WEA ZB07_wpd)	08:15	16 09:08 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	24	07:59 (WEA ZB06_wpd)	15:56	24	08:58 (WEA ZB07_wpd)	15:58	18 09:08 (WEA ZB07_wpd)
31	05:21	06:12		07:57		07:35 (WEA ZB06_wpd)			08:35 (WEA ZB07_wpd)	08:15	16 09:09 (WEA ZB07_wpd)
	21:00	19:57		16:39	24	07:59 (WEA ZB06_wpd)			15:59	18 09:09 (WEA ZB07_wpd)	
Sonnenscheinstunden	505	455	381	311		264			241		178
astr.max.mögl.Beschattung					394		483				578

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-20 - SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:50 (WEA ZB07_wpd)	07:48		06:53	07:17 (WEA ZB04_wpd)	06:41	05:35	04:49	
	16:01	19 09:09 (WEA ZB07_wpd)	16:49		17:42	17 07:34 (WEA ZB04_wpd)	19:37	20:29	21:16	
2	08:15	08:50 (WEA ZB07_wpd)	07:46		06:51	07:16 (WEA ZB04_wpd)	06:39	05:33	04:48	
	16:02	20 09:10 (WEA ZB07_wpd)	16:51	7	08:22 (WEA ZB06_wpd)	17:44	19 07:35 (WEA ZB04_wpd)	19:39	20:31	21:18
3	08:15	08:51 (WEA ZB07_wpd)	07:44		06:49	08:13 (WEA ZB06_wpd)	06:37	05:31	04:47	
	16:03	20 09:11 (WEA ZB07_wpd)	16:53	12	08:25 (WEA ZB06_wpd)	17:46	19 07:34 (WEA ZB04_wpd)	19:41	20:33	21:19
4	08:15	08:51 (WEA ZB07_wpd)	07:43		06:46	08:11 (WEA ZB06_wpd)	06:34	05:29	04:46	
	16:04	21 09:12 (WEA ZB07_wpd)	16:55	16	08:27 (WEA ZB06_wpd)	17:48	19 07:34 (WEA ZB04_wpd)	19:43	20:35	21:20
5	08:15	08:51 (WEA ZB07_wpd)	07:41		06:44	08:10 (WEA ZB06_wpd)	06:32	05:28	04:46	
	16:05	22 09:13 (WEA ZB07_wpd)	16:57	18	08:28 (WEA ZB06_wpd)	17:49	19 07:34 (WEA ZB04_wpd)	19:44	20:36	21:21
6	08:14	08:52 (WEA ZB07_wpd)	07:39		06:42	08:09 (WEA ZB06_wpd)	06:30	05:26	04:45	
	16:06	22 09:14 (WEA ZB07_wpd)	16:59	20	08:29 (WEA ZB06_wpd)	17:51	19 07:33 (WEA ZB04_wpd)	19:46	20:38	21:22
7	08:14	08:52 (WEA ZB07_wpd)	07:38		06:40	08:08 (WEA ZB06_wpd)	06:27	05:24	04:44	
	16:08	22 09:14 (WEA ZB07_wpd)	17:01	21	08:29 (WEA ZB06_wpd)	17:53	17 07:32 (WEA ZB04_wpd)	19:48	20:40	21:23
8	08:13	08:51 (WEA ZB07_wpd)	07:36		06:37	08:07 (WEA ZB06_wpd)	06:25	05:22	04:44	
	16:09	23 09:14 (WEA ZB07_wpd)	17:03	23	08:30 (WEA ZB06_wpd)	17:55	15 07:31 (WEA ZB04_wpd)	19:50	20:41	21:24
9	08:13	08:52 (WEA ZB07_wpd)	07:34		06:35	08:08 (WEA ZB06_wpd)	06:23	05:20	04:43	
	16:10	24 09:16 (WEA ZB07_wpd)	17:04	23	08:31 (WEA ZB06_wpd)	17:57	12 07:29 (WEA ZB04_wpd)	19:51	20:43	21:24
10	08:12	08:52 (WEA ZB07_wpd)	07:32		06:33	08:08 (WEA ZB06_wpd)	06:20	05:18	04:43	
	16:12	24 09:16 (WEA ZB07_wpd)	17:06	23	08:31 (WEA ZB06_wpd)	17:58	6 07:26 (WEA ZB04_wpd)	19:53	20:45	21:25
11	08:12	08:52 (WEA ZB07_wpd)	07:30		06:30	08:08 (WEA ZB06_wpd)	06:18	05:17	04:42	
	16:13	24 09:16 (WEA ZB07_wpd)	17:08	24	08:32 (WEA ZB06_wpd)	18:00		19:55	20:46	21:26
12	08:11	08:53 (WEA ZB07_wpd)	07:28		06:28	08:08 (WEA ZB06_wpd)	06:16	05:15	04:42	
	16:15	24 09:17 (WEA ZB07_wpd)	17:10	23	08:31 (WEA ZB06_wpd)	18:02		19:57	20:48	21:27
13	08:10	08:53 (WEA ZB07_wpd)	07:26		06:26	08:08 (WEA ZB06_wpd)	06:14	05:13	04:42	
	16:16	24 09:17 (WEA ZB07_wpd)	17:12	23	08:31 (WEA ZB06_wpd)	18:04		19:58	20:50	21:27
14	08:10	08:53 (WEA ZB07_wpd)	07:25		06:24	08:08 (WEA ZB06_wpd)	06:11	05:12	04:42	
	16:18	24 09:17 (WEA ZB07_wpd)	17:14	22	08:30 (WEA ZB06_wpd)	18:06		20:00	20:51	21:28
15	08:09	08:53 (WEA ZB07_wpd)	07:23		06:21	08:08 (WEA ZB06_wpd)	06:09	05:10	04:41	
	16:19	25 09:18 (WEA ZB07_wpd)	17:16	21	08:29 (WEA ZB06_wpd)	18:07		20:02	20:53	21:29
16	08:08	08:54 (WEA ZB07_wpd)	07:21		06:19	08:09 (WEA ZB06_wpd)	06:07	05:09	04:41	
	16:21	24 09:18 (WEA ZB07_wpd)	17:18	19	08:28 (WEA ZB06_wpd)	18:09		20:03	20:54	21:29
17	08:07	08:55 (WEA ZB07_wpd)	07:19		06:17	08:11 (WEA ZB06_wpd)	06:05	05:07	04:41	
	16:23	23 09:18 (WEA ZB07_wpd)	17:20	16	08:27 (WEA ZB06_wpd)	18:11		20:05	20:56	21:30
18	08:06	08:55 (WEA ZB07_wpd)	07:17		06:14	08:13 (WEA ZB06_wpd)	06:02	05:06	04:41	
	16:24	24 09:19 (WEA ZB07_wpd)	17:22	12	08:25 (WEA ZB06_wpd)	18:13		20:07	20:57	21:30
19	08:05	08:56 (WEA ZB07_wpd)	07:15		06:12	08:16 (WEA ZB06_wpd)	06:00	05:04	04:41	
	16:26	23 09:19 (WEA ZB07_wpd)	17:23	6	08:22 (WEA ZB06_wpd)	18:15		20:09	20:59	21:30
20	08:04	08:56 (WEA ZB07_wpd)	07:12		06:09		06:09	05:58	05:03	04:41
	16:28	22 09:18 (WEA ZB07_wpd)	17:25		18:16		18:16	20:10	21:00	21:31
21	08:03	08:57 (WEA ZB07_wpd)	07:10		06:07		06:07	05:56	05:01	04:41
	16:29	21 09:18 (WEA ZB07_wpd)	17:27		18:18		18:18	20:12	21:02	21:31
22	08:02	08:58 (WEA ZB07_wpd)	07:08		06:05		06:05	05:54	05:00	04:42
	16:31	20 09:18 (WEA ZB07_wpd)	17:29		18:20		18:20	20:14	21:03	21:31
23	08:00	08:59 (WEA ZB07_wpd)	07:06		06:02		06:02	05:52	04:59	04:42
	16:33	18 09:17 (WEA ZB07_wpd)	17:31		18:22		18:22	20:16	21:05	21:31
24	07:59	09:00 (WEA ZB07_wpd)	07:04		06:00		06:00	05:50	04:57	04:42
	16:35	17 09:17 (WEA ZB07_wpd)	17:33		18:23		18:23	20:17	21:06	21:31
25	07:58	09:02 (WEA ZB07_wpd)	07:02		05:58		05:58	05:47	04:56	04:42
	16:36	14 09:16 (WEA ZB07_wpd)	17:35		18:25		18:25	20:19	21:08	21:32
26	07:56	09:04 (WEA ZB07_wpd)	07:00		05:55		05:55	05:45	04:55	04:43
	16:38	10 09:14 (WEA ZB07_wpd)	17:37	5	07:24 (WEA ZB04_wpd)	05:55		20:21	21:09	21:32
27	07:55		06:58		05:53		05:53	05:43	04:54	04:43
	16:40		17:38	10	07:21 (WEA ZB04_wpd)	05:53		20:23	21:10	21:31
28	07:54		06:55		05:51		05:51	05:41	04:53	04:44
	16:42		17:40	14	07:33 (WEA ZB04_wpd)	05:51		20:24	21:12	21:31
29	07:52				06:48		06:48	05:39	04:52	04:44
	16:44				19:32		19:32	20:26	21:13	21:31
30	07:51				06:46		06:46	05:37	04:51	04:45
	16:46				19:34		19:34	20:28	21:14	21:31
31	07:49				06:44		06:44		04:50	
	16:47				19:36		19:36		21:15	
Sonnenscheinstunden	256		276		367		417	488	502	
astr.max.mögl.Beschattung	554		358		162					

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-20 - SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:36 (WEA ZB06_wpd) 07:51 08:34 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	24 08:00 (WEA ZB06_wpd) 15:55 24 08:58 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:37 (WEA ZB06_wpd) 07:53 08:35 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	23 08:00 (WEA ZB06_wpd) 15:54 24 08:59 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:37 (WEA ZB06_wpd) 07:54 08:35 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	23 08:00 (WEA ZB06_wpd) 15:54 24 08:59 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:38 (WEA ZB06_wpd) 07:55 08:37 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	21 07:59 (WEA ZB06_wpd) 15:53 22 08:59 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:38 (WEA ZB06_wpd) 07:57 08:37 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	20 07:58 (WEA ZB06_wpd) 15:53 22 08:59 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:39 (WEA ZB06_wpd) 07:58 08:37 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	18 07:57 (WEA ZB06_wpd) 15:52 22 08:59 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:41 (WEA ZB06_wpd) 07:59 08:38 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	15 07:56 (WEA ZB06_wpd) 15:52 22 09:00 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:43 (WEA ZB06_wpd) 08:01 08:39 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	12 07:55 (WEA ZB06_wpd) 15:51 21 09:00 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:46 (WEA ZB06_wpd) 08:02 08:39 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	6 07:52 (WEA ZB06_wpd) 15:51 21 09:00 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:49 (WEA ZB06_wpd) 08:03 08:41 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	15 08:00 (WEA ZB06_wpd) 15:51 20 09:01 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:49 (WEA ZB06_wpd) 08:04 08:41 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	08:08 (WEA ZB06_wpd) 15:51 20 09:01 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:49 (WEA ZB06_wpd) 08:05 08:42 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	18 08:07 (WEA ZB06_wpd) 15:51 19 09:01 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	07:51 (WEA ZB06_wpd) 08:06 08:42 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	15 08:06 (WEA ZB06_wpd) 15:50 19 09:01 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	07:53 (WEA ZB06_wpd) 08:07 08:43 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	12 08:05 (WEA ZB06_wpd) 15:50 18 09:01 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	07:55 (WEA ZB06_wpd) 08:08 08:44 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	8 08:03 (WEA ZB06_wpd) 15:51 17 09:01 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:04 (WEA ZB06_wpd) 08:09 08:45 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	10 08:04 (WEA ZB06_wpd) 15:51 17 09:02 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:05 (WEA ZB06_wpd) 08:10 08:45 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	14 08:09 (WEA ZB06_wpd) 15:51 16 09:01 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:06 (WEA ZB06_wpd) 08:10 08:45 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	16:09	17 08:11 (WEA ZB06_wpd) 15:51 17 09:02 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:07 (WEA ZB06_wpd) 08:11 08:46 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	18 08:12 (WEA ZB06_wpd) 15:51 16 09:02 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:13 (WEA ZB06_wpd) 08:12 08:46 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	20 08:13 (WEA ZB06_wpd) 15:52 16 09:02 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:14 (WEA ZB06_wpd) 08:12 08:47 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	21 08:14 (WEA ZB06_wpd) 15:52 16 09:03 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:15 (WEA ZB06_wpd) 08:13 08:47 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	22 08:15 (WEA ZB06_wpd) 15:53 16 09:03 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:16 (WEA ZB06_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	9 08:14 (WEA ZB06_wpd) 15:53 16 09:04 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:17 (WEA ZB06_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	24 08:16 (WEA ZB06_wpd) 15:54 16 09:04 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:18 (WEA ZB06_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	23 08:16 (WEA ZB06_wpd) 15:54 17 09:05 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:19 (WEA ZB06_wpd) 08:15 08:49 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	24 08:17 (WEA ZB06_wpd) 15:55 17 09:06 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:20 (WEA ZB06_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	24 08:17 (WEA ZB06_wpd) 15:56 16 09:06 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:21 (WEA ZB06_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	24 08:17 (WEA ZB06_wpd) 15:57 17 09:07 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:22 (WEA ZB06_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	24 08:18 (WEA ZB06_wpd) 15:57 18 09:08 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56	07:50	08:23 (WEA ZB06_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	24 08:18 (WEA ZB06_wpd) 15:58 18 09:08 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:51	08:24 (WEA ZB06_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:00	19:57	18:44	16:39	15:59	24 08:19 (WEA ZB06_wpd) 15:59 18 09:09 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				360	475	582

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-21 - SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:53 (WEA ZB07_vpd)	07:48	08:15 (WEA ZB06_vpd)	06:53	07:20 (WEA ZB04_vpd)	06:41	05:35	04:49
	16:01	21 09:14 (WEA ZB07_vpd)	16:49	14 08:29 (WEA ZB06_vpd)	17:42	19 07:39 (WEA ZB04_vpd)	19:37	20:29	21:16
2	08:15	08:53 (WEA ZB07_vpd)	07:46	08:15 (WEA ZB06_vpd)	06:51	07:20 (WEA ZB04_vpd)	06:39	05:33	04:48
	16:02	22 09:15 (WEA ZB07_vpd)	16:51	17 08:32 (WEA ZB06_vpd)	17:44	19 07:39 (WEA ZB04_vpd)	19:39	20:31	21:18
3	08:15	08:54 (WEA ZB07_vpd)	07:44	08:14 (WEA ZB06_vpd)	06:49	07:19 (WEA ZB04_vpd)	06:37	05:31	04:47
	16:03	22 09:16 (WEA ZB07_vpd)	16:53	18 08:32 (WEA ZB06_vpd)	17:46	19 07:38 (WEA ZB04_vpd)	19:41	20:33	21:19
4	08:15	08:53 (WEA ZB07_vpd)	07:43	08:13 (WEA ZB06_vpd)	06:46	07:19 (WEA ZB04_vpd)	06:34	05:29	04:46
	16:04	23 09:16 (WEA ZB07_vpd)	16:55	20 08:33 (WEA ZB06_vpd)	17:48	19 07:38 (WEA ZB04_vpd)	19:43	20:35	21:20
5	08:15	08:54 (WEA ZB07_vpd)	07:41	08:12 (WEA ZB06_vpd)	06:44	07:20 (WEA ZB04_vpd)	06:32	05:28	04:46
	16:05	23 09:17 (WEA ZB07_vpd)	16:57	22 08:34 (WEA ZB06_vpd)	17:49	17 07:37 (WEA ZB04_vpd)	19:44	20:36	21:21
6	08:14	08:55 (WEA ZB07_vpd)	07:39	08:12 (WEA ZB06_vpd)	06:42	07:20 (WEA ZB04_vpd)	06:30	05:26	04:45
	16:06	23 09:18 (WEA ZB07_vpd)	16:59	22 08:34 (WEA ZB06_vpd)	17:51	15 07:35 (WEA ZB04_vpd)	19:46	20:38	21:22
7	08:14	08:55 (WEA ZB07_vpd)	07:38	08:11 (WEA ZB06_vpd)	06:40	07:22 (WEA ZB04_vpd)	06:27	05:24	04:44
	16:08	23 09:18 (WEA ZB07_vpd)	17:01	24 08:35 (WEA ZB06_vpd)	17:53	12 07:34 (WEA ZB04_vpd)	19:48	20:40	21:23
8	08:13	08:55 (WEA ZB07_vpd)	07:36	08:11 (WEA ZB06_vpd)	06:37	07:25 (WEA ZB04_vpd)	06:25	05:22	04:44
	16:09	23 09:18 (WEA ZB07_vpd)	17:03	24 08:35 (WEA ZB06_vpd)	17:55	6 07:31 (WEA ZB04_vpd)	19:50	20:41	21:24
9	08:13	08:56 (WEA ZB07_vpd)	07:34	08:12 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43
	16:10	23 09:19 (WEA ZB07_vpd)	17:04	24 08:36 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24
10	08:12	08:56 (WEA ZB07_vpd)	07:32	08:12 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43
	16:12	24 09:20 (WEA ZB07_vpd)	17:06	24 08:36 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25
11	08:12	08:56 (WEA ZB07_vpd)	07:30	08:13 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42
	16:13	24 09:20 (WEA ZB07_vpd)	17:08	22 08:35 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26
12	08:11	08:56 (WEA ZB07_vpd)	07:28	08:13 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42
	16:15	24 09:20 (WEA ZB07_vpd)	17:10	22 08:35 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27
13	08:10	08:57 (WEA ZB07_vpd)	07:26	08:14 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42
	16:16	23 09:20 (WEA ZB07_vpd)	17:12	20 08:34 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27
14	08:10	08:57 (WEA ZB07_vpd)	07:25	08:14 (WEA ZB06_vpd)	06:24		06:11	05:12	04:42
	16:18	24 09:21 (WEA ZB07_vpd)	17:14	18 08:32 (WEA ZB06_vpd)	18:06		20:00	20:51	21:28
15	08:09	08:58 (WEA ZB07_vpd)	07:23	08:15 (WEA ZB06_vpd)	06:21		06:09	05:10	04:41
	16:19	23 09:21 (WEA ZB07_vpd)	17:16	16 08:31 (WEA ZB06_vpd)	18:07		20:02	20:53	21:29
16	08:08	08:58 (WEA ZB07_vpd)	07:21	08:17 (WEA ZB06_vpd)	06:19		06:07	05:09	04:41
	16:21	23 09:21 (WEA ZB07_vpd)	17:18	12 08:29 (WEA ZB06_vpd)	18:09		20:03	20:54	21:29
17	08:07	08:59 (WEA ZB07_vpd)	07:19	08:22 (WEA ZB06_vpd)	06:17		06:05	05:07	04:41
	16:23	22 09:21 (WEA ZB07_vpd)	17:20	2 08:24 (WEA ZB06_vpd)	18:11		20:05	20:56	21:30
18	08:06	09:00 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41
	16:24	21 09:21 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30
19	08:05	09:01 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41
	16:26	20 09:21 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30
20	08:04	09:01 (WEA ZB07_vpd)	07:12		06:09		05:58	05:03	04:41
	16:28	19 09:20 (WEA ZB07_vpd)	17:25		18:16		20:10	21:00	21:31
21	08:03	09:03 (WEA ZB07_vpd)	07:10		06:07		05:56	05:01	04:41
	16:29	17 09:20 (WEA ZB07_vpd)	17:27		18:18		20:12	21:02	21:31
22	08:02	09:04 (WEA ZB07_vpd)	07:08		06:05		05:54	05:00	04:42
	16:31	15 09:19 (WEA ZB07_vpd)	17:29		18:20		20:14	21:03	21:31
23	08:00	09:05 (WEA ZB07_vpd)	07:06		06:02		05:52	04:59	04:42
	16:33	13 09:18 (WEA ZB07_vpd)	17:31		18:22		20:16	21:05	21:31
24	07:59	09:08 (WEA ZB07_vpd)	07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42
	16:35	8 09:16 (WEA ZB07_vpd)	17:33	5 07:33 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31
25	07:58		07:02	07:26 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42
	16:36		17:35	10 07:36 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32
26	07:56		07:00	07:24 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43
	16:38		17:37	13 07:37 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32
27	07:55		06:58	07:21 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43
	16:40		17:38	16 07:37 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31
28	07:54		06:55	07:20 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44
	16:42		17:40	18 07:38 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31
29	07:52				06:48		05:39	04:52	04:44
	16:44				19:32		20:26	21:13	21:31
30	07:51				06:46		05:37	04:51	04:45
	16:46				19:34		20:28	21:14	21:31
31	07:49	08:17 (WEA ZB06_vpd)			06:44			04:50	
	16:47	10 08:27 (WEA ZB06_vpd)			19:36			21:15	
Sonnenscheinstunden	256		276		367		417	488	502
astr.max.mögl.Beschattung	513		383		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 (WEA mit erstem Schatten)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-21 - SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:41 (WEA ZB06_wpd) 07:51 08:38 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	23 08:04 (WEA ZB06_wpd) 15:55 24 09:02 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:41 (WEA ZB06_wpd) 07:53 08:39 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	23 08:04 (WEA ZB06_wpd) 15:54 24 09:03 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:41 (WEA ZB06_wpd) 07:54 08:39 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	23 08:04 (WEA ZB06_wpd) 15:54 24 09:03 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:41 (WEA ZB06_wpd) 07:55 08:40 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	23 08:04 (WEA ZB06_wpd) 15:53 24 09:03 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:41 (WEA ZB06_wpd) 07:57 08:40 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	23 08:04 (WEA ZB06_wpd) 15:53 23 09:03 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:42 (WEA ZB06_wpd) 07:58 08:40 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	21 08:03 (WEA ZB06_wpd) 15:52 23 09:03 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:57 (WEA ZB04_wpd) 07:10	07:43 (WEA ZB06_wpd) 07:59 08:41 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	20 08:03 (WEA ZB06_wpd) 15:52 23 09:04 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:56 (WEA ZB04_wpd) 07:12	07:44 (WEA ZB06_wpd) 08:01 08:41 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	18 08:02 (WEA ZB06_wpd) 15:51 23 09:04 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:55 (WEA ZB04_wpd) 07:14	07:45 (WEA ZB06_wpd) 08:02 08:42 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	16 08:01 (WEA ZB06_wpd) 15:51 22 09:04 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:53 (WEA ZB04_wpd) 07:16	07:46 (WEA ZB06_wpd) 08:03 08:43 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	14 08:00 (WEA ZB06_wpd) 15:51 22 09:05 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:53 (WEA ZB04_wpd) 07:17	07:49 (WEA ZB06_wpd) 08:04 08:44 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	9 07:58 (WEA ZB06_wpd) 15:51 21 09:05 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:53 (WEA ZB04_wpd) 07:19	08:05 08:44 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	15 08:12 (WEA ZB06_wpd) 15:51 21 09:05 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:53 (WEA ZB04_wpd) 07:21	08:06 08:45 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	19 08:12 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:53 (WEA ZB04_wpd) 07:23	08:07 08:45 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	18 08:11 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:55 (WEA ZB04_wpd) 07:25	08:08 08:46 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	15 08:10 (WEA ZB06_wpd) 15:51 20 09:06 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:56 (WEA ZB04_wpd) 07:26	08:09 08:47 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	12 08:08 (WEA ZB06_wpd) 15:51 20 09:07 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 07:28	08:10 08:46 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	8 08:06 (WEA ZB06_wpd) 15:51 20 09:06 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:42 (WEA ZB07_wpd) 08:10 08:47 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	8 08:50 (WEA ZB07_wpd) 15:51 20 09:07 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:49 (WEA ZB07_wpd) 08:11 08:48 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	13 08:53 (WEA ZB07_wpd) 15:51 20 09:08 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:39 (WEA ZB07_wpd) 08:12 08:48 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	15 08:54 (WEA ZB07_wpd) 15:52 20 09:08 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:39 (WEA ZB07_wpd) 08:12 08:49 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	17 08:56 (WEA ZB07_wpd) 15:52 19 09:08 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:38 (WEA ZB07_wpd) 08:13 08:49 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	19 08:57 (WEA ZB07_wpd) 15:53 19 09:08 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:37 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	20 08:57 (WEA ZB07_wpd) 15:53 19 09:09 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:37 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	21 08:58 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:37 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	22 08:59 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:47 (WEA ZB06_wpd) 07:43	08:37 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	23 09:00 (WEA ZB07_wpd) 15:55 20 09:11 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:44 (WEA ZB06_wpd) 07:45	08:37 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	23 09:00 (WEA ZB07_wpd) 15:56 20 09:12 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:43 (WEA ZB06_wpd) 07:47	08:37 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	24 09:01 (WEA ZB07_wpd) 15:57 20 09:12 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:42 (WEA ZB06_wpd) 07:48	08:38 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	23 09:01 (WEA ZB07_wpd) 15:57 21 09:13 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56	07:42 (WEA ZB06_wpd) 07:50	08:37 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	24 09:01 (WEA ZB07_wpd) 15:58 21 09:13 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:41 (WEA ZB06_wpd) 07:49	08:37 (WEA ZB07_wpd) 08:15 08:53 (WEA ZB07_wpd)
	21:00	19:57	18:44	16:39	15:59	21 09:14 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				307	465	655

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-22 - SR-22, Am Fuchsbau 1, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:51 (WEA ZB07_vpd)	07:48	08:15 (WEA ZB06_vpd)	06:53	07:19 (WEA ZB04_vpd)	06:41	05:35	04:49
	16:01	20 09:11 (WEA ZB07_vpd)	16:49	12 08:27 (WEA ZB06_vpd)	17:42	19 07:38 (WEA ZB04_vpd)	19:37	20:29	21:16
2	08:15	08:51 (WEA ZB07_vpd)	07:46	08:14 (WEA ZB06_vpd)	06:51	07:19 (WEA ZB04_vpd)	06:39	05:33	04:48
	16:02	21 09:12 (WEA ZB07_vpd)	16:51	15 08:29 (WEA ZB06_vpd)	17:44	19 07:38 (WEA ZB04_vpd)	19:39	20:31	21:18
3	08:15	08:52 (WEA ZB07_vpd)	07:44	08:13 (WEA ZB06_vpd)	06:49	07:19 (WEA ZB04_vpd)	06:37	05:31	04:47
	16:03	21 09:13 (WEA ZB07_vpd)	16:53	17 08:30 (WEA ZB06_vpd)	17:46	18 07:37 (WEA ZB04_vpd)	19:41	20:33	21:19
4	08:15	08:51 (WEA ZB07_vpd)	07:43	08:12 (WEA ZB06_vpd)	06:46	07:19 (WEA ZB04_vpd)	06:34	05:29	04:46
	16:04	22 09:13 (WEA ZB07_vpd)	16:55	19 08:31 (WEA ZB06_vpd)	17:48	18 07:37 (WEA ZB04_vpd)	19:43	20:35	21:20
5	08:15	08:52 (WEA ZB07_vpd)	07:41	08:11 (WEA ZB06_vpd)	06:44	07:20 (WEA ZB04_vpd)	06:32	05:28	04:46
	16:05	22 09:14 (WEA ZB07_vpd)	16:57	21 08:32 (WEA ZB06_vpd)	17:49	16 07:36 (WEA ZB04_vpd)	19:44	20:36	21:21
6	08:14	08:53 (WEA ZB07_vpd)	07:39	08:10 (WEA ZB06_vpd)	06:42	07:20 (WEA ZB04_vpd)	06:30	05:26	04:45
	16:06	22 09:15 (WEA ZB07_vpd)	16:59	22 08:32 (WEA ZB06_vpd)	17:51	14 07:34 (WEA ZB04_vpd)	19:46	20:38	21:22
7	08:14	08:53 (WEA ZB07_vpd)	07:38	08:10 (WEA ZB06_vpd)	06:40	07:22 (WEA ZB04_vpd)	06:27	05:24	04:44
	16:08	22 09:15 (WEA ZB07_vpd)	17:01	23 08:33 (WEA ZB06_vpd)	17:53	11 07:33 (WEA ZB04_vpd)	19:48	20:40	21:23
8	08:13	08:52 (WEA ZB07_vpd)	07:36	08:10 (WEA ZB06_vpd)	06:37	07:26 (WEA ZB04_vpd)	06:25	05:22	04:44
	16:09	23 09:15 (WEA ZB07_vpd)	17:03	23 08:33 (WEA ZB06_vpd)	17:55	3 07:29 (WEA ZB04_vpd)	19:50	20:41	21:24
9	08:13	08:53 (WEA ZB07_vpd)	07:34	08:11 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43
	16:10	24 09:17 (WEA ZB07_vpd)	17:04	23 08:34 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24
10	08:12	08:53 (WEA ZB07_vpd)	07:32	08:11 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43
	16:12	24 09:17 (WEA ZB07_vpd)	17:06	23 08:34 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25
11	08:12	08:54 (WEA ZB07_vpd)	07:30	08:11 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42
	16:13	23 09:17 (WEA ZB07_vpd)	17:08	23 08:34 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26
12	08:11	08:54 (WEA ZB07_vpd)	07:28	08:12 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42
	16:15	23 09:17 (WEA ZB07_vpd)	17:10	21 08:33 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27
13	08:10	08:54 (WEA ZB07_vpd)	07:26	08:12 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42
	16:16	24 09:18 (WEA ZB07_vpd)	17:12	20 08:32 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27
14	08:10	08:55 (WEA ZB07_vpd)	07:25	08:12 (WEA ZB06_vpd)	06:24		06:11	05:12	04:42
	16:18	23 09:18 (WEA ZB07_vpd)	17:14	19 08:31 (WEA ZB06_vpd)	18:06		20:00	20:51	21:28
15	08:09	08:55 (WEA ZB07_vpd)	07:23	08:14 (WEA ZB06_vpd)	06:21		06:09	05:10	04:41
	16:19	23 09:18 (WEA ZB07_vpd)	17:16	15 08:29 (WEA ZB06_vpd)	18:07		20:02	20:53	21:29
16	08:08	08:56 (WEA ZB07_vpd)	07:21	08:16 (WEA ZB06_vpd)	06:19		06:07	05:09	04:41
	16:21	22 09:18 (WEA ZB07_vpd)	17:18	11 08:27 (WEA ZB06_vpd)	18:09		20:03	20:54	21:29
17	08:07	08:56 (WEA ZB07_vpd)	07:19	08:20 (WEA ZB06_vpd)	06:17		06:05	05:07	04:41
	16:23	22 09:18 (WEA ZB07_vpd)	17:20	3 08:23 (WEA ZB06_vpd)	18:11		20:05	20:56	21:30
18	08:06	08:57 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41
	16:24	22 09:19 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30
19	08:05	08:58 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41
	16:26	21 09:19 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30
20	08:04	08:58 (WEA ZB07_vpd)	07:12		06:09		05:58	05:03	04:41
	16:28	20 09:18 (WEA ZB07_vpd)	17:25		18:16		20:10	21:00	21:31
21	08:03	09:00 (WEA ZB07_vpd)	07:10		06:07		05:56	05:01	04:41
	16:29	18 09:18 (WEA ZB07_vpd)	17:27		18:18		20:12	21:02	21:31
22	08:02	09:01 (WEA ZB07_vpd)	07:08		06:05		05:54	05:00	04:42
	16:31	16 09:17 (WEA ZB07_vpd)	17:29		18:20		20:14	21:03	21:31
23	08:00	09:02 (WEA ZB07_vpd)	07:06		06:02		05:52	04:59	04:42
	16:33	14 09:16 (WEA ZB07_vpd)	17:31		18:22		20:16	21:05	21:31
24	07:59	09:05 (WEA ZB07_vpd)	07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42
	16:35	10 09:15 (WEA ZB07_vpd)	17:33	4 07:32 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31
25	07:58	09:09 (WEA ZB07_vpd)	07:02	07:26 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42
	16:36	3 09:12 (WEA ZB07_vpd)	17:35	9 07:35 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32
26	07:56		07:00	07:24 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43
	16:38		17:37	13 07:37 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32
27	07:55		06:58	07:21 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43
	16:40		17:38	16 07:37 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31
28	07:54		06:55	07:20 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44
	16:42		17:40	18 07:38 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31
29	07:52				06:48		05:39	04:52	04:44
	16:44				19:32		20:26	21:13	21:31
30	07:51				06:46		05:37	04:51	04:45
	16:46				19:34		20:28	21:14	21:31
31	07:49				06:44			04:50	
	16:47	7 08:24 (WEA ZB06_vpd)			19:36			21:15	
Sonnenscheinstunden	256		276		367		417	488	502
astr.max.mögl.Beschattung	512		370		118				

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-22 - SR-22, Am Fuchsbau 1, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:40 (WEA ZB06_wpd) 07:51 08:36 (WEA ZB07_wpd)	
	21:31	20:58	19:55	18:44	16:37	22 08:02 (WEA ZB06_wpd) 15:55 23 08:59 (WEA ZB07_wpd)	
2	04:46	05:24	06:16	07:06	07:01	07:40 (WEA ZB06_wpd) 07:53 08:37 (WEA ZB07_wpd)	
	21:30	20:56	19:52	18:42	16:35	23 08:03 (WEA ZB06_wpd) 15:54 23 09:00 (WEA ZB07_wpd)	
3	04:47	05:26	06:17	07:07	07:03	07:40 (WEA ZB06_wpd) 07:54 08:37 (WEA ZB07_wpd)	
	21:30	20:55	19:50	18:39	16:33	22 08:02 (WEA ZB06_wpd) 15:54 23 09:00 (WEA ZB07_wpd)	
4	04:48	05:28	06:19	07:09	07:05	07:40 (WEA ZB06_wpd) 07:55 08:38 (WEA ZB07_wpd)	
	21:30	20:53	19:48	18:37	16:31	22 08:02 (WEA ZB06_wpd) 15:53 22 09:00 (WEA ZB07_wpd)	
5	04:49	05:29	06:21	07:11	07:06	07:40 (WEA ZB06_wpd) 07:57 08:38 (WEA ZB07_wpd)	
	21:29	20:51	19:45	18:35	16:29	22 08:02 (WEA ZB06_wpd) 15:53 22 09:00 (WEA ZB07_wpd)	
6	04:49	05:31	06:22	07:13	07:08	07:41 (WEA ZB06_wpd) 07:58 08:38 (WEA ZB07_wpd)	
	21:28	20:49	19:43	18:32	8 08:07 (WEA ZB04_wpd) 16:27 21 08:02 (WEA ZB06_wpd) 15:52 22 09:00 (WEA ZB07_wpd)		
7	04:50	05:32	06:24	07:14	07:57 (WEA ZB04_wpd) 16:22 17 07:42 (WEA ZB06_wpd) 15:51 21 09:01 (WEA ZB07_wpd)		
	21:28	20:47	19:41	18:30	13 08:10 (WEA ZB04_wpd) 16:26 19 08:01 (WEA ZB06_wpd) 15:52 22 09:01 (WEA ZB07_wpd)		
8	04:51	05:34	06:26	07:16	07:56 (WEA ZB04_wpd) 16:22 17 07:43 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)		
	21:27	20:45	19:38	18:28	15 08:11 (WEA ZB04_wpd) 16:24 17 08:00 (WEA ZB06_wpd) 15:51 22 09:01 (WEA ZB07_wpd)		
9	04:52	05:36	06:27	07:18	07:55 (WEA ZB04_wpd) 16:21 17 07:44 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)		
	21:27	20:44	19:36	18:25	17 08:12 (WEA ZB04_wpd) 16:22 15 07:59 (WEA ZB06_wpd) 15:51 21 09:01 (WEA ZB07_wpd)		
10	04:53	05:37	06:29	07:20	07:53 (WEA ZB04_wpd) 16:21 17 07:46 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)		
	21:26	20:42	19:34	18:23	18 08:11 (WEA ZB04_wpd) 16:21 11 07:57 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)		
11	04:54	05:39	06:31	07:21	07:53 (WEA ZB04_wpd) 16:21 17 07:49 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)		
	21:25	20:40	19:31	18:21	19 08:12 (WEA ZB04_wpd) 16:19 6 07:55 (WEA ZB06_wpd) 15:51 20 09:02 (WEA ZB07_wpd)		
12	04:55	05:41	06:32	07:23	07:53 (WEA ZB04_wpd) 16:19 19 08:12 (WEA ZB04_wpd) 16:17 19 08:05 (WEA ZB07_wpd)		
	21:24	20:38	19:29	18:19	19 08:12 (WEA ZB04_wpd) 16:17 19 08:05 (WEA ZB07_wpd)		
13	04:57	05:42	06:34	07:25	07:53 (WEA ZB04_wpd) 16:16 18 08:11 (WEA ZB04_wpd) 16:16 18 08:06 (WEA ZB07_wpd)		
	21:23	20:36	19:27	18:16	18 08:11 (WEA ZB04_wpd) 16:16 18 08:06 (WEA ZB07_wpd)		
14	04:58	05:44	06:35	07:27	07:53 (WEA ZB04_wpd) 16:14 18 08:11 (WEA ZB04_wpd) 16:14 18 08:08 (WEA ZB07_wpd)		
	21:22	20:34	19:24	18:14	18 08:11 (WEA ZB04_wpd) 16:14 18 08:08 (WEA ZB07_wpd)		
15	04:59	05:46	06:37	07:28	07:55 (WEA ZB04_wpd) 16:13 15 08:10 (WEA ZB04_wpd) 16:13 15 08:09 (WEA ZB07_wpd)		
	21:21	20:32	19:22	18:12	15 08:10 (WEA ZB04_wpd) 16:13 15 08:09 (WEA ZB07_wpd)		
16	05:00	05:47	06:39	07:30	07:56 (WEA ZB04_wpd) 16:11 12 08:08 (WEA ZB04_wpd) 16:11 12 08:05 (WEA ZB07_wpd)		
	21:20	20:30	19:20	18:10	12 08:08 (WEA ZB04_wpd) 16:11 4 08:41 (WEA ZB07_wpd) 15:51 18 09:03 (WEA ZB07_wpd)		
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 16:10 8 08:06 (WEA ZB04_wpd) 16:10 8 08:45 (WEA ZB07_wpd) 15:51 18 09:03 (WEA ZB07_wpd)		
	21:19	20:28	19:17	18:07	8 08:06 (WEA ZB04_wpd) 16:10 4 08:45 (WEA ZB07_wpd) 15:51 18 09:03 (WEA ZB07_wpd)		
18	05:03	05:51	06:42	07:34	07:30 16:09 11 08:49 (WEA ZB07_wpd) 15:51 19 09:04 (WEA ZB07_wpd)		
	21:18	20:26	19:15	18:05	16:09 11 08:49 (WEA ZB07_wpd) 15:51 19 09:04 (WEA ZB07_wpd)		
19	05:04	05:52	06:44	07:35	07:32 16:07 14 08:51 (WEA ZB07_wpd) 15:51 18 09:04 (WEA ZB07_wpd)		
	21:17	20:23	19:12	18:03	16:07 14 08:51 (WEA ZB07_wpd) 15:51 18 09:04 (WEA ZB07_wpd)		
20	05:05	05:54	06:45	07:37	07:33 16:06 16 08:52 (WEA ZB07_wpd) 15:52 18 09:04 (WEA ZB07_wpd)		
	21:16	20:21	19:10	18:01	16:06 16 08:52 (WEA ZB07_wpd) 15:52 18 09:04 (WEA ZB07_wpd)		
21	05:07	05:56	06:47	07:39	07:35 16:05 18 08:54 (WEA ZB07_wpd) 15:52 18 09:05 (WEA ZB07_wpd)		
	21:14	20:19	19:08	17:59	16:05 18 08:54 (WEA ZB07_wpd) 15:52 18 09:05 (WEA ZB07_wpd)		
22	05:08	05:57	06:49	07:41	07:37 16:04 20 08:55 (WEA ZB07_wpd) 15:53 18 09:05 (WEA ZB07_wpd)		
	21:13	20:17	19:05	17:57	16:04 20 08:55 (WEA ZB07_wpd) 15:53 18 09:05 (WEA ZB07_wpd)		
23	05:09	05:59	06:51	07:43	07:39 16:03 21 08:55 (WEA ZB07_wpd) 15:53 18 09:06 (WEA ZB07_wpd)		
	21:12	20:15	19:03	17:55	16:03 21 08:55 (WEA ZB07_wpd) 15:53 18 09:06 (WEA ZB07_wpd)		
24	05:11	06:01	06:52	07:44	07:40 16:01 22 08:56 (WEA ZB07_wpd) 15:54 18 09:06 (WEA ZB07_wpd)		
	21:10	20:13	19:01	17:53	16:01 22 08:56 (WEA ZB07_wpd) 15:54 18 09:06 (WEA ZB07_wpd)		
25	05:12	06:02	06:54	07:46	07:42 16:00 22 08:57 (WEA ZB07_wpd) 15:54 18 09:06 (WEA ZB07_wpd)		
	21:09	20:10	18:58	16:50	6 07:49 (WEA ZB06_wpd) 16:00 22 08:57 (WEA ZB07_wpd) 15:54 18 09:06 (WEA ZB07_wpd)		
26	05:14	06:04	06:56	07:48	07:46 (WEA ZB06_wpd) 15:59 22 08:57 (WEA ZB07_wpd) 15:55 18 09:08 (WEA ZB07_wpd)		
	21:07	20:08	18:56	16:48	12 07:58 (WEA ZB06_wpd) 15:59 22 08:57 (WEA ZB07_wpd) 15:55 18 09:08 (WEA ZB07_wpd)		
27	05:15	06:06	06:57	07:50	07:45 16:00 23 08:57 (WEA ZB07_wpd) 15:56 18 09:08 (WEA ZB07_wpd)		
	21:06	20:06	18:53	16:46	16 07:59 (WEA ZB06_wpd) 15:58 23 08:57 (WEA ZB07_wpd) 15:56 18 09:08 (WEA ZB07_wpd)		
28	05:17	06:07	06:59	07:52	07:42 (WEA ZB06_wpd) 15:58 23 08:58 (WEA ZB07_wpd) 15:57 19 09:09 (WEA ZB07_wpd)		
	21:04	20:04	18:51	16:44	18 08:00 (WEA ZB06_wpd) 15:58 23 08:58 (WEA ZB07_wpd) 15:57 19 09:09 (WEA ZB07_wpd)		
29	05:18	06:09	07:01	07:54	07:41 (WEA ZB06_wpd) 15:57 24 08:59 (WEA ZB07_wpd) 15:57 19 09:09 (WEA ZB07_wpd)		
	21:03	20:01	18:49	16:42	20 08:01 (WEA ZB06_wpd) 15:57 24 08:59 (WEA ZB07_wpd) 15:57 19 09:09 (WEA ZB07_wpd)		
30	05:20	06:11	07:02	07:56	07:40 (WEA ZB06_wpd) 15:56 23 08:58 (WEA ZB07_wpd) 15:57 19 09:10 (WEA ZB07_wpd)		
	21:01	19:59	18:46	16:40	22 08:02 (WEA ZB06_wpd) 15:56 23 08:58 (WEA ZB07_wpd) 15:57 19 09:10 (WEA ZB07_wpd)		
31	05:21	06:12	07:03	07:57	07:40 (WEA ZB06_wpd) 15:55 20 09:11 (WEA ZB07_wpd)		
	21:00	19:57	18:43	16:39	22 08:02 (WEA ZB06_wpd) 15:55 20 09:11 (WEA ZB07_wpd)		
Sonnenscheinstunden		505	455	381	311	264	241
astr.max.mögl.Beschattung					296	463	613

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-23 - SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:53 (WEA ZB07_vpd)   07:48	08:15 (WEA ZB06_vpd)   06:53	07:21 (WEA ZB04_vpd)   06:41	05:35	04:49	
2	16:01	22 09:15 (WEA ZB07_vpd)   16:49	17 08:32 (WEA ZB06_vpd)   17:42	20 07:41 (WEA ZB04_vpd)   19:37	20:29	21:16	
3	08:15	08:53 (WEA ZB07_vpd)   07:46	08:15 (WEA ZB06_vpd)   06:51	07:22 (WEA ZB04_vpd)   06:39	05:33	04:48	
4	16:02	23 09:16 (WEA ZB07_vpd)   16:51	19 08:34 (WEA ZB06_vpd)   17:44	19 07:41 (WEA ZB04_vpd)   19:39	20:31	21:18	
5	08:15	08:54 (WEA ZB07_vpd)   07:44	08:14 (WEA ZB06_vpd)   06:49	07:21 (WEA ZB04_vpd)   06:37	05:31	04:47	
6	16:03	23 09:17 (WEA ZB07_vpd)   16:53	21 08:35 (WEA ZB06_vpd)   17:46	18 07:39 (WEA ZB04_vpd)   19:41	20:33	21:19	
7	08:15	08:54 (WEA ZB07_vpd)   07:43	08:14 (WEA ZB06_vpd)   06:46	07:22 (WEA ZB04_vpd)   06:34	05:29	04:46	
8	16:04	22 09:16 (WEA ZB07_vpd)   16:55	21 08:35 (WEA ZB06_vpd)   17:48	17 07:39 (WEA ZB04_vpd)   19:43	20:35	21:20	
9	08:15	08:55 (WEA ZB07_vpd)   07:41	08:13 (WEA ZB06_vpd)   06:44	07:23 (WEA ZB04_vpd)   06:32	05:28	04:46	
10	16:05	22 09:17 (WEA ZB07_vpd)   16:57	22 08:35 (WEA ZB06_vpd)   17:49	15 07:38 (WEA ZB04_vpd)   19:44	20:36	21:21	
11	08:14	08:55 (WEA ZB07_vpd)   07:39	08:13 (WEA ZB06_vpd)   06:42	07:24 (WEA ZB04_vpd)   06:30	05:26	04:45	
12	16:06	24 09:19 (WEA ZB07_vpd)   16:59	23 08:36 (WEA ZB06_vpd)   17:51	11 07:35 (WEA ZB04_vpd)   19:46	20:38	21:22	
13	08:14	08:55 (WEA ZB07_vpd)   07:38	08:13 (WEA ZB06_vpd)   06:40	07:27 (WEA ZB04_vpd)   06:27	05:24	04:44	
14	16:08	24 09:19 (WEA ZB07_vpd)   17:01	23 08:36 (WEA ZB06_vpd)   17:53	5 07:32 (WEA ZB04_vpd)   19:48	20:40	21:23	
15	08:13	08:55 (WEA ZB07_vpd)   07:36	08:13 (WEA ZB06_vpd)   06:37	06:25	05:22	04:44	
16	16:09	24 09:19 (WEA ZB07_vpd)   17:03	23 08:36 (WEA ZB06_vpd)   17:55	19:50	20:41	21:24	
17	08:13	08:56 (WEA ZB07_vpd)   07:34	08:14 (WEA ZB06_vpd)   06:35	06:23	05:20	04:43	
18	16:10	24 09:20 (WEA ZB07_vpd)   17:04	23 08:37 (WEA ZB06_vpd)   17:57	19:51	20:43	21:24	
19	08:12	08:57 (WEA ZB07_vpd)   07:32	08:14 (WEA ZB06_vpd)   06:33	06:20	05:18	04:43	
20	16:12	23 09:20 (WEA ZB07_vpd)   17:06	22 08:36 (WEA ZB06_vpd)   17:58	19:53	20:45	21:25	
21	08:12	08:57 (WEA ZB07_vpd)   07:30	08:15 (WEA ZB06_vpd)   06:30	06:18	05:17	04:42	
22	16:13	23 09:20 (WEA ZB07_vpd)   17:08	21 08:36 (WEA ZB06_vpd)   18:00	19:55	20:46	21:26	
23	08:11	08:57 (WEA ZB07_vpd)   07:28	08:15 (WEA ZB06_vpd)   06:28	06:16	05:15	04:42	
24	16:15	23 09:20 (WEA ZB07_vpd)   17:10	20 08:35 (WEA ZB06_vpd)   18:02	19:57	20:48	21:27	
25	08:10	08:58 (WEA ZB07_vpd)   07:26	08:17 (WEA ZB06_vpd)   06:26	06:14	05:13	04:42	
26	16:16	22 09:20 (WEA ZB07_vpd)   17:12	17 08:34 (WEA ZB06_vpd)   18:04	19:58	20:50	21:27	
27	08:10	08:58 (WEA ZB07_vpd)   07:25	08:17 (WEA ZB06_vpd)   06:24	06:11	05:12	04:42	
28	16:18	23 09:21 (WEA ZB07_vpd)   17:14	15 08:32 (WEA ZB06_vpd)   18:06	20:00	20:51	21:28	
29	08:09	08:59 (WEA ZB07_vpd)   07:23	08:19 (WEA ZB06_vpd)   06:21	06:09	05:10	04:41	
30	16:19	22 09:21 (WEA ZB07_vpd)   17:16	11 08:30 (WEA ZB06_vpd)   18:07	20:02	20:53	21:29	
31	08:08	08:59 (WEA ZB07_vpd)   07:21	06:19	06:07	05:09	04:41	
32	16:21	22 09:21 (WEA ZB07_vpd)   17:18	18:09	20:03	20:54	21:29	
33	08:07	09:00 (WEA ZB07_vpd)   07:19	06:17	06:05	05:07	04:41	
34	16:23	21 09:21 (WEA ZB07_vpd)   17:20	18:11	20:05	20:56	21:30	
35	08:06	09:01 (WEA ZB07_vpd)   07:17	06:14	06:02	05:06	04:41	
36	16:24	20 09:21 (WEA ZB07_vpd)   17:22	18:13	20:07	20:57	21:30	
37	08:05	09:02 (WEA ZB07_vpd)   07:15	06:12	06:00	05:04	04:41	
38	16:26	19 09:21 (WEA ZB07_vpd)   17:23	18:15	20:09	20:59	21:30	
39	08:04	09:03 (WEA ZB07_vpd)   07:12	06:09	05:58	05:03	04:41	
40	16:28	17 09:20 (WEA ZB07_vpd)   17:25	18:16	20:10	21:00	21:31	
41	08:03	09:04 (WEA ZB07_vpd)   07:10	06:07	05:56	05:01	04:41	
42	16:29	15 09:19 (WEA ZB07_vpd)   17:27	18:18	20:12	21:02	21:31	
43	08:02	09:06 (WEA ZB07_vpd)   07:08	06:05	05:54	05:00	04:42	
44	16:31	12 09:18 (WEA ZB07_vpd)   17:29	18:20	20:14	21:03	21:31	
45	08:00	09:08 (WEA ZB07_vpd)   07:06	06:02	05:52	04:59	04:42	
46	16:33	8 09:16 (WEA ZB07_vpd)   17:31	4 07:34 (WEA ZB04_vpd)   18:22	20:16	21:05	21:31	
47	07:59	07:04	06:00	05:50	04:57	04:42	
48	16:35	17:33	9 07:37 (WEA ZB04_vpd)   18:23	20:17	21:06	21:31	
49	07:58	07:02	05:58	05:47	04:56	04:42	
50	16:36	17:35	13 07:39 (WEA ZB04_vpd)   18:25	20:19	21:08	21:32	
51	07:56	07:00	05:55	05:45	04:55	04:43	
52	16:38	17:37	16 07:40 (WEA ZB04_vpd)   18:27	20:21	21:09	21:32	
53	07:55	06:58	05:53	05:43	04:54	04:43	
54	16:40	17:38	18 07:40 (WEA ZB04_vpd)   18:29	20:23	21:10	21:31	
55	07:54	06:55	05:51	05:41	04:53	04:44	
56	16:42	17:40	19 07:40 (WEA ZB04_vpd)   18:30	20:24	21:12	21:31	
57	07:52	06:48	05:48	05:39	04:52	04:44	
58	16:44	19:32	20:26	20:26	21:13	21:31	
59	07:51	06:46	05:46	05:37	04:51	04:45	
60	16:46	10 08:29 (WEA ZB06_vpd)   19:34	20:28	21:14	21:14	21:31	
61	07:49	08:17 (WEA ZB06_vpd)   19:36	06:44	06:50	04:50	04:45	
62	16:47	14 08:31 (WEA ZB06_vpd)   19:36	06:44	06:50	21:15	21:31	
63	Sonnenscheinstunden	256	276	367	417	488	502
64	astr.max.mögl.Beschattung	502	377	105			

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-23 - SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober	November	Dezember
1	04:45	05:23	06:14	07:04	06:59	07:43 (WEA ZB06_wpd) 07:51 08:39 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	22 08:05 (WEA ZB06_wpd) 15:55 23 09:02 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:42 (WEA ZB06_wpd) 07:53 08:40 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	23 08:05 (WEA ZB06_wpd) 15:54 23 09:03 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:42 (WEA ZB06_wpd) 07:54 08:39 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	24 08:06 (WEA ZB06_wpd) 15:54 24 09:03 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:42 (WEA ZB06_wpd) 07:55 24 08:40 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	24 08:06 (WEA ZB06_wpd) 15:53 24 09:04 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:43 (WEA ZB06_wpd) 07:57 08:40 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	22 08:05 (WEA ZB06_wpd) 15:53 24 09:04 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:43 (WEA ZB06_wpd) 07:58 08:40 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:05 (WEA ZB06_wpd) 15:52 24 09:04 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:44 (WEA ZB06_wpd) 07:59 08:42 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	21 08:05 (WEA ZB06_wpd) 15:52 23 09:05 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:44 (WEA ZB06_wpd) 08:01 08:42 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	20 08:04 (WEA ZB06_wpd) 15:51 23 09:05 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:45 (WEA ZB06_wpd) 08:02 08:42 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	19 08:04 (WEA ZB06_wpd) 15:51 23 09:05 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:46 (WEA ZB06_wpd) 08:03 08:44 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	17 08:03 (WEA ZB06_wpd) 15:51 22 09:06 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:48 (WEA ZB06_wpd) 08:04 08:44 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	13 08:01 (WEA ZB06_wpd) 15:51 22 09:06 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:50 (WEA ZB06_wpd) 08:05 08:44 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	10 08:00 (WEA ZB06_wpd) 15:51 22 09:06 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	07:55 (WEA ZB06_wpd) 08:06 08:45 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	19 08:14 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	07:55 (WEA ZB06_wpd) 08:07 08:46 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	18 08:13 (WEA ZB06_wpd) 15:50 21 09:07 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	07:55 (WEA ZB06_wpd) 08:08 08:46 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	18 08:13 (WEA ZB06_wpd) 15:51 21 09:07 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	07:56 (WEA ZB06_wpd) 08:09 08:47 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	15 08:11 (WEA ZB06_wpd) 15:51 21 09:08 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	07:58 (WEA ZB06_wpd) 08:10 08:47 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	12 08:10 (WEA ZB06_wpd) 15:51 20 09:07 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:00 (WEA ZB06_wpd) 08:11 08:48 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	8 08:08 (WEA ZB06_wpd) 15:51 20 09:08 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:01 (WEA ZB06_wpd) 08:11 08:48 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	8 08:51 (WEA ZB07_wpd) 15:51 21 09:09 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:41 (WEA ZB07_wpd) 08:12 08:48 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	12 08:53 (WEA ZB07_wpd) 15:52 20 09:08 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:40 (WEA ZB07_wpd) 08:12 08:49 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15 08:55 (WEA ZB07_wpd) 15:52 20 09:09 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:40 (WEA ZB07_wpd) 08:13 08:49 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	17 08:57 (WEA ZB07_wpd) 15:53 20 09:09 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:38 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	19 08:57 (WEA ZB07_wpd) 15:53 20 09:10 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:38 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	20 08:58 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:38 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	21 08:59 (WEA ZB07_wpd) 15:54 21 09:11 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:38 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	4 07:57 (WEA ZB06_wpd) 15:59 20 09:12 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:38 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	22 09:00 (WEA ZB07_wpd) 15:56 20 09:12 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:38 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	23 09:01 (WEA ZB07_wpd) 15:57 21 09:13 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	23 09:02 (WEA ZB07_wpd) 15:57 21 09:13 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	08:38 (WEA ZB07_wpd) 08:15 08:53 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	23 09:01 (WEA ZB07_wpd) 15:58 21 09:14 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:43 (WEA ZB06_wpd)	08:38 (WEA ZB07_wpd) 08:15 08:53 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	22 08:05 (WEA ZB06_wpd) 15:59 22 09:15 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				275	462	668

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)	Schattende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---------------------------------------



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-24 - SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:57 (WEA ZB07_vpd)	07:48	08:17 (WEA ZB06_vpd)	06:53	07:23 (WEA ZB04_vpd)
	16:01	23 09:20 (WEA ZB07_vpd)	16:49	20 08:37 (WEA ZB06_vpd)	17:42	19 07:42 (WEA ZB04_vpd)
2	08:15	08:58 (WEA ZB07_vpd)	07:46	08:18 (WEA ZB06_vpd)	06:51	07:23 (WEA ZB04_vpd)
	16:02	23 09:21 (WEA ZB07_vpd)	16:51	21 08:39 (WEA ZB06_vpd)	17:44	19 07:42 (WEA ZB04_vpd)
3	08:15	08:58 (WEA ZB07_vpd)	07:44	08:17 (WEA ZB06_vpd)	06:49	07:23 (WEA ZB04_vpd)
	16:03	24 09:22 (WEA ZB07_vpd)	16:53	22 08:39 (WEA ZB06_vpd)	17:46	18 07:41 (WEA ZB04_vpd)
4	08:15	08:58 (WEA ZB07_vpd)	07:43	08:16 (WEA ZB06_vpd)	06:46	07:24 (WEA ZB04_vpd)
	16:04	24 09:22 (WEA ZB07_vpd)	16:55	23 08:39 (WEA ZB06_vpd)	17:48	18 07:40 (WEA ZB04_vpd)
5	08:15	08:59 (WEA ZB07_vpd)	07:41	08:16 (WEA ZB06_vpd)	06:44	07:25 (WEA ZB04_vpd)
	16:05	24 09:23 (WEA ZB07_vpd)	16:57	24 08:40 (WEA ZB06_vpd)	17:49	14 07:39 (WEA ZB04_vpd)
6	08:14	09:00 (WEA ZB07_vpd)	07:39	08:16 (WEA ZB06_vpd)	06:42	07:26 (WEA ZB04_vpd)
	16:06	24 09:24 (WEA ZB07_vpd)	16:59	24 08:40 (WEA ZB06_vpd)	17:51	10 07:36 (WEA ZB04_vpd)
7	08:14	09:00 (WEA ZB07_vpd)	07:38	08:16 (WEA ZB06_vpd)	06:40	06:27
	16:08	24 09:24 (WEA ZB07_vpd)	17:01	24 08:40 (WEA ZB06_vpd)	17:53	19:48
8	08:13	09:00 (WEA ZB07_vpd)	07:36	08:16 (WEA ZB06_vpd)	06:37	06:25
	16:09	24 09:24 (WEA ZB07_vpd)	17:03	23 08:39 (WEA ZB06_vpd)	17:55	19:50
9	08:13	09:01 (WEA ZB07_vpd)	07:34	08:17 (WEA ZB06_vpd)	06:35	06:23
	16:10	24 09:25 (WEA ZB07_vpd)	17:04	23 08:40 (WEA ZB06_vpd)	17:57	19:51
10	08:12	09:01 (WEA ZB07_vpd)	07:32	08:18 (WEA ZB06_vpd)	06:33	06:20
	16:12	24 09:25 (WEA ZB07_vpd)	17:06	22 08:40 (WEA ZB06_vpd)	17:58	19:53
11	08:12	09:02 (WEA ZB07_vpd)	07:30	08:19 (WEA ZB06_vpd)	06:30	06:18
	16:13	23 09:25 (WEA ZB07_vpd)	17:08	20 08:39 (WEA ZB06_vpd)	18:00	19:55
12	08:11	09:02 (WEA ZB07_vpd)	07:28	08:20 (WEA ZB06_vpd)	06:28	06:16
	16:15	23 09:25 (WEA ZB07_vpd)	17:10	18 08:38 (WEA ZB06_vpd)	18:02	19:57
13	08:10	09:03 (WEA ZB07_vpd)	07:26	08:21 (WEA ZB06_vpd)	06:26	06:14
	16:16	22 09:25 (WEA ZB07_vpd)	17:12	16 08:37 (WEA ZB06_vpd)	18:04	19:58
14	08:10	09:03 (WEA ZB07_vpd)	07:25	08:22 (WEA ZB06_vpd)	06:24	06:11
	16:18	22 09:25 (WEA ZB07_vpd)	17:14	12 08:34 (WEA ZB06_vpd)	18:06	20:00
15	08:09	09:04 (WEA ZB07_vpd)	07:23	08:26 (WEA ZB06_vpd)	06:21	06:09
	16:19	21 09:25 (WEA ZB07_vpd)	17:16	4 08:30 (WEA ZB06_vpd)	18:07	20:02
16	08:08	09:05 (WEA ZB07_vpd)	07:21	06:19	06:19	06:07
	16:21	20 09:25 (WEA ZB07_vpd)	17:18	18:09	20:03	20:54
17	08:07	09:06 (WEA ZB07_vpd)	07:19	06:17	06:17	06:05
	16:23	19 09:25 (WEA ZB07_vpd)	17:20	18:11	20:05	20:56
18	08:06	09:07 (WEA ZB07_vpd)	07:17	06:14	06:14	06:02
	16:24	18 09:25 (WEA ZB07_vpd)	17:22	18:13	20:07	20:57
19	08:05	09:09 (WEA ZB07_vpd)	07:15	06:12	06:12	06:00
	16:26	15 09:24 (WEA ZB07_vpd)	17:23	18:15	20:09	20:59
20	08:04	09:09 (WEA ZB07_vpd)	07:12	06:09	06:09	05:58
	16:28	14 09:23 (WEA ZB07_vpd)	17:25	18:16	20:10	21:00
21	08:03	09:12 (WEA ZB07_vpd)	07:10	06:07	06:07	05:56
	16:29	9 09:21 (WEA ZB07_vpd)	17:27	18:18	20:12	21:02
22	08:02	09:16 (WEA ZB07_vpd)	07:08	06:05	06:05	05:54
	16:31	2 09:18 (WEA ZB07_vpd)	17:29	18:20	20:14	21:03
23	08:00	07:06	06:02	06:02	05:52	04:59
	16:33	17:31	8 07:30 (WEA ZB04_vpd)	18:22	20:16	21:05
24	07:59	07:04	8 07:38 (WEA ZB04_vpd)	06:00	05:50	04:57
	16:35	17:33	12 07:40 (WEA ZB04_vpd)	18:23	20:17	21:06
25	07:58	07:02	12 07:40 (WEA ZB04_vpd)	05:58	05:47	04:56
	16:36	17:35	15 07:41 (WEA ZB04_vpd)	18:25	20:19	21:08
26	07:56	07:00	15 07:41 (WEA ZB04_vpd)	05:55	05:45	04:55
	16:38	17:37	18 07:42 (WEA ZB04_vpd)	18:27	20:21	21:09
27	07:55	06:58	18 07:42 (WEA ZB04_vpd)	05:53	05:43	04:54
	16:40	17:38	19 07:42 (WEA ZB04_vpd)	18:29	20:23	21:10
28	07:54	08:23 (WEA ZB06_vpd)	06:55	07:23 (WEA ZB04_vpd)	05:51	05:41
	16:42	8 08:31 (WEA ZB06_vpd)	17:40	19 07:42 (WEA ZB04_vpd)	18:30	20:24
29	07:52	08:20 (WEA ZB06_vpd)	06:48	06:48	05:39	04:52
	16:44	13 08:33 (WEA ZB06_vpd)	17:42	19:32	20:26	21:13
30	07:51	08:20 (WEA ZB06_vpd)	06:46	06:46	05:37	04:51
	16:46	15 08:35 (WEA ZB06_vpd)	17:44	19:34	20:28	21:14
31	07:49	08:18 (WEA ZB06_vpd)	06:44	06:44	05:35	04:50
	16:47	18 08:36 (WEA ZB06_vpd)	17:46	19:36	20:30	21:15
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	500	387	96			

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-24 - SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04		06:59	07:47 (WEA ZB06_wpd)	07:51	08:44 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44		16:37	21 08:08 (WEA ZB06_wpd)	15:55	23 09:07 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06		07:01	07:46 (WEA ZB06_wpd)	07:53	08:44 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42		16:35	23 08:09 (WEA ZB06_wpd)	15:54	24 09:08 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07		07:03	07:46 (WEA ZB06_wpd)	07:54	08:44 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39		16:33	23 08:09 (WEA ZB06_wpd)	15:54	24 09:08 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09		07:05	07:46 (WEA ZB06_wpd)	07:55	08:45 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37		16:31	23 08:09 (WEA ZB06_wpd)	15:53	24 09:09 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11		07:06	07:46 (WEA ZB06_wpd)	07:57	08:45 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35		16:29	23 08:09 (WEA ZB06_wpd)	15:53	24 09:09 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13		07:08	07:46 (WEA ZB06_wpd)	07:58	08:45 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32		16:27	23 08:09 (WEA ZB06_wpd)	15:52	24 09:09 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14		07:10	07:46 (WEA ZB06_wpd)	07:59	08:46 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	7	16:26	23 08:09 (WEA ZB06_wpd)	15:52	24 09:10 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16		07:12	07:47 (WEA ZB06_wpd)	08:01	08:46 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	12	16:24	22 08:09 (WEA ZB06_wpd)	15:51	24 09:10 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18		07:14	07:47 (WEA ZB06_wpd)	08:02	08:46 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16	16:22	21 08:08 (WEA ZB06_wpd)	15:51	24 09:10 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20		07:16	07:48 (WEA ZB06_wpd)	08:03	08:48 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	18	16:21	20 08:08 (WEA ZB06_wpd)	15:51	23 09:11 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21		07:17	07:49 (WEA ZB06_wpd)	08:04	08:48 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	18	16:19	18 08:07 (WEA ZB06_wpd)	15:51	24 09:12 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23		07:19	07:51 (WEA ZB06_wpd)	08:05	08:48 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	20	16:17	15 08:06 (WEA ZB06_wpd)	15:51	24 09:12 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25		07:21	07:52 (WEA ZB06_wpd)	08:06	08:49 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	20	16:16	13 08:05 (WEA ZB06_wpd)	15:50	23 09:12 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27		07:23	07:55 (WEA ZB06_wpd)	08:07	08:49 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	19	16:14	7 08:02 (WEA ZB06_wpd)	15:50	24 09:13 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28		07:25		08:08	08:50 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	19	16:13		15:51	23 09:13 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30		07:26		08:09	08:51 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	17	16:11		15:51	23 09:14 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32		07:28		08:10	08:50 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	14	16:10		15:51	23 09:13 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34		07:30		08:10	08:51 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	11	16:09		15:51	23 09:14 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35		07:32		08:11	08:52 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	6	16:07		15:51	23 09:15 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37		07:33	08:51 (WEA ZB07_wpd)	08:12	08:52 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01		16:06	2 08:53 (WEA ZB07_wpd)	15:52	22 09:14 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39		07:35	08:48 (WEA ZB07_wpd)	08:12	08:53 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59		16:05	9 08:57 (WEA ZB07_wpd)	15:52	22 09:15 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41		07:37	08:46 (WEA ZB07_wpd)	08:13	08:53 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57		16:04	14 09:00 (WEA ZB07_wpd)	15:53	22 09:15 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43		07:39	08:45 (WEA ZB07_wpd)	08:14	08:54 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55		16:03	15 09:00 (WEA ZB07_wpd)	15:53	22 09:16 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44		07:40	08:44 (WEA ZB07_wpd)	08:14	08:54 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53		16:01	18 09:02 (WEA ZB07_wpd)	15:54	23 09:17 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46		07:42	08:44 (WEA ZB07_wpd)	08:14	08:54 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50		16:00	19 09:03 (WEA ZB07_wpd)	15:54	23 09:17 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48		07:43	08:44 (WEA ZB07_wpd)	08:15	08:55 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48		15:59	20 09:04 (WEA ZB07_wpd)	15:55	23 09:18 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50		07:45	08:43 (WEA ZB07_wpd)	08:15	08:56 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	7	15:58	21 09:04 (WEA ZB07_wpd)	15:56	22 09:18 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52		07:47	08:43 (WEA ZB07_wpd)	08:15	08:56 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	13	15:58	22 09:05 (WEA ZB07_wpd)	15:57	23 09:19 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54		07:48	08:44 (WEA ZB07_wpd)	08:15	08:56 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	17	15:57	22 09:06 (WEA ZB07_wpd)	15:57	23 09:19 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56		07:50	08:43 (WEA ZB07_wpd)	08:15	08:57 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	19	15:56	23 08:43 (WEA ZB07_wpd)	15:58	23 09:20 (WEA ZB07_wpd)
31	05:21	06:12		07:57		07:51	09:06 (WEA ZB07_wpd)	08:15	08:57 (WEA ZB07_wpd)
	21:00	19:57		16:39	21	15:59		15:59	24 09:21 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331		264		241	
astr.max.mögl.Beschattung					274		460		720

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-25 - SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:59 (WEA ZB07_vpd)	07:48	08:19 (WEA ZB06_vpd)	06:53	07:24 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	24 09:23 (WEA ZB07_vpd)	16:49	21 08:40 (WEA ZB06_vpd)	17:42	20 07:44 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:00 (WEA ZB07_vpd)	07:46	08:19 (WEA ZB06_vpd)	06:51	07:25 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	24 09:24 (WEA ZB07_vpd)	16:51	22 08:41 (WEA ZB06_vpd)	17:44	19 07:44 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	09:00 (WEA ZB07_vpd)	07:44	08:18 (WEA ZB06_vpd)	06:49	07:25 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	24 09:24 (WEA ZB07_vpd)	16:53	24 08:42 (WEA ZB06_vpd)	17:46	17 07:42 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	09:00 (WEA ZB07_vpd)	07:43	08:18 (WEA ZB06_vpd)	06:46	07:26 (WEA ZB04_vpd)	06:34	05:29	04:46		
	16:04	24 09:24 (WEA ZB07_vpd)	16:55	24 08:42 (WEA ZB06_vpd)	17:48	15 07:41 (WEA ZB04_vpd)	19:43	20:35	21:20		
5	08:15	09:01 (WEA ZB07_vpd)	07:41	08:18 (WEA ZB06_vpd)	06:44	07:27 (WEA ZB04_vpd)	06:32	05:28	04:46		
	16:05	24 09:25 (WEA ZB07_vpd)	16:57	24 08:42 (WEA ZB06_vpd)	17:49	13 07:40 (WEA ZB04_vpd)	19:44	20:36	21:21		
6	08:14	09:02 (WEA ZB07_vpd)	07:39	08:18 (WEA ZB06_vpd)	06:42	07:29 (WEA ZB04_vpd)	06:30	05:26	04:45		
	16:06	24 09:26 (WEA ZB07_vpd)	16:59	24 08:42 (WEA ZB06_vpd)	17:51	7 07:36 (WEA ZB04_vpd)	19:46	20:38	21:22		
7	08:14	09:02 (WEA ZB07_vpd)	07:38	08:18 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	24 09:26 (WEA ZB07_vpd)	17:01	24 08:42 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:02 (WEA ZB07_vpd)	07:36	08:18 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	24 09:26 (WEA ZB07_vpd)	17:03	23 08:41 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:03 (WEA ZB07_vpd)	07:34	08:20 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	24 09:27 (WEA ZB07_vpd)	17:04	22 08:42 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:04 (WEA ZB07_vpd)	07:32	08:21 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	23 09:27 (WEA ZB07_vpd)	17:06	20 08:41 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	09:04 (WEA ZB07_vpd)	07:30	08:21 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42		
	16:13	23 09:27 (WEA ZB07_vpd)	17:08	19 08:40 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26		
12	08:11	09:05 (WEA ZB07_vpd)	07:28	08:23 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42		
	16:15	22 09:27 (WEA ZB07_vpd)	17:10	16 08:39 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27		
13	08:10	09:05 (WEA ZB07_vpd)	07:26	08:25 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42		
	16:16	22 09:27 (WEA ZB07_vpd)	17:12	12 08:37 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27		
14	08:10	09:06 (WEA ZB07_vpd)	07:25	08:27 (WEA ZB06_vpd)	06:24		06:11	05:12	04:42		
	16:18	21 09:27 (WEA ZB07_vpd)	17:14	6 08:33 (WEA ZB06_vpd)	18:06		20:00	20:51	21:28		
15	08:09	09:07 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	20 09:27 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:08 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	18 09:26 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07	09:09 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41		
	16:23	17 09:26 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30		
18	08:06	09:10 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41		
	16:24	16 09:26 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30		
19	08:05	09:12 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41		
	16:26	13 09:25 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30		
20	08:04	09:14 (WEA ZB07_vpd)	07:12		06:09		05:58	05:03	04:41		
	16:28	9 09:23 (WEA ZB07_vpd)	17:25		18:16		20:10	21:00	21:31		
21	08:03		07:10		06:07		05:56	05:01	04:41		
	16:29		17:27		18:18		20:12	21:02	21:31		
22	08:02		07:08	07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:42		
	16:31		17:29	6 07:38 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00		07:06	07:39 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33		17:31	11 07:41 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59		07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35		17:33	14 07:42 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58		07:02	07:26 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36		17:35	18 07:44 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56		07:00	07:25 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38		17:37	19 07:44 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:24 (WEA ZB06_vpd)	06:58	07:24 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	8 08:32 (WEA ZB06_vpd)	17:38	20 07:44 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:22 (WEA ZB06_vpd)	06:55	20 07:24 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	13 08:35 (WEA ZB06_vpd)	17:40	20 07:44 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:21 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	16 08:37 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:20 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	18 08:38 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:19 (WEA ZB06_vpd)			06:44			04:50			
	16:47	20 08:39 (WEA ZB06_vpd)			19:36			21:15			
	Sonnenscheinstunden	256						417	488	502	
	astr.max.mögl.Beschattung	495	276	389		367	91				

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-25 - SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:49 (WEA ZB06_wpd) 07:51 08:46 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	21 08:10 (WEA ZB06_wpd) 15:55 23 09:09 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:48 (WEA ZB06_wpd) 07:53 08:47 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	23 08:11 (WEA ZB06_wpd) 15:54 23 09:10 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:48 (WEA ZB06_wpd) 07:54 08:47 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	23 08:11 (WEA ZB06_wpd) 15:54 23 09:10 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:48 (WEA ZB06_wpd) 07:55 08:47 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	23 08:11 (WEA ZB06_wpd) 15:53 24 09:11 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:48 (WEA ZB06_wpd) 07:57 08:47 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	24 08:12 (WEA ZB06_wpd) 15:53 24 09:11 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:48 (WEA ZB06_wpd) 07:58 08:47 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	24 08:12 (WEA ZB06_wpd) 15:52 24 09:11 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:48 (WEA ZB06_wpd) 07:59 08:48 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	24 08:12 (WEA ZB06_wpd) 15:52 24 09:12 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	08:04 (WEA ZB04_wpd) 07:12	07:48 (WEA ZB06_wpd) 08:01 08:48 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	9 08:13 (WEA ZB04_wpd) 16:24	23 08:11 (WEA ZB06_wpd) 15:51 24 09:12 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	08:02 (WEA ZB04_wpd) 07:14	07:49 (WEA ZB06_wpd) 08:02 08:48 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	13 08:15 (WEA ZB04_wpd) 16:22	22 08:11 (WEA ZB06_wpd) 15:51 24 09:12 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:59 (WEA ZB04_wpd) 07:16	07:49 (WEA ZB06_wpd) 08:03 08:50 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	17 08:16 (WEA ZB04_wpd) 16:21	22 08:11 (WEA ZB06_wpd) 15:51 24 09:14 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:58 (WEA ZB04_wpd) 07:17	07:50 (WEA ZB06_wpd) 08:04 08:50 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	18 08:16 (WEA ZB04_wpd) 16:19	20 08:10 (WEA ZB06_wpd) 15:51 24 09:14 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:58 (WEA ZB04_wpd) 07:19	07:51 (WEA ZB06_wpd) 08:05 08:50 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	19 08:17 (WEA ZB04_wpd) 16:17	18 08:09 (WEA ZB06_wpd) 15:51 24 09:14 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:57 (WEA ZB04_wpd) 07:21	07:53 (WEA ZB06_wpd) 08:06 08:51 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	20 08:17 (WEA ZB04_wpd) 16:16	15 08:08 (WEA ZB06_wpd) 15:50 24 09:15 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:57 (WEA ZB04_wpd) 07:23	07:54 (WEA ZB06_wpd) 08:07 08:51 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	20 08:17 (WEA ZB04_wpd) 16:14	13 08:07 (WEA ZB06_wpd) 15:50 24 09:15 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:57 (WEA ZB04_wpd) 07:25	07:50 (WEA ZB06_wpd) 08:08 08:52 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	20 08:17 (WEA ZB04_wpd) 16:13	8 08:05 (WEA ZB06_wpd) 15:51 23 09:15 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:57 (WEA ZB04_wpd) 07:26	08:09 08:53 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	18 08:15 (WEA ZB04_wpd) 16:11	15:51 23 09:16 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 07:28	08:10 08:52 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16 08:14 (WEA ZB04_wpd) 16:10	15:51 24 09:16 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:00 (WEA ZB04_wpd) 07:30	08:10 08:53 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	13 08:13 (WEA ZB04_wpd) 16:09	15:51 23 09:16 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:02 (WEA ZB04_wpd) 07:32	08:11 08:54 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	10 08:12 (WEA ZB04_wpd) 16:07	15:51 23 09:17 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:04 (WEA ZB04_wpd) 07:33	08:12 08:54 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	5 08:09 (WEA ZB04_wpd) 16:06	15:52 23 09:17 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:12 08:55 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15:52 23 09:18 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:51 (WEA ZB07_wpd) 08:13 08:55 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	9 09:00 (WEA ZB07_wpd) 15:53 23 09:18 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:48 (WEA ZB07_wpd) 08:14 08:56 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	13 09:01 (WEA ZB07_wpd) 15:53 23 09:19 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:48 (WEA ZB07_wpd) 08:14 08:56 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	15 09:03 (WEA ZB07_wpd) 15:54 23 09:19 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:47 (WEA ZB07_wpd) 08:14 08:56 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	17 09:04 (WEA ZB07_wpd) 15:54 23 09:19 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:47 (WEA ZB07_wpd) 08:15 08:57 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	18 09:05 (WEA ZB07_wpd) 15:55 24 09:21 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:46 (WEA ZB07_wpd) 08:15 08:57 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	20 09:06 (WEA ZB07_wpd) 15:56 24 09:21 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:55 (WEA ZB06_wpd) 07:47	08:46 (WEA ZB07_wpd) 08:15 08:58 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	8 08:03 (WEA ZB06_wpd) 15:58	21 09:07 (WEA ZB07_wpd) 15:57 23 09:21 (WEA ZB07_wpd)
29	05:18	06:09	07:01	06:54	07:53 (WEA ZB06_wpd) 07:48	08:46 (WEA ZB07_wpd) 08:15 08:58 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	13 08:06 (WEA ZB06_wpd) 15:57	22 09:08 (WEA ZB07_wpd) 15:57 24 09:22 (WEA ZB07_wpd)
30	05:20	06:11	07:02	06:55	07:51 (WEA ZB06_wpd) 07:50	08:46 (WEA ZB07_wpd) 08:15 08:59 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	17 08:08 (WEA ZB06_wpd) 15:56	22 09:08 (WEA ZB07_wpd) 15:58 23 09:22 (WEA ZB07_wpd)
31	05:21	06:12	07:03	06:57	07:50 (WEA ZB06_wpd) 07:49	08:45 (WEA ZB07_wpd) 08:15 08:59 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	19 08:09 (WEA ZB06_wpd) 15:59	24 09:23 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				255	460	729

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-26 - SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:01 (WEA ZB07_vpd)   07:48	08:20 (WEA ZB06_vpd)   06:53	07:26 (WEA ZB04_vpd)   06:41	05:35	04:49
	16:01	24 09:25 (WEA ZB07_vpd)   16:49	22 08:42 (WEA ZB06_vpd)   17:42	19 07:45 (WEA ZB04_vpd)   19:37	20:29	21:16
2	08:15	09:02 (WEA ZB07_vpd)   07:46	08:20 (WEA ZB06_vpd)   06:51	07:27 (WEA ZB04_vpd)   06:39	05:33	04:48
	16:02	24 09:26 (WEA ZB07_vpd)   16:51	24 08:44 (WEA ZB06_vpd)   17:44	18 07:45 (WEA ZB04_vpd)   19:39	20:31	21:18
3	08:15	09:02 (WEA ZB07_vpd)   07:44	08:20 (WEA ZB06_vpd)   06:49	07:26 (WEA ZB04_vpd)   06:37	05:31	04:47
	16:03	24 09:26 (WEA ZB07_vpd)   16:53	24 08:44 (WEA ZB06_vpd)   17:46	17 07:43 (WEA ZB04_vpd)   19:41	20:33	21:19
4	08:15	09:02 (WEA ZB07_vpd)   07:43	08:20 (WEA ZB06_vpd)   06:46	07:28 (WEA ZB04_vpd)   06:34	05:29	04:46
	16:04	24 09:26 (WEA ZB07_vpd)   16:55	24 08:44 (WEA ZB06_vpd)   17:48	14 07:42 (WEA ZB04_vpd)   19:43	20:35	21:20
5	08:15	09:03 (WEA ZB07_vpd)   07:41	08:20 (WEA ZB06_vpd)   06:44	07:30 (WEA ZB04_vpd)   06:32	05:28	04:46
	16:05	24 09:27 (WEA ZB07_vpd)   16:57	24 08:44 (WEA ZB06_vpd)   17:49	10 07:40 (WEA ZB04_vpd)   19:44	20:36	21:21
6	08:14	09:04 (WEA ZB07_vpd)   07:39	08:20 (WEA ZB06_vpd)   06:42	06:30	05:26	04:45
	16:06	24 09:28 (WEA ZB07_vpd)   16:59	24 08:44 (WEA ZB06_vpd)   17:51	19:46	20:38	21:22
7	08:14	09:04 (WEA ZB07_vpd)   07:38	08:20 (WEA ZB06_vpd)   06:40	06:27	05:24	04:44
	16:08	24 09:28 (WEA ZB07_vpd)   17:01	23 08:43 (WEA ZB06_vpd)   17:53	19:48	20:40	21:23
8	08:13	09:04 (WEA ZB07_vpd)   07:36	08:21 (WEA ZB06_vpd)   06:37	06:25	05:22	04:44
	16:09	24 09:28 (WEA ZB07_vpd)   17:03	22 08:43 (WEA ZB06_vpd)   17:55	19:50	20:41	21:24
9	08:13	09:06 (WEA ZB07_vpd)   07:34	08:22 (WEA ZB06_vpd)   06:35	06:23	05:20	04:43
	16:10	23 09:29 (WEA ZB07_vpd)   17:04	21 08:43 (WEA ZB06_vpd)   17:57	19:51	20:43	21:24
10	08:12	09:06 (WEA ZB07_vpd)   07:32	08:23 (WEA ZB06_vpd)   06:33	06:20	05:18	04:43
	16:12	23 09:29 (WEA ZB07_vpd)   17:06	19 08:42 (WEA ZB06_vpd)   17:58	19:53	20:45	21:25
11	08:12	09:07 (WEA ZB07_vpd)   07:30	08:24 (WEA ZB06_vpd)   06:30	06:18	05:17	04:42
	16:13	22 09:29 (WEA ZB07_vpd)   17:08	17 08:41 (WEA ZB06_vpd)   18:00	19:55	20:46	21:26
12	08:11	09:07 (WEA ZB07_vpd)   07:28	08:26 (WEA ZB06_vpd)   06:28	06:16	05:15	04:42
	16:15	22 09:29 (WEA ZB07_vpd)   17:10	14 08:40 (WEA ZB06_vpd)   18:02	19:57	20:48	21:27
13	08:10	09:08 (WEA ZB07_vpd)   07:26	08:29 (WEA ZB06_vpd)   06:26	06:14	05:13	04:42
	16:16	20 09:28 (WEA ZB07_vpd)   17:12	8 08:37 (WEA ZB06_vpd)   18:04	19:58	20:50	21:27
14	08:10	09:09 (WEA ZB07_vpd)   07:25	06:24	06:11	05:12	04:42
	16:18	19 09:28 (WEA ZB07_vpd)   17:14	18:06	20:00	20:51	21:28
15	08:09	09:10 (WEA ZB07_vpd)   07:23	06:21	06:09	05:10	04:41
	16:19	18 09:28 (WEA ZB07_vpd)   17:16	18:07	20:02	20:53	21:29
16	08:08	09:11 (WEA ZB07_vpd)   07:21	06:19	06:07	05:09	04:41
	16:21	17 09:28 (WEA ZB07_vpd)   17:18	18:09	20:03	20:54	21:29
17	08:07	09:12 (WEA ZB07_vpd)   07:19	06:17	06:05	05:07	04:41
	16:23	15 09:27 (WEA ZB07_vpd)   17:20	18:11	20:05	20:56	21:30
18	08:06	09:14 (WEA ZB07_vpd)   07:17	06:14	06:02	05:06	04:41
	16:24	12 09:26 (WEA ZB07_vpd)   17:22	18:13	20:07	20:57	21:30
19	08:05	09:16 (WEA ZB07_vpd)   07:15	06:12	06:00	05:04	04:41
	16:26	9 09:25 (WEA ZB07_vpd)   17:23	18:15	20:09	20:59	21:30
20	08:04	07:12	06:09	05:58	05:03	04:41
	16:28	17:25	18:16	20:10	21:00	21:31
21	08:03	07:10	06:07	05:56	05:01	04:41
	16:29	17:27	4 07:39 (WEA ZB04_vpd)   18:18	20:12	21:02	21:31
22	08:02	07:08	06:05	05:54	05:00	04:42
	16:31	17:29	9 07:41 (WEA ZB04_vpd)   18:20	20:14	21:03	21:31
23	08:00	07:06	06:02	05:52	04:59	04:42
	16:33	17:31	13 07:43 (WEA ZB04_vpd)   18:22	20:16	21:05	21:31
24	07:59	07:04	06:00	05:50	04:57	04:42
	16:35	17:33	16 07:44 (WEA ZB04_vpd)   18:23	20:17	21:06	21:31
25	07:58	07:02	05:58	05:47	04:56	04:42
	16:36	17:35	18 07:45 (WEA ZB04_vpd)   18:25	20:19	21:08	21:32
26	07:56	07:00	05:55	05:45	04:55	04:43
	16:38	8 08:34 (WEA ZB06_vpd)   17:37	19 07:46 (WEA ZB04_vpd)   18:27	20:21	21:09	21:32
27	07:55	06:58	05:53	05:43	04:54	04:43
	16:40	13 08:36 (WEA ZB06_vpd)   17:38	20 07:45 (WEA ZB04_vpd)   18:29	20:23	21:10	21:31
28	07:54	06:55	05:51	05:41	04:53	04:44
	16:42	16 08:39 (WEA ZB06_vpd)   17:40	19 07:45 (WEA ZB04_vpd)   18:30	20:24	21:12	21:31
29	07:52	06:48	05:48	05:39	04:52	04:44
	16:44	19 08:40 (WEA ZB06_vpd)   17:42	19:32	20:26	21:13	21:31
30	07:51	06:46	05:46	05:37	04:51	04:45
	16:46	20 08:41 (WEA ZB06_vpd)   17:44	19:34	20:28	21:14	21:31
31	07:49	06:44	05:44	05:35	04:50	04:45
	16:47	21 08:42 (WEA ZB06_vpd)   17:46	19:36	20:30	21:15	21:31
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	489	384	78			

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-26 - SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:52 (WEA ZB06_wpd) 07:51 08:49 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	19 08:11 (WEA ZB06_wpd) 15:55 22 09:11 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:51 (WEA ZB06_wpd) 07:53 08:49 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	21 08:12 (WEA ZB06_wpd) 15:54 23 09:12 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:50 (WEA ZB06_wpd) 07:54 08:49 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	23 08:13 (WEA ZB06_wpd) 15:54 23 09:12 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:50 (WEA ZB06_wpd) 07:55 08:50 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	23 08:13 (WEA ZB06_wpd) 15:53 23 09:13 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:50 (WEA ZB06_wpd) 07:57 08:49 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	23 08:13 (WEA ZB06_wpd) 15:53 24 09:13 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:50 (WEA ZB06_wpd) 07:58 08:49 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	24 08:14 (WEA ZB06_wpd) 15:52 24 09:13 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:50 (WEA ZB06_wpd) 07:59 08:50 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	24 08:14 (WEA ZB06_wpd) 15:52 24 09:14 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	08:07 (WEA ZB04_wpd) 07:12	07:50 (WEA ZB06_wpd) 08:01 08:50 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	6 08:13 (WEA ZB04_wpd) 16:24	24 08:14 (WEA ZB06_wpd) 15:51 24 09:14 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	08:04 (WEA ZB04_wpd) 07:14	07:50 (WEA ZB06_wpd) 08:02 08:50 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	12 08:16 (WEA ZB04_wpd) 16:22	23 08:13 (WEA ZB06_wpd) 15:51 25 09:15 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	08:01 (WEA ZB04_wpd) 07:16	07:51 (WEA ZB06_wpd) 08:03 08:52 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	15 08:16 (WEA ZB04_wpd) 16:21	22 08:13 (WEA ZB06_wpd) 15:51 24 09:16 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	08:00 (WEA ZB04_wpd) 07:17	07:52 (WEA ZB06_wpd) 08:04 08:52 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	17 08:17 (WEA ZB04_wpd) 16:19	21 08:13 (WEA ZB06_wpd) 15:51 24 09:16 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:59 (WEA ZB04_wpd) 07:19	07:52 (WEA ZB06_wpd) 08:05 08:52 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	19 08:18 (WEA ZB04_wpd) 16:17	20 08:12 (WEA ZB06_wpd) 15:51 24 09:16 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:59 (WEA ZB04_wpd) 07:21	07:53 (WEA ZB06_wpd) 08:06 08:53 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	19 08:18 (WEA ZB04_wpd) 16:16	18 08:11 (WEA ZB06_wpd) 15:50 24 09:17 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:59 (WEA ZB04_wpd) 07:23	07:55 (WEA ZB06_wpd) 08:07 08:53 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	19 08:18 (WEA ZB04_wpd) 16:14	15 08:10 (WEA ZB06_wpd) 15:50 24 09:17 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:59 (WEA ZB04_wpd) 07:25	07:56 (WEA ZB06_wpd) 08:08 08:54 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	19 08:18 (WEA ZB04_wpd) 16:13	13 08:09 (WEA ZB06_wpd) 15:51 24 09:18 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:58 (WEA ZB04_wpd) 07:26	07:59 (WEA ZB06_wpd) 08:09 08:54 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	19 08:17 (WEA ZB04_wpd) 16:11	8 08:07 (WEA ZB06_wpd) 15:51 24 09:18 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 07:28	08:10 08:54 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	18 08:16 (WEA ZB04_wpd) 16:10	15:51 24 09:18 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:00 (WEA ZB04_wpd) 07:30	08:10 08:55 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	15 08:15 (WEA ZB04_wpd) 16:09	15:51 24 09:19 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:02 (WEA ZB04_wpd) 07:32	08:11 08:56 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	12 08:14 (WEA ZB04_wpd) 16:07	15:51 23 09:19 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:04 (WEA ZB04_wpd) 07:33	08:12 08:56 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	8 08:12 (WEA ZB04_wpd) 16:06	15:52 23 09:19 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:12 08:57 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15:52 23 09:20 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:13 08:56 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	15:53 24 09:20 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:14 08:58 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	9 09:01 (WEA ZB07_wpd) 15:53 23 09:21 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:51 (WEA ZB07_wpd) 08:14 08:58 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	12 09:03 (WEA ZB07_wpd) 15:54 23 09:21 (WEA ZB07_wpd)
25	05:12	06:02	06:54	06:46	07:42	08:50 (WEA ZB07_wpd) 08:14 08:58 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	15 09:05 (WEA ZB07_wpd) 15:54 24 09:22 (WEA ZB07_wpd)
26	05:14	06:04	06:56	06:48	07:43	08:50 (WEA ZB07_wpd) 08:15 08:59 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	17 09:07 (WEA ZB07_wpd) 15:55 24 09:23 (WEA ZB07_wpd)
27	05:15	06:06	06:57	06:50	07:45	08:49 (WEA ZB07_wpd) 08:15 08:59 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	18 09:07 (WEA ZB07_wpd) 15:56 24 09:23 (WEA ZB07_wpd)
28	05:17	06:07	06:59	06:52	07:47	08:49 (WEA ZB07_wpd) 08:15 09:00 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	19 09:08 (WEA ZB07_wpd) 15:57 24 09:24 (WEA ZB07_wpd)
29	05:18	06:09	07:01	06:54	07:48	08:49 (WEA ZB07_wpd) 08:15 09:00 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	10 07:56 (WEA ZB06_wpd) 07:48	20 09:09 (WEA ZB07_wpd) 15:57 24 09:24 (WEA ZB07_wpd)
30	05:20	06:11	07:02	06:55	07:50	08:48 (WEA ZB07_wpd) 08:15 09:01 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15 08:09 (WEA ZB06_wpd) 15:56	22 09:10 (WEA ZB07_wpd) 15:58 24 09:25 (WEA ZB07_wpd)
31	05:21	06:12	07:03	06:57	07:53 (WEA ZB06_wpd) 15:57	08:15 09:01 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	17 08:10 (WEA ZB06_wpd) 15:59	24 09:25 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				240	453	735

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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-27 - SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:03 (WEA ZB07_vpd)	07:48	08:22 (WEA ZB06_vpd)	06:53	07:28 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	25 09:28 (WEA ZB07_vpd)	16:49	23 08:45 (WEA ZB06_vpd)	17:42	18 07:46 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:04 (WEA ZB07_vpd)	07:46	08:22 (WEA ZB06_vpd)	06:51	07:28 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	24 09:28 (WEA ZB07_vpd)	16:51	24 08:46 (WEA ZB06_vpd)	17:44	18 07:46 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	09:05 (WEA ZB07_vpd)	07:44	08:22 (WEA ZB06_vpd)	06:49	07:29 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	24 09:29 (WEA ZB07_vpd)	16:53	24 08:46 (WEA ZB06_vpd)	17:46	15 07:44 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	09:05 (WEA ZB07_vpd)	07:43	08:22 (WEA ZB06_vpd)	06:46	07:30 (WEA ZB04_vpd)	06:34	05:29	04:46		
	16:04	24 09:29 (WEA ZB07_vpd)	16:55	24 08:46 (WEA ZB06_vpd)	17:48	12 07:42 (WEA ZB04_vpd)	19:43	20:35	21:20		
5	08:15	09:06 (WEA ZB07_vpd)	07:41	08:22 (WEA ZB06_vpd)	06:44	07:33 (WEA ZB04_vpd)	06:32	05:28	04:46		
	16:05	24 09:30 (WEA ZB07_vpd)	16:57	24 08:46 (WEA ZB06_vpd)	17:49	6 07:39 (WEA ZB04_vpd)	19:44	20:36	21:21		
6	08:14	09:07 (WEA ZB07_vpd)	07:39	08:22 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	23 09:30 (WEA ZB07_vpd)	16:59	24 08:46 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:07 (WEA ZB07_vpd)	07:38	08:23 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	23 09:30 (WEA ZB07_vpd)	17:01	22 08:45 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:07 (WEA ZB07_vpd)	07:36	08:23 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	23 09:30 (WEA ZB07_vpd)	17:03	22 08:45 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:09 (WEA ZB07_vpd)	07:34	08:25 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	22 09:31 (WEA ZB07_vpd)	17:04	20 08:45 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:09 (WEA ZB07_vpd)	07:32	08:26 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	22 09:31 (WEA ZB07_vpd)	17:06	18 08:44 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	09:10 (WEA ZB07_vpd)	07:30	08:28 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42		
	16:13	21 09:31 (WEA ZB07_vpd)	17:08	14 08:42 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26		
12	08:11	09:10 (WEA ZB07_vpd)	07:28	08:30 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42		
	16:15	20 09:30 (WEA ZB07_vpd)	17:10	10 08:40 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27		
13	08:10	09:11 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42		
	16:16	19 09:30 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27		
14	08:10	09:12 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	18 09:30 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	09:13 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	17 09:30 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:14 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	15 09:29 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07	09:16 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41		
	16:23	12 09:28 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30		
18	08:06	09:19 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41		
	16:24	8 09:27 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30		
19	08:05		07:15		06:12		06:00	05:04	04:41		
	16:26		17:23		18:15		20:09	20:59	21:30		
20	08:04		07:12		06:09		05:58	05:03	04:41		
	16:28		17:25		18:16		20:10	21:00	21:31		
21	08:03		07:10		06:07		05:56	05:01	04:41		
	16:29		17:27	8 07:35 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02		07:08		06:05		05:54	05:00	04:41		
	16:31		17:29	12 07:44 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00		07:06		06:02		05:52	04:59	04:42		
	16:33		17:31	16 07:46 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59		07:04		06:00		05:50	04:57	04:42		
	16:35		17:33	18 07:47 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	9 08:28 (WEA ZB06_vpd)	07:02		05:58		05:47	04:56	04:42		
	16:36	08:37 (WEA ZB06_vpd)	17:35	19 07:47 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:26 (WEA ZB06_vpd)	07:00		05:55		05:45	04:55	04:43		
	16:38	13 08:39 (WEA ZB06_vpd)	17:37	20 07:48 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:24 (WEA ZB06_vpd)	06:58		05:53		05:43	04:54	04:43		
	16:40	16 08:40 (WEA ZB06_vpd)	17:38	20 07:47 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:24 (WEA ZB06_vpd)	06:55		05:51		05:41	04:53	04:44		
	16:42	18 08:42 (WEA ZB06_vpd)	17:40	20 07:47 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:23 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	20 08:43 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:23 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	21 08:44 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:22 (WEA ZB06_vpd)			06:44			04:50			
	16:47	23 08:45 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	484		382		69						

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-27 - SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04		06:59	07:55 (WEA ZB06_wpd)	07:51	08:52 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44		16:37	18 08:13 (WEA ZB06_wpd)	15:55	21 09:13 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06		07:01	07:54 (WEA ZB06_wpd)	07:53	08:52 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42		16:35	20 08:14 (WEA ZB06_wpd)	15:54	22 09:14 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07		07:03	07:53 (WEA ZB06_wpd)	07:54	08:52 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39		16:33	21 08:14 (WEA ZB06_wpd)	15:54	22 09:14 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09		07:05	07:52 (WEA ZB06_wpd)	07:55	08:52 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37		16:31	23 08:15 (WEA ZB06_wpd)	15:53	23 09:15 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11		07:06	07:52 (WEA ZB06_wpd)	07:57	08:52 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35		16:29	23 08:15 (WEA ZB06_wpd)	15:53	23 09:15 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13		07:08	07:52 (WEA ZB06_wpd)	07:58	08:52 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32		16:27	24 08:16 (WEA ZB06_wpd)	15:52	23 09:15 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14		07:10	07:52 (WEA ZB06_wpd)	07:59	08:53 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30		16:26	24 08:16 (WEA ZB06_wpd)	15:52	24 09:17 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16		07:12	07:52 (WEA ZB06_wpd)	08:01	08:53 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28		16:24	24 08:16 (WEA ZB06_wpd)	15:51	24 09:17 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18		07:14	07:52 (WEA ZB06_wpd)	08:02	08:53 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	9	16:22	24 08:16 (WEA ZB06_wpd)	15:51	24 09:17 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20		07:16	07:53 (WEA ZB06_wpd)	08:03	08:54 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	13	16:21	23 08:16 (WEA ZB06_wpd)	15:51	24 09:18 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21		07:17	07:53 (WEA ZB06_wpd)	08:04	08:55 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16	16:19	23 08:16 (WEA ZB06_wpd)	15:51	24 09:19 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23		07:19	07:54 (WEA ZB06_wpd)	08:05	08:55 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	18	16:17	21 08:15 (WEA ZB06_wpd)	15:51	24 09:19 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25		07:21	07:55 (WEA ZB06_wpd)	08:06	08:55 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	19	16:16	20 08:15 (WEA ZB06_wpd)	15:50	24 09:19 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27		07:23	07:56 (WEA ZB06_wpd)	08:07	08:56 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	20	16:14	18 08:14 (WEA ZB06_wpd)	15:50	24 09:20 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28		07:25	07:57 (WEA ZB06_wpd)	08:08	08:56 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	20	16:13	16 08:13 (WEA ZB06_wpd)	15:51	24 09:20 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30		07:26	07:59 (WEA ZB06_wpd)	08:09	08:57 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	20	16:11	13 08:12 (WEA ZB06_wpd)	15:51	24 09:21 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32		07:28	08:01 (WEA ZB06_wpd)	08:10	08:57 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	18	16:10	9 08:10 (WEA ZB06_wpd)	15:51	24 09:21 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34		07:30	08:00 (WEA ZB06_wpd)	08:10	08:57 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	18	16:09	18 08:18 (WEA ZB04_wpd)	15:51	24 09:21 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35		07:32	08:02 (WEA ZB06_wpd)	08:11	08:58 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	15	16:07	18 08:17 (WEA ZB04_wpd)	15:51	24 09:22 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37		07:33	08:04 (WEA ZB06_wpd)	08:12	08:58 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	11	16:06	11 08:15 (WEA ZB04_wpd)	15:52	24 09:22 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39		07:35	08:06 (WEA ZB06_wpd)	08:12	08:59 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	6	16:05	6 08:12 (WEA ZB04_wpd)	15:52	24 09:23 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41		07:37		08:13	08:59 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57		16:04		15:53	24 09:23 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43		07:39		08:14	09:00 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55		16:03		15:53	24 09:24 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44		07:40	08:56 (WEA ZB07_wpd)	08:14	09:00 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53		16:01	8 09:04 (WEA ZB07_wpd)	15:54	24 09:24 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46		07:42	08:54 (WEA ZB07_wpd)	08:14	09:00 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50		16:00	12 09:06 (WEA ZB07_wpd)	15:54	24 09:24 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48		07:43	08:54 (WEA ZB07_wpd)	08:15	09:01 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48		15:59	14 09:08 (WEA ZB07_wpd)	15:55	25 09:26 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50		07:45	08:52 (WEA ZB07_wpd)	08:15	09:02 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46		15:58	17 09:09 (WEA ZB07_wpd)	15:56	24 09:26 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52		07:47	08:52 (WEA ZB07_wpd)	08:15	09:02 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44		15:58	18 09:10 (WEA ZB07_wpd)	15:57	24 09:26 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54		07:48	08:52 (WEA ZB07_wpd)	08:15	09:03 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42		15:57	19 09:11 (WEA ZB07_wpd)	15:57	24 09:27 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55		07:50	08:51 (WEA ZB07_wpd)	08:15	09:03 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	11	15:56	20 09:11 (WEA ZB07_wpd)	15:58	24 09:27 (WEA ZB07_wpd)
31	05:21	06:12		07:57		07:56	07:56 (WEA ZB06_wpd)	08:15	09:04 (WEA ZB07_wpd)
	21:00	19:57		16:39	15		08:11 (WEA ZB06_wpd)	15:59	24 09:28 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331		264		241	
astr.max.mögl.Beschattung					229		452		735

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-28 - SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:07 (WEA ZB07_vpd)	07:48	08:24 (WEA ZB06_vpd)	06:53	07:30 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	24 09:31 (WEA ZB07_vpd)	16:49	25 08:49 (WEA ZB06_vpd)	17:42	18 07:48 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:08 (WEA ZB07_vpd)	07:46	08:25 (WEA ZB06_vpd)	06:51	07:31 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	24 09:32 (WEA ZB07_vpd)	16:51	25 08:50 (WEA ZB06_vpd)	17:44	16 07:47 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	09:09 (WEA ZB07_vpd)	07:44	08:25 (WEA ZB06_vpd)	06:49	07:31 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	24 09:33 (WEA ZB07_vpd)	16:53	25 08:50 (WEA ZB06_vpd)	17:46	14 07:45 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	09:09 (WEA ZB07_vpd)	07:43	08:25 (WEA ZB06_vpd)	06:46	07:33 (WEA ZB04_vpd)	06:34	05:29	04:46		
	16:04	23 09:32 (WEA ZB07_vpd)	16:55	24 08:49 (WEA ZB06_vpd)	17:48	10 07:43 (WEA ZB04_vpd)	19:43	20:35	21:20		
5	08:15	09:10 (WEA ZB07_vpd)	07:41	24 08:25 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	23 09:33 (WEA ZB07_vpd)	16:57	24 08:49 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:11 (WEA ZB07_vpd)	07:39	24 08:26 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	23 09:34 (WEA ZB07_vpd)	16:59	23 08:49 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:11 (WEA ZB07_vpd)	07:38	08:26 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	23 09:34 (WEA ZB07_vpd)	17:01	22 08:48 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:12 (WEA ZB07_vpd)	07:36	08:27 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	21 09:33 (WEA ZB07_vpd)	17:03	20 08:47 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:13 (WEA ZB07_vpd)	07:34	08:29 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	21 09:34 (WEA ZB07_vpd)	17:04	18 08:47 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:14 (WEA ZB07_vpd)	07:32	08:31 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	20 09:34 (WEA ZB07_vpd)	17:06	15 08:46 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	09:14 (WEA ZB07_vpd)	07:30	08:33 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42		
	16:13	20 09:34 (WEA ZB07_vpd)	17:08	10 08:43 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26		
12	08:11	09:15 (WEA ZB07_vpd)	07:28		06:28		06:16	05:15	04:42		
	16:15	18 09:33 (WEA ZB07_vpd)	17:10		18:02		19:57	20:48	21:27		
13	08:10	09:16 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42		
	16:16	17 09:33 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27		
14	08:10	09:17 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	15 09:32 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	09:19 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	13 09:32 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:21 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	10 09:31 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07	09:24 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41		
	16:23	4 09:28 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30		
18	08:06		07:17		06:14		06:02	05:06	04:41		
	16:24		17:22		18:13		20:07	20:57	21:30		
19	08:05		07:15		06:12		06:00	05:04	04:41		
	16:26		17:23		18:15		20:09	20:59	21:30		
20	08:04		07:12	07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28		17:25	7 07:44 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03		07:10	07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29		17:27	11 07:46 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02		07:08	07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31		17:29	15 07:47 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:31 (WEA ZB06_vpd)	07:06	07:30 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	7 08:38 (WEA ZB06_vpd)	17:31	18 07:48 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:29 (WEA ZB06_vpd)	07:04	07:30 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	12 08:41 (WEA ZB06_vpd)	17:33	19 07:49 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:28 (WEA ZB06_vpd)	07:02	07:30 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	15 08:43 (WEA ZB06_vpd)	17:35	19 07:49 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:27 (WEA ZB06_vpd)	07:00	07:29 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	17 08:44 (WEA ZB06_vpd)	17:37	21 07:50 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:26 (WEA ZB06_vpd)	06:58	07:29 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	19 08:45 (WEA ZB06_vpd)	17:38	20 07:49 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:26 (WEA ZB06_vpd)	06:55	07:29 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	21 08:47 (WEA ZB06_vpd)	17:40	20 07:49 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:25 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	22 08:47 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:25 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	23 08:48 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:25 (WEA ZB06_vpd)			06:44			04:50			
	16:47	24 08:49 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	483		381		58						

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-28 - SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04		06:59	07:59 (WEA ZB06_wpd)	07:51	08:56 (WEA ZB07_wpd)				
	21:31	20:58	19:55	18:44		16:37	15	08:14 (WEA ZB06_wpd)	15:55	20	09:16 (WEA ZB07_wpd)		
2	04:46	05:24	06:16	07:06		07:01		07:58 (WEA ZB06_wpd)	07:53		08:57 (WEA ZB07_wpd)		
	21:30	20:56	19:52	18:42		16:35	18	08:16 (WEA ZB06_wpd)	15:54	20	09:17 (WEA ZB07_wpd)		
3	04:47	05:26	06:17	07:07		07:03		07:57 (WEA ZB06_wpd)	07:54		08:56 (WEA ZB07_wpd)		
	21:30	20:55	19:50	18:39		16:33	20	08:17 (WEA ZB06_wpd)	15:54	21	09:17 (WEA ZB07_wpd)		
4	04:48	05:28	06:19	07:09		07:05		07:56 (WEA ZB06_wpd)	07:55		08:57 (WEA ZB07_wpd)		
	21:30	20:53	19:48	18:37		16:31	22	08:18 (WEA ZB06_wpd)	15:53	22	09:19 (WEA ZB07_wpd)		
5	04:49	05:29	06:21	07:11		07:06		07:55 (WEA ZB06_wpd)	07:57		08:56 (WEA ZB07_wpd)		
	21:29	20:51	19:45	18:35		16:29	23	08:18 (WEA ZB06_wpd)	15:53	23	09:19 (WEA ZB07_wpd)		
6	04:49	05:31	06:22	07:13		07:08		07:55 (WEA ZB06_wpd)	07:58		08:56 (WEA ZB07_wpd)		
	21:28	20:49	19:43	18:32		16:27	24	08:19 (WEA ZB06_wpd)	15:52	23	09:19 (WEA ZB07_wpd)		
7	04:50	05:32	06:24	07:14		07:10		07:55 (WEA ZB06_wpd)	07:59		08:57 (WEA ZB07_wpd)		
	21:28	20:47	19:41	18:30		16:26	24	08:19 (WEA ZB06_wpd)	15:52	23	09:20 (WEA ZB07_wpd)		
8	04:51	05:34	06:26	07:16		07:12		07:55 (WEA ZB06_wpd)	08:01		08:57 (WEA ZB07_wpd)		
	21:27	20:45	19:38	18:28		16:24	24	08:19 (WEA ZB06_wpd)	15:51	24	09:21 (WEA ZB07_wpd)		
9	04:52	05:36	06:27	07:18		07:14		07:55 (WEA ZB06_wpd)	08:02		08:57 (WEA ZB07_wpd)		
	21:27	20:44	19:36	18:25	6	08:16 (WEA ZB04_wpd)	16:22	24	08:19 (WEA ZB06_wpd)	15:51	24	09:21 (WEA ZB07_wpd)	
10	04:53	05:37	06:29	07:20		08:06 (WEA ZB04_wpd)	07:16		07:55 (WEA ZB06_wpd)	08:03		08:58 (WEA ZB07_wpd)	
	21:26	20:42	19:34	18:23	12	08:18 (WEA ZB04_wpd)	16:21	24	08:19 (WEA ZB06_wpd)	15:51	24	09:22 (WEA ZB07_wpd)	
11	04:54	05:39	06:31	07:21		08:04 (WEA ZB04_wpd)	07:17		07:56 (WEA ZB06_wpd)	08:04		08:58 (WEA ZB07_wpd)	
	21:25	20:40	19:31	18:21	16	08:20 (WEA ZB04_wpd)	16:19	23	08:19 (WEA ZB06_wpd)	15:51	25	09:23 (WEA ZB07_wpd)	
12	04:55	05:41	06:32	07:23		08:03 (WEA ZB04_wpd)	07:19		07:56 (WEA ZB06_wpd)	08:05		08:59 (WEA ZB07_wpd)	
	21:24	20:38	19:29	18:19	18	08:21 (WEA ZB04_wpd)	16:17	23	08:19 (WEA ZB06_wpd)	15:51	24	09:23 (WEA ZB07_wpd)	
13	04:57	05:42	06:34	07:25		08:02 (WEA ZB04_wpd)	07:21		07:57 (WEA ZB06_wpd)	08:06		08:59 (WEA ZB07_wpd)	
	21:23	20:36	19:27	18:16	19	08:21 (WEA ZB04_wpd)	16:16	22	08:19 (WEA ZB06_wpd)	15:50	24	09:23 (WEA ZB07_wpd)	
14	04:58	05:44	06:35	07:27		08:02 (WEA ZB04_wpd)	07:23		07:58 (WEA ZB06_wpd)	08:07		09:00 (WEA ZB07_wpd)	
	21:22	20:34	19:24	18:14	20	08:22 (WEA ZB04_wpd)	16:14	20	08:18 (WEA ZB06_wpd)	15:50	24	09:24 (WEA ZB07_wpd)	
15	04:59	05:46	06:37	07:28		08:02 (WEA ZB04_wpd)	07:25		07:59 (WEA ZB06_wpd)	08:08		09:00 (WEA ZB07_wpd)	
	21:21	20:32	19:22	18:12	20	08:22 (WEA ZB04_wpd)	16:13	19	08:18 (WEA ZB06_wpd)	15:51	24	09:24 (WEA ZB07_wpd)	
16	05:00	05:47	06:39	07:30		08:01 (WEA ZB04_wpd)	07:26		08:00 (WEA ZB06_wpd)	08:09		09:01 (WEA ZB07_wpd)	
	21:20	20:30	19:20	18:10	20	08:21 (WEA ZB04_wpd)	16:11	17	08:17 (WEA ZB06_wpd)	15:51	24	09:25 (WEA ZB07_wpd)	
17	05:01	05:49	06:40	07:32		08:01 (WEA ZB04_wpd)	07:28		08:01 (WEA ZB06_wpd)	08:10		09:00 (WEA ZB07_wpd)	
	21:19	20:28	19:17	18:07	20	08:21 (WEA ZB04_wpd)	16:10	15	08:16 (WEA ZB06_wpd)	15:51	25	09:25 (WEA ZB07_wpd)	
18	05:03	05:51	06:42	07:34		08:01 (WEA ZB04_wpd)	07:30		08:03 (WEA ZB06_wpd)	08:10		09:01 (WEA ZB07_wpd)	
	21:18	20:25	19:15	18:05	19	08:20 (WEA ZB04_wpd)	16:09	12	08:15 (WEA ZB06_wpd)	15:51	24	09:25 (WEA ZB07_wpd)	
19	05:04	05:52	06:44	07:35		08:02 (WEA ZB04_wpd)	07:32		08:06 (WEA ZB06_wpd)	08:11		09:02 (WEA ZB07_wpd)	
	21:17	20:23	19:12	18:03	17	08:19 (WEA ZB04_wpd)	16:07	7	08:13 (WEA ZB06_wpd)	15:51	24	09:26 (WEA ZB07_wpd)	
20	05:05	05:54	06:45	07:37		08:04 (WEA ZB04_wpd)	07:33			08:12		09:02 (WEA ZB07_wpd)	
	21:16	20:21	19:10	18:01	14	08:18 (WEA ZB04_wpd)	16:06			15:52	24	09:26 (WEA ZB07_wpd)	
21	05:07	05:56	06:47	07:39		08:06 (WEA ZB04_wpd)	07:35			08:12		09:03 (WEA ZB07_wpd)	
	21:14	20:19	19:08	17:59	10	08:16 (WEA ZB04_wpd)	16:05			15:52	24	09:27 (WEA ZB07_wpd)	
22	05:08	05:57	06:49	07:41		08:08 (WEA ZB04_wpd)	07:37			08:13		09:03 (WEA ZB07_wpd)	
	21:13	20:17	19:05	17:57	5	08:13 (WEA ZB04_wpd)	16:04			15:53	24	09:27 (WEA ZB07_wpd)	
23	05:09	05:59	06:51	07:43			07:39			08:14		09:04 (WEA ZB07_wpd)	
	21:12	20:15	19:03	17:55			16:03			15:53	24	09:28 (WEA ZB07_wpd)	
24	05:11	06:01	06:52	07:44			07:40			08:14		09:04 (WEA ZB07_wpd)	
	21:10	20:13	19:01	17:53			16:01			15:54	24	09:28 (WEA ZB07_wpd)	
25	05:12	06:02	06:54	07:46			07:42		09:02 (WEA ZB07_wpd)	08:14		09:04 (WEA ZB07_wpd)	
	21:09	20:10	18:58	16:50			16:00		4	09:06 (WEA ZB07_wpd)	15:54	24	09:28 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48			07:43			08:15		09:05 (WEA ZB07_wpd)	
	21:07	20:08	18:56	16:48			15:59		10	09:10 (WEA ZB07_wpd)	15:55	25	09:30 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50			07:45		13	08:58 (WEA ZB07_wpd)	08:15		09:06 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46			15:58			09:11 (WEA ZB07_wpd)	15:56	24	09:30 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52			07:47			08:57 (WEA ZB07_wpd)	08:15		09:06 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44			15:58		15	09:12 (WEA ZB07_wpd)	15:57	24	09:30 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54			07:48			08:57 (WEA ZB07_wpd)	08:15		09:06 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42			15:57		17	09:14 (WEA ZB07_wpd)	15:57	25	09:31 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55		08:06 (WEA ZB06_wpd)	07:50			08:56 (WEA ZB07_wpd)	08:15		09:07 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	2	08:08 (WEA ZB06_wpd)	15:56		18	09:14 (WEA ZB07_wpd)	15:58	24	09:31 (WEA ZB07_wpd)
31	05:21	06:12		07:57		08:01 (WEA ZB06_wpd)				08:15			09:08 (WEA ZB07_wpd)
	21:00	19:57		16:39	11	08:12 (WEA ZB06_wpd)				15:59	24	09:32 (WEA ZB07_wpd)	
Sonnenscheinstunden	505	455	381	331			264			241			732
astr.max.mögl.Beschattung					229			453					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-29 - SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:11 (WEA ZB07_vpd)	07:48	08:28 (WEA ZB06_vpd)	06:53	07:35 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	23 09:34 (WEA ZB07_vpd)	16:49	24 08:52 (WEA ZB06_vpd)	17:42	15 07:50 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:12 (WEA ZB07_vpd)	07:46	08:29 (WEA ZB06_vpd)	06:51	07:36 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	23 09:35 (WEA ZB07_vpd)	16:51	24 08:53 (WEA ZB06_vpd)	17:44	12 07:48 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	09:13 (WEA ZB07_vpd)	07:44	08:29 (WEA ZB06_vpd)	06:49	07:39 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	22 09:35 (WEA ZB07_vpd)	16:53	24 08:53 (WEA ZB06_vpd)	17:46	5 07:44 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	09:13 (WEA ZB07_vpd)	07:43	08:30 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46		
	16:04	22 09:35 (WEA ZB07_vpd)	16:55	22 08:52 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20		
5	08:15	09:14 (WEA ZB07_vpd)	07:41	08:30 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	21 09:35 (WEA ZB07_vpd)	16:57	22 08:52 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:15 (WEA ZB07_vpd)	07:39	08:31 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	21 09:36 (WEA ZB07_vpd)	16:59	20 08:51 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:16 (WEA ZB07_vpd)	07:38	08:32 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	20 09:36 (WEA ZB07_vpd)	17:01	18 08:50 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:16 (WEA ZB07_vpd)	07:36	08:33 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	19 09:35 (WEA ZB07_vpd)	17:03	15 08:48 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:18 (WEA ZB07_vpd)	07:34	08:36 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	18 09:36 (WEA ZB07_vpd)	17:04	11 08:47 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:19 (WEA ZB07_vpd)	07:32		06:33		06:20	05:18	04:43		
	16:12	16 09:35 (WEA ZB07_vpd)	17:06		17:58		19:53	20:45	21:25		
11	08:12	09:19 (WEA ZB07_vpd)	07:30		06:30		06:18	05:17	04:42		
	16:13	16 09:35 (WEA ZB07_vpd)	17:08		18:00		19:55	20:46	21:26		
12	08:11	09:21 (WEA ZB07_vpd)	07:28		06:28		06:16	05:15	04:42		
	16:15	13 09:34 (WEA ZB07_vpd)	17:10		18:02		19:57	20:48	21:27		
13	08:10	09:22 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42		
	16:16	11 09:33 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27		
14	08:10	09:24 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	8 09:32 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09		07:23		06:21		06:09	05:10	04:41		
	16:19		17:16		18:07		20:02	20:53	21:29		
16	08:08		07:21		06:19		06:07	05:09	04:41		
	16:21		17:18		18:09		20:03	20:54	21:29		
17	08:07		07:19		06:17		06:05	05:07	04:41		
	16:23		17:20		18:11		20:05	20:56	21:30		
18	08:06		07:17	07:41 (WEA ZB04_vpd)	06:14		06:02	05:06	04:41		
	16:24		17:22	5 07:46 (WEA ZB04_vpd)	18:13		20:07	20:57	21:30		
19	08:05		07:15	07:39 (WEA ZB04_vpd)	06:12		06:00	05:04	04:41		
	16:26		17:23	10 07:49 (WEA ZB04_vpd)	18:15		20:09	20:59	21:30		
20	08:04	08:35 (WEA ZB06_vpd)	07:12	14 07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28	4 08:39 (WEA ZB06_vpd)	17:25	10 07:51 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03	08:33 (WEA ZB06_vpd)	07:10	14 07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29	10 08:43 (WEA ZB06_vpd)	17:27	17 07:52 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02	08:32 (WEA ZB06_vpd)	07:08	19 07:33 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31	13 08:45 (WEA ZB06_vpd)	17:29	19 07:52 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:30 (WEA ZB06_vpd)	07:06	19 07:33 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	16 08:46 (WEA ZB06_vpd)	17:31	19 07:52 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:30 (WEA ZB06_vpd)	07:04	19 07:33 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	18 08:48 (WEA ZB06_vpd)	17:33	20 07:53 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:30 (WEA ZB06_vpd)	07:02	20 07:33 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	19 08:49 (WEA ZB06_vpd)	17:35	20 07:53 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:29 (WEA ZB06_vpd)	07:00	20 07:33 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	21 08:50 (WEA ZB06_vpd)	17:37	20 07:53 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:28 (WEA ZB06_vpd)	06:58	19 07:32 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	22 08:50 (WEA ZB06_vpd)	17:38	19 07:51 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:28 (WEA ZB06_vpd)	06:55	19 07:33 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	23 08:51 (WEA ZB06_vpd)	17:40	18 07:51 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:28 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	23 08:51 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:28 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	24 08:52 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:28 (WEA ZB06_vpd)			06:44			04:50			
	16:47	24 08:52 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	470		361		32						

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-29 - SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	08:08 (WEA ZB06_wpd) 07:51 09:02 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	4 08:12 (WEA ZB06_wpd) 15:55 15 09:17 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	08:05 (WEA ZB06_wpd) 07:53 09:02 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	11 08:16 (WEA ZB06_wpd) 15:54 16 09:18 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	08:03 (WEA ZB06_wpd) 07:54 09:01 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	15 08:18 (WEA ZB06_wpd) 15:54 18 09:19 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	08:01 (WEA ZB06_wpd) 07:55 19 09:01 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	19 08:20 (WEA ZB06_wpd) 15:53 19 09:20 (WEA ZB07_wpd)
5	04:48	05:29	06:21	07:11	07:06	08:01 (WEA ZB06_wpd) 07:57 09:01 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	20 08:21 (WEA ZB06_wpd) 15:53 20 09:21 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	08:00 (WEA ZB06_wpd) 07:58 09:01 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	21 08:21 (WEA ZB06_wpd) 15:52 20 09:21 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:59 (WEA ZB06_wpd) 07:59 09:01 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	23 08:22 (WEA ZB06_wpd) 15:52 21 09:22 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:59 (WEA ZB06_wpd) 08:01 09:01 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	24 08:23 (WEA ZB06_wpd) 15:51 22 09:23 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:59 (WEA ZB06_wpd) 08:02 09:01 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	24 08:23 (WEA ZB06_wpd) 15:51 22 09:23 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:59 (WEA ZB06_wpd) 08:03 09:02 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	24 08:23 (WEA ZB06_wpd) 15:51 23 09:25 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:59 (WEA ZB06_wpd) 08:04 09:02 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	24 08:23 (WEA ZB06_wpd) 15:51 23 09:25 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	08:09 (WEA ZB04_wpd) 07:19	07:59 (WEA ZB06_wpd) 08:05 09:03 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	24 08:23 (WEA ZB06_wpd) 15:51 23 09:26 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	08:07 (WEA ZB04_wpd) 07:21	08:00 (WEA ZB06_wpd) 08:06 09:03 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	23 08:23 (WEA ZB06_wpd) 15:50 23 09:26 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	08:06 (WEA ZB04_wpd) 07:23	08:00 (WEA ZB06_wpd) 08:07 09:03 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	23 08:23 (WEA ZB06_wpd) 15:50 24 09:27 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	08:05 (WEA ZB04_wpd) 07:25	08:01 (WEA ZB06_wpd) 08:08 09:04 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	22 08:23 (WEA ZB06_wpd) 15:51 23 09:27 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	08:04 (WEA ZB04_wpd) 07:26	08:02 (WEA ZB06_wpd) 08:09 09:04 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	21 08:23 (WEA ZB06_wpd) 15:51 24 09:28 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	08:04 (WEA ZB04_wpd) 07:28	08:03 (WEA ZB06_wpd) 08:10 09:04 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	19 08:22 (WEA ZB06_wpd) 15:51 24 09:28 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:04 (WEA ZB04_wpd) 07:30	08:04 (WEA ZB06_wpd) 08:10 09:05 (WEA ZB07_wpd)
	21:18	20:25	19:15	18:05	16:09	18 08:22 (WEA ZB06_wpd) 15:51 23 09:28 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:04 (WEA ZB04_wpd) 07:32	08:05 (WEA ZB06_wpd) 08:11 09:05 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	16 08:21 (WEA ZB06_wpd) 15:51 24 09:29 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:05 (WEA ZB04_wpd) 07:33	08:07 (WEA ZB06_wpd) 08:12 09:05 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	13 08:20 (WEA ZB06_wpd) 15:52 24 09:29 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	08:06 (WEA ZB04_wpd) 07:35	08:09 (WEA ZB06_wpd) 08:12 09:06 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	10 08:19 (WEA ZB06_wpd) 15:52 24 09:30 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	08:08 (WEA ZB04_wpd) 07:37	08:12 (WEA ZB06_wpd) 08:13 09:06 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	4 08:16 (WEA ZB06_wpd) 15:53 24 09:30 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	08:10 (WEA ZB04_wpd) 07:39	08:14 08:14 09:07 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	9 08:19 (WEA ZB04_wpd) 15:53 24 09:31 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:14 08:14 09:07 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	15:54 24 09:31 (WEA ZB07_wpd)
25	05:12	06:02	06:54	06:46	07:42	08:14 08:14 09:07 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	15:54 24 09:31 (WEA ZB07_wpd)
26	05:14	06:04	06:56	06:48	07:43	08:15 08:15 09:09 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	15:55 23 09:32 (WEA ZB07_wpd)
27	05:15	06:06	06:57	06:50	07:45	08:15 08:15 09:09 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	15:56 24 09:33 (WEA ZB07_wpd)
28	05:17	06:07	06:59	06:52	07:47	08:15 08:15 09:10 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	8 09:12 (WEA ZB07_wpd) 15:57 23 09:33 (WEA ZB07_wpd)
29	05:18	06:09	07:01	06:54	07:48	09:03 (WEA ZB07_wpd) 08:15 09:10 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	11 09:14 (WEA ZB07_wpd) 15:57 23 09:33 (WEA ZB07_wpd)
30	05:20	06:11	07:02	06:55	07:50	09:02 (WEA ZB07_wpd) 08:15 09:11 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	13 09:15 (WEA ZB07_wpd) 15:58 23 09:34 (WEA ZB07_wpd)
31	05:21	06:12	7:03	06:57	7:51	08:15 08:15 09:11 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	23 09:34 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				212	434	690

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-30 - SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:14 (WEA ZB07_vpd)   07:48	08:30 (WEA ZB06_vpd)   06:53	07:37 (WEA ZB04_vpd)   06:41	05:35	04:49	
	16:01	22 09:36 (WEA ZB07_vpd)   16:49	24 08:54 (WEA ZB06_vpd)   17:42	13 07:50 (WEA ZB04_vpd)   19:37	20:29	21:16	
2	08:15	09:15 (WEA ZB07_vpd)   07:46	08:31 (WEA ZB06_vpd)   06:51	07:39 (WEA ZB04_vpd)   06:39	05:33	04:48	
	16:02	21 09:36 (WEA ZB07_vpd)   16:51	24 08:55 (WEA ZB06_vpd)   17:44	9 07:48 (WEA ZB04_vpd)   19:39	20:31	21:18	
3	08:15	09:16 (WEA ZB07_vpd)   07:44	08:32 (WEA ZB06_vpd)   06:49		06:37	05:31	04:47
	16:03	21 09:37 (WEA ZB07_vpd)   16:53	23 08:55 (WEA ZB06_vpd)   17:46		19:41	20:33	21:19
4	08:15	09:16 (WEA ZB07_vpd)   07:43	08:32 (WEA ZB06_vpd)   06:46		06:34	05:29	04:46
	16:04	20 09:36 (WEA ZB07_vpd)   16:55	22 08:54 (WEA ZB06_vpd)   17:48		19:43	20:35	21:20
5	08:15	09:17 (WEA ZB07_vpd)   07:41	20 08:33 (WEA ZB06_vpd)   06:44		06:32	05:28	04:46
	16:05	20 09:37 (WEA ZB07_vpd)   16:57	20 08:53 (WEA ZB06_vpd)   17:49		19:44	20:36	21:21
6	08:14	09:18 (WEA ZB07_vpd)   07:39	08:34 (WEA ZB06_vpd)   06:42		06:30	05:26	04:45
	16:06	20 09:38 (WEA ZB07_vpd)   16:59	18 08:52 (WEA ZB06_vpd)   17:51		19:46	20:38	21:22
7	08:14	09:19 (WEA ZB07_vpd)   07:38	08:35 (WEA ZB06_vpd)   06:40		06:27	05:24	04:44
	16:08	18 09:37 (WEA ZB07_vpd)   17:01	16 08:51 (WEA ZB06_vpd)   17:53		19:48	20:40	21:23
8	08:13	09:19 (WEA ZB07_vpd)   07:36	08:37 (WEA ZB06_vpd)   06:37		06:25	05:22	04:44
	16:09	18 09:37 (WEA ZB07_vpd)   17:03	12 08:49 (WEA ZB06_vpd)   17:55		19:50	20:41	21:24
9	08:13	09:21 (WEA ZB07_vpd)   07:34	08:42 (WEA ZB06_vpd)   06:35		06:23	05:20	04:43
	16:10	16 09:37 (WEA ZB07_vpd)   17:04	4 08:46 (WEA ZB06_vpd)   17:57		19:51	20:43	21:24
10	08:12	09:22 (WEA ZB07_vpd)   07:32		06:33	06:20	05:18	04:43
	16:12	15 09:37 (WEA ZB07_vpd)   17:06		17:58	19:53	20:45	21:25
11	08:12	09:23 (WEA ZB07_vpd)   07:30		06:30	06:18	05:17	04:42
	16:13	13 09:36 (WEA ZB07_vpd)   17:08		18:00	19:55	20:46	21:26
12	08:11	09:25 (WEA ZB07_vpd)   07:28		06:28	06:16	05:15	04:42
	16:15	10 09:35 (WEA ZB07_vpd)   17:10		18:02	19:57	20:48	21:27
13	08:10	09:27 (WEA ZB07_vpd)   07:26		06:26	06:14	05:13	04:42
	16:16	6 09:33 (WEA ZB07_vpd)   17:12		18:04	19:58	20:50	21:27
14	08:10		07:25	06:24	06:11	05:12	04:42
	16:18		17:14	18:06	20:00	20:51	21:28
15	08:09		07:23	06:21	06:09	05:10	04:41
	16:19		17:16	18:07	20:02	20:53	21:29
16	08:08		07:21	06:19	06:07	05:09	04:41
	16:21		17:18	18:09	20:03	20:54	21:29
17	08:07		07:19	06:17	06:05	05:07	04:41
	16:23		17:20	18:11	20:05	20:56	21:30
18	08:06		07:17	06:14	06:02	05:06	04:41
	16:24		17:22	9 07:41 (WEA ZB04_vpd)   06:14	20:07	20:57	21:30
19	08:05	08:36 (WEA ZB06_vpd)   07:15	9 07:50 (WEA ZB04_vpd)   18:13		06:00	05:04	04:41
	16:26	7 08:43 (WEA ZB06_vpd)   17:23	13 07:39 (WEA ZB04_vpd)   06:12		20:09	20:59	21:30
20	08:04	08:34 (WEA ZB06_vpd)   07:12	13 07:37 (WEA ZB04_vpd)   06:09		05:58	05:03	04:41
	16:28	11 08:45 (WEA ZB06_vpd)   17:25	16 07:53 (WEA ZB04_vpd)   18:16		20:10	21:00	21:31
21	08:03	08:33 (WEA ZB06_vpd)   07:10	18 07:36 (WEA ZB04_vpd)   06:07		05:56	05:01	04:41
	16:29	14 08:47 (WEA ZB06_vpd)   17:27	18 07:54 (WEA ZB04_vpd)   18:18		20:12	21:02	21:31
22	08:02	08:32 (WEA ZB06_vpd)   07:08		06:05	05:54	05:00	04:41
	16:31	17 08:49 (WEA ZB06_vpd)   17:29	20 07:54 (WEA ZB04_vpd)   18:20		20:14	21:03	21:31
23	08:00	08:31 (WEA ZB06_vpd)   07:06		06:02	05:52	04:59	04:42
	16:33	18 08:49 (WEA ZB06_vpd)   17:31	20 07:54 (WEA ZB04_vpd)   18:22		20:16	21:05	21:31
24	07:59	08:31 (WEA ZB06_vpd)   07:04		06:00	05:50	04:57	04:42
	16:35	20 08:51 (WEA ZB06_vpd)   17:33	20 07:54 (WEA ZB04_vpd)   18:23		20:17	21:06	21:31
25	07:58	08:31 (WEA ZB06_vpd)   07:02		05:58	05:47	04:56	04:42
	16:36	21 08:52 (WEA ZB06_vpd)   17:35	20 07:54 (WEA ZB04_vpd)   18:25		20:19	21:08	21:32
26	07:56	08:30 (WEA ZB06_vpd)   07:00		05:55	05:45	04:55	04:43
	16:38	23 08:53 (WEA ZB06_vpd)   17:37	19 07:54 (WEA ZB04_vpd)   18:27		20:21	21:09	21:32
27	07:55	08:30 (WEA ZB06_vpd)   06:58		05:53	05:43	04:54	04:43
	16:40	23 08:53 (WEA ZB06_vpd)   17:38	19 07:53 (WEA ZB04_vpd)   18:29		20:23	21:10	21:31
28	07:54	08:30 (WEA ZB06_vpd)   06:55		05:51	05:41	04:53	04:44
	16:42	24 08:54 (WEA ZB06_vpd)   17:40	17 07:52 (WEA ZB04_vpd)   18:30		20:24	21:12	21:31
29	07:52	08:30 (WEA ZB06_vpd)   06:48		05:48	05:39	04:52	04:44
	16:44	24 08:54 (WEA ZB06_vpd)   17:32		19:32	20:26	21:13	21:31
30	07:51	08:30 (WEA ZB06_vpd)   06:46		05:46	05:37	04:51	04:45
	16:46	25 08:55 (WEA ZB06_vpd)   17:34		19:34	20:28	21:14	21:31
31	07:49	08:30 (WEA ZB06_vpd)   06:44		05:44		04:50	
	16:47	25 08:55 (WEA ZB06_vpd)   17:36		19:36		21:15	
Sonnenscheinstunden	256	276	367	417	488	502	
astr.max.mögl.Beschattung	472	354	22				

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-30 - SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	07:56	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				217	433	661

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-31 - SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:17 (WEA ZB07_vpd)   07:48	08:33 (WEA ZB06_vpd)   06:53	07:39 (WEA ZB04_vpd)   06:41	05:35	04:49	
	16:01	21 09:38 (WEA ZB07_vpd)   16:49	24 08:57 (WEA ZB06_vpd)   17:42	12 07:51 (WEA ZB04_vpd)   19:37	20:29	21:16	
2	08:15	09:18 (WEA ZB07_vpd)   07:46	08:34 (WEA ZB06_vpd)   06:51	07:42 (WEA ZB04_vpd)   06:39	05:33	04:48	
	16:02	21 09:39 (WEA ZB07_vpd)   16:51	23 08:57 (WEA ZB06_vpd)   17:44	6 07:48 (WEA ZB04_vpd)   19:39	20:31	21:18	
3	08:15	09:19 (WEA ZB07_vpd)   07:44	08:35 (WEA ZB06_vpd)   06:49		06:37	05:31	04:47
	16:03	20 09:39 (WEA ZB07_vpd)   16:53	22 08:57 (WEA ZB06_vpd)   17:46		19:41	20:33	21:19
4	08:15	09:19 (WEA ZB07_vpd)   07:43	08:35 (WEA ZB06_vpd)   06:46		06:34	05:29	04:46
	16:04	20 09:39 (WEA ZB07_vpd)   16:55	21 08:56 (WEA ZB06_vpd)   17:48		19:43	20:35	21:20
5	08:15	09:21 (WEA ZB07_vpd)   07:41	08:36 (WEA ZB06_vpd)   06:44		06:32	05:28	04:46
	16:05	18 09:39 (WEA ZB07_vpd)   16:57	19 08:55 (WEA ZB06_vpd)   17:49		19:44	20:36	21:21
6	08:14	09:22 (WEA ZB07_vpd)   07:39	08:37 (WEA ZB06_vpd)   06:42		06:30	05:26	04:45
	16:06	18 09:40 (WEA ZB07_vpd)   16:59	17 08:54 (WEA ZB06_vpd)   17:51		19:46	20:38	21:22
7	08:14	09:23 (WEA ZB07_vpd)   07:38	08:39 (WEA ZB06_vpd)   06:40		06:27	05:24	04:44
	16:08	16 09:39 (WEA ZB07_vpd)   17:01	13 08:52 (WEA ZB06_vpd)   17:53		19:48	20:40	21:23
8	08:13	09:23 (WEA ZB07_vpd)   07:36	08:42 (WEA ZB06_vpd)   06:37		06:25	05:22	04:44
	16:09	16 09:39 (WEA ZB07_vpd)   17:03	7 08:49 (WEA ZB06_vpd)   17:55		19:50	20:41	21:24
9	08:13	09:25 (WEA ZB07_vpd)   07:34			06:23	05:20	04:43
	16:10	14 09:39 (WEA ZB07_vpd)   17:04			19:51	20:43	21:24
10	08:12	09:26 (WEA ZB07_vpd)   07:32			06:20	05:18	04:43
	16:12	12 09:38 (WEA ZB07_vpd)   17:06			19:53	20:45	21:25
11	08:12	09:28 (WEA ZB07_vpd)   07:30			06:18	05:17	04:42
	16:13	9 09:37 (WEA ZB07_vpd)   17:08			19:55	20:46	21:26
12	08:11	09:31 (WEA ZB07_vpd)   07:28			06:16	05:15	04:42
	16:15	3 09:34 (WEA ZB07_vpd)   17:10			19:57	20:48	21:27
13	08:10				06:14	05:13	04:42
	16:16				19:58	20:50	21:27
14	08:10				06:11	05:12	04:42
	16:18				20:00	20:51	21:28
15	08:09				06:09	05:10	04:41
	16:19				20:02	20:53	21:29
16	08:08				06:07	05:09	04:41
	16:21				20:03	20:54	21:29
17	08:07				06:05	05:07	04:41
	16:23				20:05	20:56	21:30
18	08:06				06:02	05:06	04:41
	16:24				20:07	20:57	21:30
19	08:05				06:00	05:04	04:41
	16:26				20:09	20:59	21:30
20	08:04				05:58	05:03	04:41
	16:28				20:10	21:00	21:31
21	08:03				05:56	05:01	04:41
	16:29				20:12	21:02	21:31
22	08:02				05:54	05:00	04:41
	16:31				20:14	21:03	21:31
23	08:00				05:52	04:59	04:42
	16:33				20:16	21:05	21:31
24	07:59				05:50	04:57	04:42
	16:35				20:17	21:06	21:31
25	07:58				05:47	04:56	04:42
	16:36				20:19	21:08	21:32
26	07:56				05:45	04:55	04:43
	16:38				20:21	21:09	21:32
27	07:55				05:43	04:54	04:43
	16:40				20:23	21:10	21:31
28	07:54				05:41	04:53	04:44
	16:42				20:24	21:12	21:31
29	07:52				05:39	04:52	04:44
	16:44				20:26	21:13	21:31
30	07:51				05:37	04:51	04:45
	16:46				20:28	21:14	21:31
31	07:49					04:50	
	16:47					21:15	
Sonnenscheinstunden	256				417	488	502
astr.max.mögl.Beschattung	471	276	351	18			

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-31 - SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	07:56	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonneneinstrahlung	505	455	381	331	264	241
astr.max.mögl.Beschattung				222	434	632

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-32 - SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:18 (WEA ZB07_vpd)	07:48	08:34 (WEA ZB06_vpd)	06:53	07:42 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	20 09:38 (WEA ZB07_vpd)	16:49	23 08:57 (WEA ZB06_vpd)	17:42	8 07:50 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:19 (WEA ZB07_vpd)	07:46	08:35 (WEA ZB06_vpd)	06:51		06:39	05:33	04:48		
	16:02	19 09:38 (WEA ZB07_vpd)	16:51	22 08:57 (WEA ZB06_vpd)	17:44		19:39	20:31	21:18		
3	08:15	09:20 (WEA ZB07_vpd)	07:44	08:36 (WEA ZB06_vpd)	06:49		06:37	05:31	04:47		
	16:03	19 09:39 (WEA ZB07_vpd)	16:53	21 08:57 (WEA ZB06_vpd)	17:46		19:41	20:33	21:19		
4	08:15	09:20 (WEA ZB07_vpd)	07:43	08:36 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46		
	16:04	18 09:38 (WEA ZB07_vpd)	16:55	20 08:56 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20		
5	08:15	09:21 (WEA ZB07_vpd)	07:41	08:37 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	18 09:39 (WEA ZB07_vpd)	16:57	17 08:54 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:23 (WEA ZB07_vpd)	07:39	08:39 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	16 09:39 (WEA ZB07_vpd)	16:59	14 08:53 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:23 (WEA ZB07_vpd)	07:38	08:41 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	15 09:39 (WEA ZB07_vpd)	17:01	9 08:50 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:24 (WEA ZB07_vpd)	07:36	06:37	18:00		06:25	05:22	04:44		
	16:09	14 09:38 (WEA ZB07_vpd)	17:03	17:55			19:50	20:41	21:24		
9	08:13	09:26 (WEA ZB07_vpd)	07:34	06:35	18:00		06:23	05:20	04:43		
	16:10	12 09:38 (WEA ZB07_vpd)	17:04	17:57			19:51	20:43	21:24		
10	08:12	09:28 (WEA ZB07_vpd)	07:32	06:33	18:00		06:20	05:18	04:43		
	16:12	9 09:37 (WEA ZB07_vpd)	17:06	17:58			19:53	20:45	21:25		
11	08:12	09:30 (WEA ZB07_vpd)	07:30	06:30	18:00		06:18	05:17	04:42		
	16:13	4 09:34 (WEA ZB07_vpd)	17:08	18:00			19:55	20:46	21:26		
12	08:11		07:28	06:28	18:00		06:16	05:15	04:42		
	16:15		17:10	18:02			19:57	20:48	21:27		
13	08:10		07:26	06:26	18:00		06:14	05:13	04:42		
	16:16		17:12	18:04			19:58	20:50	21:27		
14	08:10		07:25	06:24	18:00		06:11	05:12	04:42		
	16:18		17:14	18:06			20:00	20:51	21:28		
15	08:09		07:23	06:21	18:00		06:09	05:10	04:41		
	16:19		17:16	18:07			20:02	20:53	21:29		
16	08:08		07:21	06:19	07:45 (WEA ZB04_vpd)	06:19	06:07	05:09	04:41		
	16:21		17:18	18:09	07:49 (WEA ZB04_vpd)	18:09	20:03	20:54	21:29		
17	08:07	08:38 (WEA ZB06_vpd)	07:19	07:43 (WEA ZB04_vpd)	06:17		06:05	05:07	04:41		
	16:23	8 08:46 (WEA ZB06_vpd)	17:20	10 07:53 (WEA ZB04_vpd)	18:11		20:05	20:56	21:30		
18	08:06	08:36 (WEA ZB06_vpd)	07:17	07:41 (WEA ZB04_vpd)	06:14		06:02	05:06	04:41		
	16:24	12 08:48 (WEA ZB06_vpd)	17:22	13 07:54 (WEA ZB04_vpd)	18:13		20:07	20:57	21:30		
19	08:05	08:35 (WEA ZB06_vpd)	07:15	07:39 (WEA ZB04_vpd)	06:12		06:00	05:04	04:41		
	16:26	15 08:50 (WEA ZB06_vpd)	17:23	17 07:56 (WEA ZB04_vpd)	18:15		20:09	20:59	21:30		
20	08:04	08:34 (WEA ZB06_vpd)	07:12	07:38 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28	17 08:51 (WEA ZB06_vpd)	17:25	18 07:56 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03	08:34 (WEA ZB06_vpd)	07:10	07:37 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29	18 08:52 (WEA ZB06_vpd)	17:27	20 07:57 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02	08:33 (WEA ZB06_vpd)	07:08	07:36 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31	20 08:53 (WEA ZB06_vpd)	17:29	20 07:56 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:33 (WEA ZB06_vpd)	07:06	07:36 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	21 08:54 (WEA ZB06_vpd)	17:31	21 07:57 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:33 (WEA ZB06_vpd)	07:04	07:36 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	22 08:55 (WEA ZB06_vpd)	17:33	21 07:57 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:33 (WEA ZB06_vpd)	07:02	07:37 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	23 08:56 (WEA ZB06_vpd)	17:35	19 07:56 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:32 (WEA ZB06_vpd)	07:00	07:38 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	24 08:56 (WEA ZB06_vpd)	17:37	18 07:56 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:32 (WEA ZB06_vpd)	06:58	07:38 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	24 08:56 (WEA ZB06_vpd)	17:38	16 07:54 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:33 (WEA ZB06_vpd)	06:55	07:39 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	24 08:57 (WEA ZB06_vpd)	17:40	13 07:52 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:33 (WEA ZB06_vpd)		06:48			05:39	04:52	04:44		
	16:44	24 08:57 (WEA ZB06_vpd)		19:32			20:26	21:13	21:31		
30	07:51	08:33 (WEA ZB06_vpd)		06:46			05:37	04:51	04:45		
	16:46	25 08:58 (WEA ZB06_vpd)		19:34			20:28	21:14	21:31		
31	07:49	08:33 (WEA ZB06_vpd)		06:44				04:50			
	16:47	24 08:57 (WEA ZB06_vpd)		19:36				21:15			
Sonnenscheinstunden	256		276	367	8		417	488	502		
astr.max.mögl.Beschattung	465		336								

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-32 - SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	07:56	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				212	428	593

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-33 - SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:21 (WEA ZB07_vpd)   07:48	08:36 (WEA ZB06_vpd)   06:53	07:41 (WEA ZB04_vpd)   06:41	05:35	04:49
	16:01	20 09:41 (WEA ZB07_vpd)   16:49	23 08:59 (WEA ZB06_vpd)   17:42	11 07:52 (WEA ZB04_vpd)   19:37	20:29	21:16
2	08:15	09:22 (WEA ZB07_vpd)   07:46	08:37 (WEA ZB06_vpd)   06:51	06:39	05:33	04:48
	16:02	19 09:41 (WEA ZB07_vpd)   16:51	22 08:59 (WEA ZB06_vpd)   17:44	19:39	20:31	21:18
3	08:15	09:23 (WEA ZB07_vpd)   07:44	08:38 (WEA ZB06_vpd)   06:49	06:37	05:31	04:47
	16:03	19 09:42 (WEA ZB07_vpd)   16:53	21 08:59 (WEA ZB06_vpd)   17:46	19:41	20:33	21:19
4	08:15	09:23 (WEA ZB07_vpd)   07:43	20 08:38 (WEA ZB06_vpd)   06:46	06:34	05:29	04:46
	16:04	18 09:41 (WEA ZB07_vpd)   16:55	20 08:58 (WEA ZB06_vpd)   17:48	19:43	20:35	21:20
5	08:15	09:25 (WEA ZB07_vpd)   07:41	18 08:39 (WEA ZB06_vpd)   06:44	06:32	05:28	04:46
	16:05	16 09:41 (WEA ZB07_vpd)   16:57	18 08:57 (WEA ZB06_vpd)   17:49	19:44	20:36	21:21
6	08:14	09:26 (WEA ZB07_vpd)   07:39	14 08:41 (WEA ZB06_vpd)   06:42	06:30	05:26	04:45
	16:06	16 09:42 (WEA ZB07_vpd)   16:59	14 08:55 (WEA ZB06_vpd)   17:51	19:46	20:38	21:22
7	08:14	09:27 (WEA ZB07_vpd)   07:38	08:43 (WEA ZB06_vpd)   06:40	06:27	05:24	04:44
	16:08	14 09:41 (WEA ZB07_vpd)   17:01	9 08:52 (WEA ZB06_vpd)   17:53	19:48	20:40	21:23
8	08:13	09:28 (WEA ZB07_vpd)   07:36	9 08:52 (WEA ZB06_vpd)   17:53	06:25	05:22	04:44
	16:09	12 09:40 (WEA ZB07_vpd)   17:03	17:55	19:50	20:41	21:24
9	08:13	09:30 (WEA ZB07_vpd)   07:34	17:55	06:23	05:20	04:43
	16:10	10 09:40 (WEA ZB07_vpd)   17:04	17:57	19:51	20:43	21:24
10	08:12	09:32 (WEA ZB07_vpd)   07:32	06:33	06:20	05:18	04:43
	16:12	7 09:39 (WEA ZB07_vpd)   17:06	17:58	19:53	20:45	21:25
11	08:12	17:08	06:30	06:18	05:17	04:42
	16:13	17:08	18:00	19:55	20:46	21:26
12	08:11	07:28	06:28	06:16	05:15	04:42
	16:15	17:10	18:02	19:57	20:48	21:27
13	08:10	07:26	06:26	06:14	05:13	04:42
	16:16	17:12	18:04	19:58	20:50	21:27
14	08:10	07:25	06:24	06:11	05:12	04:42
	16:18	17:14	18:06	20:00	20:51	21:28
15	08:09	07:23	06:21	06:09	05:10	04:41
	16:19	17:16	18:07	20:02	20:53	21:29
16	08:08	08:40 (WEA ZB06_vpd)   07:21	07:46 (WEA ZB04_vpd)   06:19	06:07	05:09	04:41
	16:21	6 08:46 (WEA ZB06_vpd)   17:18	3 07:49 (WEA ZB04_vpd)   18:09	20:03	20:54	21:29
17	08:07	08:38 (WEA ZB06_vpd)   07:19	07:43 (WEA ZB04_vpd)   06:17	06:05	05:07	04:41
	16:23	11 08:49 (WEA ZB06_vpd)   17:20	10 07:53 (WEA ZB04_vpd)   18:11	20:05	20:56	21:30
18	08:06	08:37 (WEA ZB06_vpd)   07:17	07:41 (WEA ZB04_vpd)   06:14	06:02	05:06	04:41
	16:24	14 08:51 (WEA ZB06_vpd)   17:22	14 07:55 (WEA ZB04_vpd)   18:13	20:07	20:57	21:30
19	08:05	08:37 (WEA ZB06_vpd)   07:15	07:39 (WEA ZB04_vpd)   06:12	06:00	05:04	04:41
	16:26	16 08:53 (WEA ZB06_vpd)   17:23	17 07:56 (WEA ZB04_vpd)   18:15	20:09	20:59	21:30
20	08:04	08:35 (WEA ZB06_vpd)   07:12	19 07:38 (WEA ZB04_vpd)   06:09	05:58	05:03	04:41
	16:28	18 08:53 (WEA ZB06_vpd)   17:25	19 07:57 (WEA ZB04_vpd)   18:16	20:10	21:00	21:31
21	08:03	08:35 (WEA ZB06_vpd)   07:10	20 07:38 (WEA ZB04_vpd)   06:07	05:56	05:01	04:41
	16:29	20 08:55 (WEA ZB06_vpd)   17:27	20 07:58 (WEA ZB04_vpd)   18:18	20:12	21:02	21:31
22	08:02	08:35 (WEA ZB06_vpd)   07:08	07:37 (WEA ZB04_vpd)   06:05	05:54	05:00	04:41
	16:31	21 08:56 (WEA ZB06_vpd)   17:29	20 07:57 (WEA ZB04_vpd)   18:20	20:14	21:03	21:31
23	08:00	08:34 (WEA ZB06_vpd)   07:06	07:37 (WEA ZB04_vpd)   06:02	05:52	04:59	04:42
	16:33	22 08:56 (WEA ZB06_vpd)   17:31	20 07:57 (WEA ZB04_vpd)   18:22	20:16	21:05	21:31
24	07:59	08:34 (WEA ZB06_vpd)   07:04	07:37 (WEA ZB04_vpd)   06:00	05:50	04:57	04:42
	16:35	23 08:57 (WEA ZB06_vpd)   17:33	20 07:57 (WEA ZB04_vpd)   18:23	20:17	21:06	21:31
25	07:58	08:35 (WEA ZB06_vpd)   07:02	07:37 (WEA ZB04_vpd)   05:58	05:47	04:56	04:42
	16:36	23 08:58 (WEA ZB06_vpd)   17:35	20 07:57 (WEA ZB04_vpd)   18:25	20:19	21:08	21:32
26	07:56	08:34 (WEA ZB06_vpd)   07:00	07:38 (WEA ZB04_vpd)   05:55	05:45	04:55	04:43
	16:38	25 08:59 (WEA ZB06_vpd)   17:37	19 07:57 (WEA ZB04_vpd)   18:27	20:21	21:09	21:32
27	07:55	08:34 (WEA ZB06_vpd)   06:58	07:38 (WEA ZB04_vpd)   05:53	05:43	04:54	04:43
	16:40	24 08:58 (WEA ZB06_vpd)   17:38	17 07:55 (WEA ZB04_vpd)   18:29	20:23	21:10	21:31
28	07:54	08:34 (WEA ZB06_vpd)   06:55	07:39 (WEA ZB04_vpd)   05:51	05:41	04:53	04:44
	16:42	25 08:59 (WEA ZB06_vpd)   17:40	15 07:54 (WEA ZB04_vpd)   18:30	20:24	21:12	21:31
29	07:52	08:34 (WEA ZB06_vpd)   06:48	06:48	05:39	04:52	04:44
	16:44	25 08:59 (WEA ZB06_vpd)   17:32	19:32	20:26	21:13	21:31
30	07:51	08:35 (WEA ZB06_vpd)   06:46	06:46	05:37	04:51	04:45
	16:46	25 09:00 (WEA ZB06_vpd)   19:34	19:34	20:28	21:14	21:31
31	07:49	08:35 (WEA ZB06_vpd)   06:44	06:44	05:30	04:50	04:43
	16:47	25 09:00 (WEA ZB06_vpd)   19:36	19:36	05:30	04:50	04:43
	Sonnenscheinstunden	256	276	367	417	502
	astr.max.mögl.Beschattung	474	341	11		

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-33 - SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	08:17 (WEA ZB04_wpd)	07:19
	21:24	20:38	19:29	18:19	6 08:23 (WEA ZB04_wpd)	16:17
13	04:56	05:42	06:34	07:25	08:14 (WEA ZB04_wpd)	07:21
	21:23	20:36	19:27	18:16	12 08:26 (WEA ZB04_wpd)	16:16
14	04:58	05:44	06:35	07:27	08:12 (WEA ZB04_wpd)	07:23
	21:22	20:34	19:24	18:14	15 08:27 (WEA ZB04_wpd)	16:14
15	04:59	05:46	06:37	07:28	08:11 (WEA ZB04_wpd)	07:25
	21:21	20:32	19:22	18:12	17 08:28 (WEA ZB04_wpd)	16:13
16	05:00	05:47	06:39	07:30	08:09 (WEA ZB04_wpd)	07:26
	21:20	20:30	19:20	18:10	19 08:28 (WEA ZB04_wpd)	16:11
17	05:01	05:49	06:40	07:32	08:08 (WEA ZB04_wpd)	07:28
	21:19	20:28	19:17	18:07	21 08:29 (WEA ZB04_wpd)	16:10
18	05:03	05:51	06:42	07:34	08:08 (WEA ZB04_wpd)	07:30
	21:18	20:25	19:15	18:05	21 08:29 (WEA ZB04_wpd)	16:09
19	05:04	05:52	06:44	07:35	08:08 (WEA ZB04_wpd)	07:32
	21:17	20:23	19:12	18:03	21 08:29 (WEA ZB04_wpd)	16:07
20	05:05	05:54	06:45	07:37	08:08 (WEA ZB04_wpd)	07:33
	21:16	20:21	19:10	18:01	21 08:28 (WEA ZB04_wpd)	16:06
21	05:07	05:56	06:47	07:39	08:08 (WEA ZB04_wpd)	07:35
	21:14	20:19	19:08	17:59	20 08:28 (WEA ZB04_wpd)	16:05
22	05:08	05:57	06:49	07:41	08:09 (WEA ZB04_wpd)	07:37
	21:13	20:17	19:05	17:57	18 08:27 (WEA ZB04_wpd)	16:04
23	05:09	05:59	06:51	07:43	08:10 (WEA ZB04_wpd)	07:39
	21:12	20:15	19:03	17:55	16 08:26 (WEA ZB04_wpd)	16:03
24	05:11	06:01	06:52	07:44	08:12 (WEA ZB04_wpd)	07:40
	21:10	20:13	19:01	17:53	13 08:25 (WEA ZB04_wpd)	16:01
25	05:12	06:02	06:54	07:46	07:14 (WEA ZB04_wpd)	07:42
	21:09	20:10	18:58	16:50	9 07:23 (WEA ZB04_wpd)	16:00
26	05:14	06:04	06:56	07:48		07:43
	21:07	20:08	18:56	16:48		15:59
27	05:15	06:06	06:57	07:50		07:45
	21:06	20:06	18:53	16:46		15:58
28	05:17	06:07	06:59	07:52		07:47
	21:04	20:04	18:51	16:44		15:58
29	05:18	06:09	07:01	07:54		07:48
	21:03	20:01	18:49	16:42		15:57
30	05:20	06:11	07:02	07:56		07:50
	21:01	19:59	18:46	16:40		15:56
31	05:21	06:12		07:57		
	21:00	19:57		16:39		
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				228	451	581

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-34 - SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:25 (WEA ZB07_vpd)	07:48	08:39 (WEA ZB06_vpd)	06:53	07:46 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	18 09:43 (WEA ZB07_vpd)	16:49	22 09:01 (WEA ZB06_vpd)	17:42	5 07:51 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:26 (WEA ZB07_vpd)	07:46	08:40 (WEA ZB06_vpd)	06:51		06:39	05:33	04:48		
	16:02	17 09:43 (WEA ZB07_vpd)	16:51	22 09:02 (WEA ZB06_vpd)	17:44		19:39	20:31	21:18		
3	08:15	09:27 (WEA ZB07_vpd)	07:44	08:41 (WEA ZB06_vpd)	06:49		06:37	05:31	04:47		
	16:03	16 09:43 (WEA ZB07_vpd)	16:53	20 09:01 (WEA ZB06_vpd)	17:46		19:41	20:33	21:19		
4	08:15	09:27 (WEA ZB07_vpd)	07:43	08:42 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46		
	16:04	16 09:43 (WEA ZB07_vpd)	16:55	17 08:59 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20		
5	08:15	09:29 (WEA ZB07_vpd)	07:41	08:44 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	14 09:43 (WEA ZB07_vpd)	16:57	14 08:58 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:31 (WEA ZB07_vpd)	07:39	08:46 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	12 09:43 (WEA ZB07_vpd)	16:59	9 08:55 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:32 (WEA ZB07_vpd)	07:38		06:40		06:27	05:24	04:44		
	16:08	10 09:42 (WEA ZB07_vpd)	17:01		17:53		19:48	20:40	21:23		
8	08:13	09:33 (WEA ZB07_vpd)	07:36		06:37		06:25	05:22	04:44		
	16:09	8 09:41 (WEA ZB07_vpd)	17:03		17:55		19:50	20:41	21:24		
9	08:13		07:34		06:35		06:23	05:20	04:43		
	16:10		17:04		17:57		19:51	20:43	21:24		
10	08:12		07:32		06:33		06:20	05:18	04:43		
	16:12		17:06		17:58		19:53	20:45	21:25		
11	08:12		07:30		06:30		06:18	05:17	04:42		
	16:13		17:08		18:00		19:55	20:46	21:26		
12	08:11		07:28		06:28		06:16	05:15	04:42		
	16:15		17:10		18:02		19:57	20:48	21:27		
13	08:10		07:26		06:26		06:14	05:13	04:42		
	16:16		17:12		18:04		19:58	20:50	21:27		
14	08:10	08:43 (WEA ZB06_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	4 08:47 (WEA ZB06_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	08:41 (WEA ZB06_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	9 08:50 (WEA ZB06_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	08:40 (WEA ZB06_vpd)	07:21	07:45 (WEA ZB04_vpd)	06:19		06:07	05:09	04:41		
	16:21	12 08:52 (WEA ZB06_vpd)	17:18	10 07:55 (WEA ZB04_vpd)	18:09		20:03	20:54	21:29		
17	08:07	08:39 (WEA ZB06_vpd)	07:19	07:43 (WEA ZB04_vpd)	06:17		06:05	05:07	04:41		
	16:23	15 08:54 (WEA ZB06_vpd)	17:20	14 07:57 (WEA ZB04_vpd)	18:11		20:05	20:56	21:30		
18	08:06	08:38 (WEA ZB06_vpd)	07:17	07:41 (WEA ZB04_vpd)	06:14		06:02	05:06	04:41		
	16:24	18 08:56 (WEA ZB06_vpd)	17:22	17 07:58 (WEA ZB04_vpd)	18:13		20:07	20:57	21:30		
19	08:05	08:38 (WEA ZB06_vpd)	07:15	07:40 (WEA ZB04_vpd)	06:12		06:00	05:04	04:41		
	16:26	19 08:57 (WEA ZB06_vpd)	17:23	19 07:59 (WEA ZB04_vpd)	18:15		20:09	20:59	21:30		
20	08:04	08:37 (WEA ZB06_vpd)	07:12	07:40 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28	20 08:57 (WEA ZB06_vpd)	17:25	20 08:00 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03	08:37 (WEA ZB06_vpd)	07:10	07:40 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29	21 08:58 (WEA ZB06_vpd)	17:27	20 08:00 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02	08:37 (WEA ZB06_vpd)	07:08	07:38 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31	23 09:00 (WEA ZB06_vpd)	17:29	21 07:59 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:36 (WEA ZB06_vpd)	07:06	07:39 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	24 09:00 (WEA ZB06_vpd)	17:31	20 07:59 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:37 (WEA ZB06_vpd)	07:04	07:39 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	24 09:01 (WEA ZB06_vpd)	17:33	20 07:59 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:37 (WEA ZB06_vpd)	07:02	07:40 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	25 09:02 (WEA ZB06_vpd)	17:35	19 07:59 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:37 (WEA ZB06_vpd)	07:00	07:40 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	25 09:02 (WEA ZB06_vpd)	17:37	18 07:58 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:36 (WEA ZB06_vpd)	06:58	07:41 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	25 09:01 (WEA ZB06_vpd)	17:38	15 07:56 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:37 (WEA ZB06_vpd)	06:55	07:43 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	25 09:02 (WEA ZB06_vpd)	17:40	11 07:54 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:37 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	25 09:02 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:38 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	24 09:02 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:38 (WEA ZB06_vpd)			06:44			04:50			
	16:47	24 09:02 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden		256			367		417	488	502		
astr.max.mögl.Beschattung		473	276	328	5						

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-34 - SR-34, Wilhelm-Maass weg 20/20a, 15374 Münchenberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:30	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:56	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:38	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	07:56	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				235	468	513

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-35 - SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:01	09:35 (WEA ZB07_wpd) 09:46 (WEA ZB07_wpd)	07:48 16:49	08:47 (WEA ZB06_wpd) 09:06 (WEA ZB06_wpd)	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16
2	08:15 16:02	09:36 (WEA ZB07_wpd) 09:46 (WEA ZB07_wpd)	07:46 16:51	08:49 (WEA ZB06_wpd) 09:05 (WEA ZB06_wpd)	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18
3	08:15 16:03	09:38 (WEA ZB07_wpd) 09:46 (WEA ZB07_wpd)	07:44 16:53	08:51 (WEA ZB06_wpd) 09:04 (WEA ZB06_wpd)	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19
4	08:15 16:04	09:40 (WEA ZB07_wpd) 09:44 (WEA ZB07_wpd)	07:43 16:55	08:53 (WEA ZB06_wpd) 09:01 (WEA ZB06_wpd)	06:46 17:48	06:34 19:43	05:29 20:35	04:46 21:20
5	08:15 16:05		07:41 16:57		06:44 17:49	06:32 19:44	05:28 20:36	04:46 21:21
6	08:14 16:06		07:39 16:59		06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22
7	08:14 16:08		07:38 17:01		06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23
8	08:13 16:09		07:36 17:03		06:37 17:55	06:25 19:50	05:22 20:41	04:44 21:24
9	08:13 16:10		07:34 17:04		06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:24
10	08:12 16:12	08:47 (WEA ZB06_wpd) 08:54 (WEA ZB06_wpd)	07:32 17:06	06:33 17:58	06:20 19:53	05:18 20:45	05:18 21:25	04:43 21:25
11	08:12 16:13	08:45 (WEA ZB06_wpd) 08:56 (WEA ZB06_wpd)	07:30 17:08	06:30 18:00	06:18 19:55	05:17 20:46	05:17 21:26	04:42 21:26
12	08:11 16:15	08:44 (WEA ZB06_wpd) 08:58 (WEA ZB06_wpd)	07:28 17:10	06:28 18:02	06:16 19:57	05:15 20:48	05:15 21:27	04:42 21:27
13	08:10 16:16	08:43 (WEA ZB06_wpd) 08:59 (WEA ZB06_wpd)	07:26 17:12	06:26 18:04	06:14 19:58	05:13 20:50	05:13 21:27	04:42 21:27
14	08:10 16:18	08:43 (WEA ZB06_wpd) 09:00 (WEA ZB06_wpd)	07:25 17:14	07:49 (WEA ZB04_wpd) 07:58 (WEA ZB04_wpd)	06:24 18:06	06:11 20:00	05:12 20:51	04:42 21:28
15	08:09 16:19	08:42 (WEA ZB06_wpd) 09:01 (WEA ZB06_wpd)	07:23 17:16	07:47 (WEA ZB04_wpd) 08:00 (WEA ZB04_wpd)	06:21 18:07	06:09 20:02	05:10 20:53	04:41 21:29
16	08:08 16:21	08:42 (WEA ZB06_wpd) 09:02 (WEA ZB06_wpd)	07:21 17:18	07:45 (WEA ZB04_wpd) 08:02 (WEA ZB04_wpd)	06:19 18:09	06:07 20:03	05:09 20:54	04:41 21:29
17	08:07 16:23	08:42 (WEA ZB06_wpd) 09:03 (WEA ZB06_wpd)	07:19 17:20	07:44 (WEA ZB04_wpd) 08:03 (WEA ZB04_wpd)	06:16 18:11	06:05 20:05	05:07 20:56	04:41 21:30
18	08:06 16:24	08:42 (WEA ZB06_wpd) 09:04 (WEA ZB06_wpd)	07:17 17:22	07:44 (WEA ZB04_wpd) 08:04 (WEA ZB04_wpd)	06:14 18:13	06:02 20:07	05:06 20:57	04:41 21:30
19	08:05 16:26	08:42 (WEA ZB06_wpd) 09:05 (WEA ZB06_wpd)	07:15 17:23	07:44 (WEA ZB04_wpd) 08:04 (WEA ZB04_wpd)	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:30
20	08:04 16:28	08:41 (WEA ZB06_wpd) 09:05 (WEA ZB06_wpd)	07:12 17:25	07:43 (WEA ZB04_wpd) 08:05 (WEA ZB04_wpd)	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:31
21	08:03 16:29	08:42 (WEA ZB06_wpd) 09:06 (WEA ZB06_wpd)	07:10 17:27	07:43 (WEA ZB04_wpd) 08:05 (WEA ZB04_wpd)	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31
22	08:02 16:31	08:42 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)	07:08 17:29	07:43 (WEA ZB04_wpd) 08:04 (WEA ZB04_wpd)	06:05 18:20	05:54 20:14	05:00 21:03	04:41 21:31
23	08:00 16:33	08:42 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)	07:06 17:31	07:43 (WEA ZB04_wpd) 08:03 (WEA ZB04_wpd)	06:02 18:22	05:52 20:16	04:59 21:05	04:42 21:31
24	07:59 16:35	08:42 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	07:04 17:33	07:44 (WEA ZB04_wpd) 08:03 (WEA ZB04_wpd)	06:00 18:23	05:50 20:17	04:57 21:06	04:42 21:31
25	07:58 16:36	08:43 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	07:02 17:35	07:45 (WEA ZB04_wpd) 08:02 (WEA ZB04_wpd)	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32
26	07:56 16:38	08:43 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	07:00 17:37	07:46 (WEA ZB04_wpd) 08:01 (WEA ZB04_wpd)	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32
27	07:55 16:40	08:43 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	06:58 17:38	07:48 (WEA ZB04_wpd) 07:57 (WEA ZB04_wpd)	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:31
28	07:54 16:42	08:44 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	06:55 17:40		05:51 18:30	05:41 20:24	04:53 21:12	04:44 21:31
29	07:52 16:44	08:44 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)			06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31
30	07:51 16:46	08:46 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)			06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31
31	07:49 16:47	08:46 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)			06:44 19:36		04:50 21:15	
	Sonnenscheinstunden	256	276	367	417	488	502	
	astr.max.mögl.Beschattung	493	299					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-35 - SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:30	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:56	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:38	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:04	07:57	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				247	502	361

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-36 - SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:41 (WEA ZB07_wpd)	07:48	08:50 (WEA ZB06_wpd)	06:53		06:41	05:35		04:49	
	16:01	7 09:48 (WEA ZB07_wpd)	16:49	18 09:08 (WEA ZB06_wpd)	17:42		19:37	20:29		21:16	
2	08:15	09:43 (WEA ZB07_wpd)	07:46		08:52 (WEA ZB06_wpd)	06:51		06:39	05:33	04:48	
	16:02	4 09:47 (WEA ZB07_wpd)	16:51	15 09:07 (WEA ZB06_wpd)	17:44		19:39	20:31	21:18		
3	08:15		07:44		08:55 (WEA ZB06_wpd)	06:49	7 07:12 (WEA ZB02_wpd)	06:37	05:31	04:47	
	16:03		16:53	10 09:05 (WEA ZB06_wpd)			07:19 (WEA ZB02_wpd)	19:41	20:33	21:19	
4	08:15		07:43		06:46		07:10 (WEA ZB02_wpd)	06:34	05:29	04:46	
	16:04		16:55		17:48	11 07:21 (WEA ZB02_wpd)	19:43	20:35	21:20		
5	08:15		07:41		06:44		07:08 (WEA ZB02_wpd)	06:32	05:28	04:46	
	16:05		16:57		17:49	14 07:22 (WEA ZB02_wpd)	19:44	20:36	21:21		
6	08:14		07:39		06:42		07:05 (WEA ZB02_wpd)	06:30	05:26	04:45	
	16:06		16:59		17:51	17 07:22 (WEA ZB02_wpd)	19:46	20:38	21:22		
7	08:14		07:38		06:40		07:05 (WEA ZB02_wpd)	06:27	05:24	04:44	
	16:08		17:01		17:53	18 07:23 (WEA ZB02_wpd)	19:48	20:40	21:23		
8	08:13	08:48 (WEA ZB06_wpd)	07:36		06:37		07:05 (WEA ZB02_wpd)	06:25	05:22	04:44	
	16:09	8 08:56 (WEA ZB06_wpd)	17:03		17:55	18 07:23 (WEA ZB02_wpd)	19:50	20:41	21:24		
9	08:13	08:48 (WEA ZB06_wpd)	07:34		06:35		07:04 (WEA ZB02_wpd)	06:23	05:20	04:43	
	16:10	11 08:59 (WEA ZB06_wpd)	17:04		17:57	18 07:22 (WEA ZB02_wpd)	19:51	20:43	21:24		
10	08:12	08:47 (WEA ZB06_wpd)	07:32		06:33		07:04 (WEA ZB02_wpd)	06:20	05:18	04:43	
	16:12	13 09:00 (WEA ZB06_wpd)	17:06		17:58	17 07:21 (WEA ZB02_wpd)	19:53	20:45	21:25		
11	08:12	08:46 (WEA ZB06_wpd)	07:30		06:30		07:05 (WEA ZB02_wpd)	06:18	05:17	04:42	
	16:13	15 09:01 (WEA ZB06_wpd)	17:08		18:00	16 07:21 (WEA ZB02_wpd)	19:55	20:46	21:26		
12	08:11	08:45 (WEA ZB06_wpd)	07:28		06:28		07:05 (WEA ZB02_wpd)	06:16	05:15	04:42	
	16:15	17 09:02 (WEA ZB06_wpd)	17:10		18:02	14 07:19 (WEA ZB02_wpd)	19:57	20:48	21:27		
13	08:10	08:45 (WEA ZB06_wpd)	07:26		06:26		07:08 (WEA ZB02_wpd)	06:14	05:13	04:42	
	16:16	18 09:03 (WEA ZB06_wpd)	17:12	4 07:54 (WEA ZB04_wpd)	06:24	9 07:17 (WEA ZB02_wpd)	19:58	20:50	21:27		
14	08:10	08:45 (WEA ZB06_wpd)	07:25		07:49 (WEA ZB04_wpd)		06:11	05:12	04:42		
	16:18	19 09:04 (WEA ZB06_wpd)	17:14	11 08:00 (WEA ZB04_wpd)	18:06		20:00	20:51	21:28		
15	08:09	08:44 (WEA ZB06_wpd)	07:23		07:47 (WEA ZB04_wpd)	06:21	06:09	05:10	04:41		
	16:19	21 09:05 (WEA ZB06_wpd)	17:16	15 08:02 (WEA ZB04_wpd)	18:07		20:02	20:53	21:29		
16	08:08	08:44 (WEA ZB06_wpd)	07:21		07:46 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41		
	16:21	22 09:06 (WEA ZB06_wpd)	17:18	18 08:04 (WEA ZB04_wpd)	18:09		20:03	20:54	21:29		
17	08:07	08:44 (WEA ZB06_wpd)	07:19		07:45 (WEA ZB04_wpd)	06:16	06:05	05:07	04:41		
	16:23	23 09:07 (WEA ZB06_wpd)	17:20	20 08:05 (WEA ZB04_wpd)	18:11		20:05	20:56	21:30		
18	08:06	08:44 (WEA ZB06_wpd)	07:17		07:45 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41		
	16:24	24 09:08 (WEA ZB06_wpd)	17:22	20 08:05 (WEA ZB04_wpd)	18:13		20:07	20:57	21:30		
19	08:05	08:44 (WEA ZB06_wpd)	07:15		07:44 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41		
	16:26	25 09:09 (WEA ZB06_wpd)	17:23	22 08:06 (WEA ZB04_wpd)	18:15		20:09	20:59	21:30		
20	08:04	08:44 (WEA ZB06_wpd)	07:12		07:44 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41		
	16:28	25 09:09 (WEA ZB06_wpd)	17:25	22 08:06 (WEA ZB04_wpd)	18:16		20:10	21:00	21:31		
21	08:03	08:44 (WEA ZB06_wpd)	07:10		07:44 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41		
	16:29	26 09:10 (WEA ZB06_wpd)	17:27	22 08:06 (WEA ZB04_wpd)	18:18		20:12	21:02	21:31		
22	08:02	08:45 (WEA ZB06_wpd)	07:08		07:44 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41		
	16:31	25 09:10 (WEA ZB06_wpd)	17:29	21 08:05 (WEA ZB04_wpd)	18:20		20:14	21:03	21:31		
23	08:00	08:44 (WEA ZB06_wpd)	07:06		07:44 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42		
	16:33	26 09:10 (WEA ZB06_wpd)	17:31	21 08:05 (WEA ZB04_wpd)	18:22		20:16	21:05	21:31		
24	07:59	08:45 (WEA ZB06_wpd)	07:04		07:45 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42		
	16:35	26 09:11 (WEA ZB06_wpd)	17:33	19 08:04 (WEA ZB04_wpd)	18:23		20:17	21:06	21:31		
25	07:58	08:46 (WEA ZB06_wpd)	07:02		07:46 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42		
	16:36	26 09:12 (WEA ZB06_wpd)	17:35	17 08:03 (WEA ZB04_wpd)	18:25		20:19	21:08	21:32		
26	07:56	08:46 (WEA ZB06_wpd)	07:00		07:48 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43		
	16:38	25 09:11 (WEA ZB06_wpd)	17:37	14 08:02 (WEA ZB04_wpd)	18:27		20:21	21:09	21:32		
27	07:55	08:46 (WEA ZB06_wpd)	06:58		07:49 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43		
	16:40	25 09:11 (WEA ZB06_wpd)	17:38	10 07:59 (WEA ZB04_wpd)	18:29		20:23	21:10	21:31		
28	07:54	08:47 (WEA ZB06_wpd)	06:55		05:51		05:41	04:53	04:44		
	16:42	24 09:11 (WEA ZB06_wpd)	17:40		18:30		20:24	21:12	21:31		
29	07:52	08:47 (WEA ZB06_wpd)			06:48		05:39	04:52	04:44		
	16:44	23 09:10 (WEA ZB06_wpd)			19:32		20:26	21:13	21:31		
30	07:51	08:49 (WEA ZB06_wpd)			06:46		05:37	04:51	04:45		
	16:46	21 09:10 (WEA ZB06_wpd)			19:34		20:28	21:14	21:31		
31	07:49	08:49 (WEA ZB06_wpd)			06:44			04:50			
	16:47	20 09:09 (WEA ZB06_wpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	519		299		159						

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-36 - SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	07:46 (WEA ZB02_wpd) 06:59	07:51 08:28 (WEA ZB06_wpd)
	21:31	20:58	19:55	18:44	12 07:58 (WEA ZB02_wpd) 16:37	15:55 15 08:43 (WEA ZB06_wpd)
2	04:46	05:24	06:16	07:06	07:43 (WEA ZB02_wpd) 07:01	07:53 08:30 (WEA ZB06_wpd)
	21:30	20:56	19:52	18:42	15 07:58 (WEA ZB02_wpd) 16:35	15:54 13 08:43 (WEA ZB06_wpd)
3	04:47	05:26	06:17	07:07	07:42 (WEA ZB02_wpd) 07:03	07:54 08:31 (WEA ZB06_wpd)
	21:30	20:55	19:50	18:39	17 07:59 (WEA ZB02_wpd) 16:33	15:54 11 08:42 (WEA ZB06_wpd)
4	04:48	05:28	06:19	07:09	07:42 (WEA ZB02_wpd) 07:05	07:55 08:33 (WEA ZB06_wpd)
	21:30	20:53	19:48	18:37	18 08:00 (WEA ZB02_wpd) 16:31	15:53 8 08:41 (WEA ZB06_wpd)
5	04:48	05:29	06:21	07:11	07:42 (WEA ZB02_wpd) 07:06	07:57 08:36 (WEA ZB06_wpd)
	21:29	20:51	19:45	18:35	18 08:00 (WEA ZB02_wpd) 16:29	15:53 2 08:38 (WEA ZB06_wpd)
6	04:49	05:31	06:22	07:13	07:40 (WEA ZB02_wpd) 07:08	07:58
	21:28	20:49	19:43	18:32	19 07:59 (WEA ZB02_wpd) 16:27	15:52
7	04:50	05:32	06:24	07:14	07:41 (WEA ZB02_wpd) 07:10	08:29 (WEA ZB06_wpd) 07:59
	21:28	20:47	19:41	18:30	17 07:58 (WEA ZB02_wpd) 16:26	1 08:30 (WEA ZB06_wpd) 15:52
8	04:51	05:34	06:26	07:16	07:42 (WEA ZB02_wpd) 07:12	08:24 (WEA ZB06_wpd) 08:01
	21:27	20:45	19:38	18:28	16 07:58 (WEA ZB02_wpd) 16:24	11 08:35 (WEA ZB06_wpd) 15:51
9	04:52	05:36	06:27	07:18	07:44 (WEA ZB02_wpd) 07:14	08:22 (WEA ZB06_wpd) 08:02
	21:27	20:44	19:36	18:25	13 07:57 (WEA ZB02_wpd) 16:22	16 08:38 (WEA ZB06_wpd) 15:51
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB02_wpd) 07:16	08:21 (WEA ZB06_wpd) 08:03
	21:26	20:42	19:34	18:23	9 07:54 (WEA ZB02_wpd) 16:21	18 08:39 (WEA ZB06_wpd) 15:51
11	04:54	05:39	06:30	07:21	07:47 (WEA ZB02_wpd) 07:17	08:20 (WEA ZB06_wpd) 08:04
	21:25	20:40	19:31	18:21	5 07:52 (WEA ZB02_wpd) 16:19	20 08:40 (WEA ZB06_wpd) 15:51
12	04:55	05:41	06:32	07:23	07:19	08:20 (WEA ZB06_wpd) 08:05
	21:24	20:38	19:29	18:19	16:17	21 08:41 (WEA ZB06_wpd) 15:51
13	04:56	05:42	06:34	07:25	07:21	08:19 (WEA ZB06_wpd) 08:06
	21:23	20:36	19:27	18:16	15:16	23 08:42 (WEA ZB06_wpd) 15:50
14	04:58	05:44	06:35	07:27	08:25 (WEA ZB04_wpd) 07:23	08:19 (WEA ZB06_wpd) 08:07
	21:22	20:34	19:24	18:14	4 08:29 (WEA ZB04_wpd) 16:14	24 08:43 (WEA ZB06_wpd) 15:50
15	04:59	05:46	06:37	07:28	08:21 (WEA ZB04_wpd) 07:25	08:19 (WEA ZB06_wpd) 08:08
	21:21	20:32	19:22	18:12	12 08:33 (WEA ZB04_wpd) 16:13	25 08:44 (WEA ZB06_wpd) 15:51
16	05:00	05:47	06:39	07:30	08:18 (WEA ZB04_wpd) 07:26	08:19 (WEA ZB06_wpd) 08:09
	21:20	20:30	19:20	18:10	16 08:34 (WEA ZB04_wpd) 16:11	25 08:44 (WEA ZB06_wpd) 15:51
17	05:01	05:49	06:40	07:32	08:17 (WEA ZB04_wpd) 07:28	08:19 (WEA ZB06_wpd) 08:10
	21:19	20:28	19:17	18:07	18 08:35 (WEA ZB04_wpd) 16:10	25 08:44 (WEA ZB06_wpd) 15:51
18	05:03	05:51	06:42	07:34	08:16 (WEA ZB04_wpd) 07:30	08:19 (WEA ZB06_wpd) 08:10
	21:18	20:25	19:15	18:05	20 08:36 (WEA ZB04_wpd) 16:09	26 08:45 (WEA ZB06_wpd) 15:51
19	05:04	05:52	06:44	07:35	08:15 (WEA ZB04_wpd) 07:32	08:19 (WEA ZB06_wpd) 08:11
	21:17	20:23	19:12	18:03	21 08:36 (WEA ZB04_wpd) 16:07	26 08:45 (WEA ZB06_wpd) 15:51
20	05:05	05:54	06:45	07:37	08:15 (WEA ZB04_wpd) 07:33	08:20 (WEA ZB06_wpd) 08:12
	21:16	20:21	19:10	18:01	21 08:36 (WEA ZB04_wpd) 16:06	25 08:45 (WEA ZB06_wpd) 15:52
21	05:07	05:56	06:47	07:39	08:15 (WEA ZB04_wpd) 07:35	08:20 (WEA ZB06_wpd) 08:12
	21:14	20:19	19:08	17:59	22 08:37 (WEA ZB04_wpd) 16:05	26 08:46 (WEA ZB06_wpd) 15:52
22	05:08	05:57	06:49	07:41	08:15 (WEA ZB04_wpd) 07:37	08:21 (WEA ZB06_wpd) 08:13
	21:13	20:17	19:05	17:57	21 08:36 (WEA ZB04_wpd) 16:04	25 08:46 (WEA ZB06_wpd) 15:53
23	05:09	05:59	06:51	07:43	08:15 (WEA ZB04_wpd) 07:38	08:20 (WEA ZB06_wpd) 08:14
	21:12	20:15	19:03	17:55	21 08:36 (WEA ZB04_wpd) 16:03	25 08:45 (WEA ZB06_wpd) 15:53
24	05:11	06:01	06:52	07:44	08:15 (WEA ZB04_wpd) 07:40	08:21 (WEA ZB06_wpd) 08:14
	21:10	20:13	19:01	17:53	21 08:36 (WEA ZB04_wpd) 16:01	24 08:45 (WEA ZB06_wpd) 15:54
25	05:12	06:02	06:54	06:46	07:16 (WEA ZB04_wpd) 07:42	08:22 (WEA ZB06_wpd) 08:14
	21:09	20:10	18:58	16:50	19 07:35 (WEA ZB04_wpd) 16:00	23 08:45 (WEA ZB06_wpd) 15:54
26	05:14	06:04	06:56	06:48	07:17 (WEA ZB04_wpd) 07:43	08:23 (WEA ZB06_wpd) 08:15
	21:07	20:08	18:56	16:48	17 07:34 (WEA ZB04_wpd) 15:59	22 08:45 (WEA ZB06_wpd) 15:55
27	05:15	06:06	06:57	06:50	07:17 (WEA ZB04_wpd) 07:45	08:23 (WEA ZB06_wpd) 08:15
	21:06	20:06	18:53	16:46	14 07:31 (WEA ZB04_wpd) 15:58	21 08:44 (WEA ZB06_wpd) 15:56
28	05:17	06:07	06:59	06:52	07:19 (WEA ZB04_wpd) 07:47	08:25 (WEA ZB06_wpd) 08:15
	21:04	20:04	18:51	16:44	10 07:29 (WEA ZB04_wpd) 15:58	19 08:44 (WEA ZB06_wpd) 15:57
29	05:18	06:09	07:01	06:54	07:48	08:26 (WEA ZB06_wpd) 08:15
	21:03	20:01	18:49	16:42	15:57	18 08:44 (WEA ZB06_wpd) 15:57
30	05:20	06:11	07:02	06:55	07:50	08:26 (WEA ZB06_wpd) 08:15
	21:01	19:59	18:46	6 07:49 (WEA ZB02_wpd) 06:55	15:56	17 08:43 (WEA ZB06_wpd) 15:58
31	05:21	06:12	07:03	06:57	07:50	08:26 (WEA ZB06_wpd) 08:15
	21:00	19:57	18:43	6 06:57	16:39	15:59
					311	241
	Sonnenscheinstunden	505	465	381		264
	astr. max. mögl. Beschattung			6	416	506

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-37 - SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:01	07:48 16:49	08:53 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)	06:53 17:42	06:41 19:37	05:35 20:29	
2	08:15 16:02	07:46 16:51	08:56 (WEA ZB06_wpd) 09:06 (WEA ZB06_wpd)	06:51 17:44	06:39 19:39	05:33 20:31	
3	08:15 16:03	07:44 16:53		06:49 17:46	06:37 19:41	05:31 20:33	
4	08:15 16:04	07:43 16:55		06:46 17:48	06:34 19:43	05:29 20:35	
5	08:15 16:05	07:41 16:57		06:44 17:49	06:32 19:44	05:28 20:36	
6	08:14 16:06	08:50 (WEA ZB06_wpd) 08:56 (WEA ZB06_wpd)	07:39 16:59	06:42 17:51	06:30 19:46	05:26 20:38	
7	08:14 16:08	08:48 (WEA ZB06_wpd) 08:57 (WEA ZB06_wpd)	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	
8	08:13 16:09	08:47 (WEA ZB06_wpd) 08:59 (WEA ZB06_wpd)	07:36 17:03	06:37 17:55	06:25 19:50	05:22 20:41	
9	08:13 16:10	08:47 (WEA ZB06_wpd) 09:01 (WEA ZB06_wpd)	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	
10	08:12 16:12	08:46 (WEA ZB06_wpd) 09:02 (WEA ZB06_wpd)	07:32 17:06	06:33 17:58	06:20 19:53	05:18 20:45	
11	08:12 16:13	08:46 (WEA ZB06_wpd) 09:03 (WEA ZB06_wpd)	07:30 17:08	06:30 18:00	06:18 19:55	05:17 20:46	
12	08:11 16:15	08:45 (WEA ZB06_wpd) 09:04 (WEA ZB06_wpd)	07:28 17:10	07:55 (WEA ZB04_wpd) 08:00 (WEA ZB04_wpd)	06:28 18:02	06:16 19:57	
13	08:10 16:16	08:45 (WEA ZB06_wpd) 09:05 (WEA ZB06_wpd)	07:26 17:12	07:52 (WEA ZB04_wpd) 08:03 (WEA ZB04_wpd)	06:26 18:04	06:14 19:58	
14	08:10 16:18	08:45 (WEA ZB06_wpd) 09:06 (WEA ZB06_wpd)	07:25 17:14	07:49 (WEA ZB04_wpd) 08:04 (WEA ZB04_wpd)	06:24 18:06	06:11 20:00	
15	08:09 16:19	08:45 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)	07:23 17:16	07:48 (WEA ZB04_wpd) 08:05 (WEA ZB04_wpd)	06:21 18:07	06:09 20:02	
16	08:08 16:21	08:45 (WEA ZB06_wpd) 09:07 (WEA ZB06_wpd)	07:21 17:18	07:47 (WEA ZB04_wpd) 08:06 (WEA ZB04_wpd)	06:19 18:09	06:07 20:03	
17	08:07 16:23	08:45 (WEA ZB06_wpd) 09:08 (WEA ZB06_wpd)	07:19 17:20	07:47 (WEA ZB04_wpd) 08:07 (WEA ZB04_wpd)	06:16 18:11	06:05 20:05	
18	08:06 16:24	08:45 (WEA ZB06_wpd) 09:09 (WEA ZB06_wpd)	07:17 17:22	07:46 (WEA ZB04_wpd) 08:07 (WEA ZB04_wpd)	06:14 18:13	06:02 20:07	
19	08:05 16:26	08:45 (WEA ZB06_wpd) 09:10 (WEA ZB06_wpd)	07:15 17:23	07:46 (WEA ZB04_wpd) 08:08 (WEA ZB04_wpd)	06:12 18:15	06:00 20:09	
20	08:04 16:28	08:45 (WEA ZB06_wpd) 09:10 (WEA ZB06_wpd)	07:12 17:25	07:46 (WEA ZB04_wpd) 08:08 (WEA ZB04_wpd)	06:09 18:16	05:58 20:10	
21	08:03 16:29	08:45 (WEA ZB06_wpd) 09:10 (WEA ZB06_wpd)	07:10 17:27	07:47 (WEA ZB04_wpd) 08:07 (WEA ZB04_wpd)	06:07 18:18	05:56 20:12	
22	08:02 16:31	08:46 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	07:08 17:29	07:46 (WEA ZB04_wpd) 08:06 (WEA ZB04_wpd)	06:05 18:20	05:54 20:14	
23	08:00 16:33	08:45 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	07:06 17:31	07:47 (WEA ZB04_wpd) 08:05 (WEA ZB04_wpd)	06:02 18:22	05:52 20:16	
24	07:59 16:35	08:46 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	07:04 17:33	07:48 (WEA ZB04_wpd) 08:04 (WEA ZB04_wpd)	06:00 18:23	05:50 20:17	
25	07:58 16:36	08:47 (WEA ZB06_wpd) 09:12 (WEA ZB06_wpd)	07:02 17:35	07:50 (WEA ZB04_wpd) 08:03 (WEA ZB04_wpd)	05:58 18:25	05:47 20:19	
26	07:56 16:38	08:47 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	07:00 17:37	07:52 (WEA ZB04_wpd) 08:00 (WEA ZB04_wpd)	05:55 18:27	05:45 20:21	
27	07:55 16:40	08:47 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	06:58 17:38		05:53 18:29	05:43 20:23	
28	07:54 16:42	08:48 (WEA ZB06_wpd) 09:11 (WEA ZB06_wpd)	06:55 17:40		05:51 18:30	05:41 20:24	
29	07:52 16:44	08:49 (WEA ZB06_wpd) 09:10 (WEA ZB06_wpd)			05:48 19:32	05:39 20:26	
30	07:51 16:46	08:51 (WEA ZB06_wpd) 09:10 (WEA ZB06_wpd)			05:46 19:34	05:37 20:28	
31	07:49 16:47	08:52 (WEA ZB06_wpd) 09:09 (WEA ZB06_wpd)			06:44 19:36	04:50 21:15	
	Sonnenscheinstunden   256		276		367	417	488
	astr.max.mögl.Beschattung   529		271				502

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-37 - SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:30	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:56	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:38	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:56
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:56	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:04	07:58	15:56	15:58
	21:00	19:57	18:43	16:39	15:55	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				248	482	279

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-38 - SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg  
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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	08:15	07:48	08:57 (WEA ZB06_vpd)   06:53	07:17 (WEA ZB02_vpd)   06:41	05:35	04:49
	16:01	16:49	11 09:08 (WEA ZB06_vpd)   17:42	4 07:21 (WEA ZB02_vpd)   19:37	20:29	21:16
2	08:15	07:46	09:02 (WEA ZB06_vpd)   06:51	07:15 (WEA ZB02_vpd)   06:39	05:33	04:48
	16:02	16:51	1 09:03 (WEA ZB06_vpd)   17:44	9 07:24 (WEA ZB02_vpd)   19:39	20:31	21:18
3	08:15	07:44	06:49	07:12 (WEA ZB02_vpd)   06:37	05:31	04:47
	16:03	16:53	17:46	12 07:24 (WEA ZB02_vpd)   19:41	20:33	21:19
4	08:15	07:43	06:46	07:10 (WEA ZB02_vpd)   06:34	05:29	04:46
	16:04	16:55	17:48	15 07:25 (WEA ZB02_vpd)   19:43	20:35	21:20
5	08:15	07:41	06:44	07:08 (WEA ZB02_vpd)   06:32	05:28	04:46
	16:05	16:57	17:49	18 07:26 (WEA ZB02_vpd)   19:44	20:36	21:21
6	08:14	07:39	06:42	07:07 (WEA ZB02_vpd)   06:30	05:26	04:45
	16:06	16:59	17:51	18 07:25 (WEA ZB02_vpd)   19:46	20:38	21:22
7	08:14	07:38	06:40	07:07 (WEA ZB02_vpd)   06:27	05:24	04:44
	16:08	17:01	17:53	19 07:26 (WEA ZB02_vpd)   19:48	20:40	21:23
8	08:13	07:36	06:37	07:08 (WEA ZB02_vpd)   06:25	05:22	04:44
	16:09	17:03	17:55	17 07:25 (WEA ZB02_vpd)   19:50	20:41	21:24
9	08:13	07:34	06:35	07:07 (WEA ZB02_vpd)   06:23	05:20	04:43
	16:10	17:04	17:57	17 07:24 (WEA ZB02_vpd)   19:51	20:43	21:24
10	08:12	07:32	06:33	07:08 (WEA ZB02_vpd)   06:20	05:18	04:43
	16:12	17:06	17:58	15 07:23 (WEA ZB02_vpd)   19:53	20:45	21:25
11	08:12	07:30	06:30	07:10 (WEA ZB02_vpd)   06:18	05:17	04:42
	16:13	17:08	18:00	12 07:22 (WEA ZB02_vpd)   19:55	20:46	21:26
12	08:11	07:28	06:28	07:12 (WEA ZB02_vpd)   06:16	05:15	04:42
	16:15	17:10	10 08:04 (WEA ZB04_vpd)   18:02	6 07:18 (WEA ZB02_vpd)   19:57	20:48	21:27
13	08:10	07:26	06:26	07:52 (WEA ZB04_vpd)   06:26	06:14	05:13
	16:16	17:12	14 08:06 (WEA ZB04_vpd)   18:04	08:06 (WEA ZB04_vpd)   18:04	19:58	20:50
14	08:10	07:25	06:24	07:50 (WEA ZB04_vpd)   06:24	06:11	05:12
	16:18	17:14	16 08:06 (WEA ZB04_vpd)   18:06	08:06 (WEA ZB04_vpd)   18:06	20:00	20:51
15	08:09	07:23	06:21	07:49 (WEA ZB04_vpd)   06:21	06:09	05:10
	16:19	17:16	18 08:07 (WEA ZB04_vpd)   18:07	07:48 (WEA ZB04_vpd)   06:19	20:02	20:53
16	08:08	07:21	06:19	07:48 (WEA ZB04_vpd)   06:19	06:07	05:09
	16:21	17:18	20 08:08 (WEA ZB04_vpd)   18:09	07:48 (WEA ZB04_vpd)   06:16	20:03	20:54
17	08:07	07:19	06:16	07:48 (WEA ZB04_vpd)   06:16	06:05	05:07
	16:23	17:20	21 08:09 (WEA ZB04_vpd)   18:11	07:48 (WEA ZB04_vpd)   06:14	20:05	20:56
18	08:06	07:17	06:14	07:48 (WEA ZB04_vpd)   06:14	06:02	05:06
	16:24	17:22	21 08:09 (WEA ZB04_vpd)   18:13	07:48 (WEA ZB04_vpd)   06:12	20:07	20:57
19	08:05	07:15	06:12	07:48 (WEA ZB04_vpd)   06:12	06:00	05:04
	16:26	17:23	21 08:09 (WEA ZB04_vpd)   18:15	07:48 (WEA ZB04_vpd)   06:09	20:09	20:59
20	08:04	07:12	06:09	07:48 (WEA ZB04_vpd)   06:09	05:58	05:03
	16:28	17:25	21 08:09 (WEA ZB04_vpd)   18:16	07:48 (WEA ZB04_vpd)   06:07	20:10	21:00
21	08:03	07:10	06:07	07:48 (WEA ZB04_vpd)   06:07	05:56	05:01
	16:29	17:27	21 08:09 (WEA ZB04_vpd)   18:18	07:48 (WEA ZB04_vpd)   06:05	20:12	21:02
22	08:02	07:08	06:05	07:48 (WEA ZB04_vpd)   06:05	05:54	05:00
	16:31	17:29	19 08:07 (WEA ZB04_vpd)   18:20	07:48 (WEA ZB04_vpd)   06:02	20:14	21:03
23	08:00	07:06	06:02	07:49 (WEA ZB04_vpd)   06:02	05:52	04:59
	16:33	17:31	18 08:07 (WEA ZB04_vpd)   18:22	07:50 (WEA ZB04_vpd)   06:00	20:16	21:05
24	07:59	07:04	06:00	07:50 (WEA ZB04_vpd)   06:00	05:50	04:57
	16:35	17:33	15 08:05 (WEA ZB04_vpd)   18:23	07:50 (WEA ZB04_vpd)   06:00	20:17	21:06
25	07:58	07:02	05:58	07:52 (WEA ZB04_vpd)   05:58	05:47	04:56
	16:36	17:35	12 08:04 (WEA ZB04_vpd)   18:25	07:52 (WEA ZB04_vpd)   05:55	20:19	21:08
26	07:56	07:00	05:55	07:56 (WEA ZB04_vpd)   05:55	05:45	04:55
	16:38	17:37	4 08:00 (WEA ZB04_vpd)   18:27	07:56 (WEA ZB04_vpd)   05:53	20:21	21:09
27	07:55	06:58	05:53	08:00 (WEA ZB04_vpd)   05:53	05:43	04:54
	16:40	17:38	18:29	08:00 (WEA ZB04_vpd)   05:51	20:23	21:10
28	07:54	06:55	05:51	08:00 (WEA ZB04_vpd)   05:51	05:41	04:53
	16:42	17:40	18:30	08:00 (WEA ZB04_vpd)   05:49	20:24	21:12
29	07:52	07:00	06:48	08:00 (WEA ZB04_vpd)   05:48	05:39	04:52
	16:44	17:42	19:32	08:00 (WEA ZB04_vpd)   05:46	20:26	21:13
30	07:51	07:00	06:46	08:00 (WEA ZB04_vpd)   05:44	05:37	04:51
	16:46	17:44	19:34	08:00 (WEA ZB04_vpd)   05:42	20:28	21:14
31	07:49	06:55	06:44	08:00 (WEA ZB04_vpd)   05:41	05:35	04:50
	16:47	17:45	19:36	08:00 (WEA ZB04_vpd)   05:39	20:30	21:15
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	573	263	162			

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-38 - SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:49 (WEA ZB02_wpd)	07:53
	21:30	20:56	19:52	18:42	10 07:59 (WEA ZB02_wpd)	15:54
3	04:47	05:26	06:17	07:07	07:47 (WEA ZB02_wpd)	07:54
	21:30	20:55	19:50	18:39	08:00 (WEA ZB02_wpd)	15:54
4	04:48	05:28	06:19	07:09	07:46 (WEA ZB02_wpd)	07:55
	21:30	20:53	19:48	18:37	15 08:01 (WEA ZB02_wpd)	15:53
5	04:48	05:29	06:21	07:11	07:45 (WEA ZB02_wpd)	07:57
	21:29	20:51	19:45	18:35	17 08:02 (WEA ZB02_wpd)	15:53
6	04:49	05:31	06:22	07:13	07:43 (WEA ZB02_wpd)	07:58
	21:28	20:49	19:43	18:32	18 08:01 (WEA ZB02_wpd)	15:52
7	04:50	05:32	06:24	07:14	07:43 (WEA ZB02_wpd)	07:59
	21:28	20:47	19:41	18:30	19 08:02 (WEA ZB02_wpd)	15:52
8	04:51	05:34	06:26	07:16	07:43 (WEA ZB02_wpd)	08:01
	21:27	20:45	19:38	18:28	18 08:01 (WEA ZB02_wpd)	15:51
9	04:52	05:36	06:27	07:18	07:44 (WEA ZB02_wpd)	08:02
	21:27	20:44	19:36	18:25	17 08:01 (WEA ZB02_wpd)	15:51
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB02_wpd)	08:03
	21:26	20:42	19:34	18:23	14 07:59 (WEA ZB02_wpd)	15:51
11	04:54	05:39	06:30	07:21	07:47 (WEA ZB02_wpd)	08:04
	21:25	20:40	19:31	18:21	11 07:58 (WEA ZB02_wpd)	15:51
12	04:55	05:41	06:32	07:23	07:49 (WEA ZB02_wpd)	08:05
	21:24	20:38	19:29	18:19	7 07:56 (WEA ZB02_wpd)	15:51
13	04:56	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	20 08:24 (WEA ZB06_wpd)	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	22 08:45 (WEA ZB06_wpd)	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	23 08:23 (WEA ZB06_wpd)	15:50
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	8 08:33 (WEA ZB04_wpd)	15:51
17	05:01	05:49	06:40	07:32	08:23 (WEA ZB04_wpd)	08:10
	21:19	20:28	19:17	18:07	13 08:36 (WEA ZB04_wpd)	15:51
18	05:03	05:51	06:42	07:34	08:21 (WEA ZB04_wpd)	08:10
	21:18	20:25	19:15	18:05	16 08:37 (WEA ZB04_wpd)	15:51
19	05:04	05:52	06:44	07:35	08:20 (WEA ZB04_wpd)	08:11
	21:17	20:23	19:12	18:03	18 08:38 (WEA ZB04_wpd)	15:51
20	05:05	05:54	06:45	07:37	08:19 (WEA ZB04_wpd)	08:12
	21:16	20:21	19:10	18:01	20 08:39 (WEA ZB04_wpd)	15:52
21	05:07	05:55	06:47	07:39	08:18 (WEA ZB04_wpd)	08:12
	21:14	20:19	19:08	17:59	21 08:39 (WEA ZB04_wpd)	15:52
22	05:08	05:57	06:49	07:41	08:18 (WEA ZB04_wpd)	08:13
	21:13	20:17	19:05	17:57	22 08:40 (WEA ZB04_wpd)	15:53
23	05:09	05:59	06:51	07:43	08:18 (WEA ZB04_wpd)	08:14
	21:12	20:15	19:03	17:55	22 08:40 (WEA ZB04_wpd)	15:53
24	05:11	06:00	06:52	07:44	08:18 (WEA ZB04_wpd)	08:14
	21:10	20:13	19:01	17:53	21 08:39 (WEA ZB04_wpd)	15:54
25	05:12	06:02	06:54	07:46	07:18 (WEA ZB04_wpd)	08:14
	21:09	20:10	18:58	16:50	21 07:39 (WEA ZB04_wpd)	15:54
26	05:14	06:04	06:56	07:48	07:19 (WEA ZB04_wpd)	08:15
	21:07	20:08	18:56	16:48	20 07:39 (WEA ZB04_wpd)	15:55
27	05:15	06:06	06:57	07:50	07:19 (WEA ZB04_wpd)	08:15
	21:06	20:06	18:53	16:46	18 07:37 (WEA ZB04_wpd)	15:56
28	05:17	06:07	06:59	07:52	07:20 (WEA ZB04_wpd)	08:15
	21:04	20:04	18:51	16:44	16 07:36 (WEA ZB04_wpd)	15:56
29	05:18	06:09	07:01	07:54	07:21 (WEA ZB04_wpd)	08:15
	21:03	20:01	18:49	16:42	13 07:34 (WEA ZB04_wpd)	15:57
30	05:20	06:11	07:02	07:55	07:23 (WEA ZB04_wpd)	08:15
	21:01	19:59	18:46	16:40	9 07:32 (WEA ZB04_wpd)	15:58
31	05:21	06:12	07:03	07:56	07:24 (WEA ZB04_wpd)	08:15
	21:00	19:57	18:44	16:39	07:25 (WEA ZB04_wpd)	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				417	473	221

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-39 - SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:01	08:51 (WEA ZB06_vpd)   07:48 08:58 (WEA ZB06_vpd)   16:49	09:03 (WEA ZB06_vpd)   06:53 09:07 (WEA ZB06_vpd)   17:42	07:17 (WEA ZB02_vpd)   06:41 07:24 (WEA ZB02_vpd)   19:37	05:35 20:29	04:49 21:16
2	08:15 16:02	08:51 (WEA ZB06_vpd)   07:46 09:00 (WEA ZB06_vpd)   16:51	06:51 17:44	07:15 (WEA ZB02_vpd)   06:39 07:26 (WEA ZB02_vpd)   19:39	05:33 20:31	04:48 21:18
3	08:15 16:03	08:51 (WEA ZB06_vpd)   07:44 09:02 (WEA ZB06_vpd)   16:53	06:49 17:46	07:12 (WEA ZB02_vpd)   06:37 07:26 (WEA ZB02_vpd)   19:41	05:31 20:33	04:47 21:19
4	08:15 16:04	08:50 (WEA ZB06_vpd)   07:43 09:03 (WEA ZB06_vpd)   16:55	06:46 17:48	07:10 (WEA ZB02_vpd)   06:34 07:27 (WEA ZB02_vpd)   19:43	05:29 20:35	04:46 21:20
5	08:15 16:05	08:50 (WEA ZB06_vpd)   07:41 09:04 (WEA ZB06_vpd)   16:57	06:44 17:49	07:09 (WEA ZB02_vpd)   06:32 07:27 (WEA ZB02_vpd)   19:44	05:28 20:36	04:46 21:21
6	08:14 16:06	08:50 (WEA ZB06_vpd)   07:39 09:06 (WEA ZB06_vpd)   16:59	06:42 17:51	07:08 (WEA ZB02_vpd)   06:30 07:27 (WEA ZB02_vpd)   19:46	05:26 20:38	04:45 21:22
7	08:14 16:08	08:49 (WEA ZB06_vpd)   07:38 09:07 (WEA ZB06_vpd)   17:01	06:40 17:53	07:08 (WEA ZB02_vpd)   06:27 07:27 (WEA ZB02_vpd)   19:48	05:24 20:40	04:44 21:23
8	08:13 16:09	08:49 (WEA ZB06_vpd)   07:36 09:07 (WEA ZB06_vpd)   17:03	06:37 17:55	07:09 (WEA ZB02_vpd)   06:25 07:26 (WEA ZB02_vpd)   19:50	05:22 20:41	04:44 21:24
9	08:13 16:10	08:49 (WEA ZB06_vpd)   07:34 09:09 (WEA ZB06_vpd)   17:04	06:35 17:57	07:09 (WEA ZB02_vpd)   06:23 07:25 (WEA ZB02_vpd)   19:51	05:20 20:43	04:43 21:24
10	08:12 16:12	08:49 (WEA ZB06_vpd)   07:32 09:09 (WEA ZB06_vpd)   17:06	06:33 17:58	07:10 (WEA ZB02_vpd)   06:20 07:24 (WEA ZB02_vpd)   19:53	05:18 20:45	04:43 21:25
11	08:12 16:13	08:49 (WEA ZB06_vpd)   07:30 09:10 (WEA ZB06_vpd)   17:08	06:30 18:00	07:12 (WEA ZB02_vpd)   06:18 07:22 (WEA ZB02_vpd)   19:55	05:17 20:46	04:42 21:26
12	08:11 16:15	08:49 (WEA ZB06_vpd)   07:28 09:11 (WEA ZB06_vpd)   17:10	06:28 18:02	07:15 (WEA ZB02_vpd)   06:16 07:17 (WEA ZB02_vpd)   19:57	05:15 20:48	04:42 21:27
13	08:10 16:16	08:48 (WEA ZB06_vpd)   07:26 09:12 (WEA ZB06_vpd)   17:12	06:26 18:04	07:15 (WEA ZB02_vpd)   06:14 07:10 (WEA ZB02_vpd)   19:58	05:13 20:50	04:42 21:27
14	08:10 16:18	08:48 (WEA ZB06_vpd)   07:25 09:12 (WEA ZB06_vpd)   17:14	06:23 18:06	07:15 (WEA ZB02_vpd)   06:12 08:09 (WEA ZB04_vpd)   18:06	05:11 20:51	04:42 21:28
15	08:09 16:19	08:49 (WEA ZB06_vpd)   07:23 09:13 (WEA ZB06_vpd)   17:16	06:21 18:07	08:09 (WEA ZB04_vpd)   18:06 07:49 (WEA ZB04_vpd)   18:09	05:09 20:52	04:41 21:29
16	08:08 16:21	08:49 (WEA ZB06_vpd)   07:21 09:14 (WEA ZB06_vpd)   17:18	06:19 18:09	07:49 (WEA ZB04_vpd)   18:09 08:11 (WEA ZB04_vpd)   18:11	05:07 20:54	04:41 21:29
17	08:07 16:23	08:49 (WEA ZB06_vpd)   07:19 09:14 (WEA ZB06_vpd)   17:20	06:16 18:11	07:49 (WEA ZB04_vpd)   18:11 08:11 (WEA ZB04_vpd)   18:11	05:07 20:56	04:41 21:30
18	08:06 16:24	08:49 (WEA ZB06_vpd)   07:17 09:15 (WEA ZB06_vpd)   17:22	06:14 18:13	07:49 (WEA ZB04_vpd)   18:14 08:11 (WEA ZB04_vpd)   18:13	05:06 20:57	04:41 21:30
19	08:05 16:26	08:50 (WEA ZB06_vpd)   07:15 09:16 (WEA ZB06_vpd)   17:23	06:12 18:15	07:51 (WEA ZB04_vpd)   18:12 08:11 (WEA ZB04_vpd)   18:15	05:04 20:59	04:41 21:30
20	08:04 16:28	08:49 (WEA ZB06_vpd)   07:12 09:15 (WEA ZB06_vpd)   17:25	06:09 18:16	07:50 (WEA ZB04_vpd)   18:09 08:11 (WEA ZB04_vpd)   18:16	05:03 21:00	04:41 21:31
21	08:03 16:29	08:50 (WEA ZB06_vpd)   07:10 09:16 (WEA ZB06_vpd)   17:27	06:07 18:18	07:50 (WEA ZB04_vpd)   18:07 08:10 (WEA ZB04_vpd)   18:18	05:01 21:02	04:41 21:31
22	08:02 16:31	08:51 (WEA ZB06_vpd)   07:08 09:16 (WEA ZB06_vpd)   17:29	06:05 18:20	07:50 (WEA ZB04_vpd)   18:05 08:09 (WEA ZB04_vpd)   18:20	05:00 21:04	04:41 21:31
23	08:00 16:33	08:50 (WEA ZB06_vpd)   07:06 09:16 (WEA ZB06_vpd)   17:31	06:02 18:22	07:51 (WEA ZB04_vpd)   18:02 08:08 (WEA ZB04_vpd)   18:22	04:59 21:06	04:42 21:31
24	07:59 16:35	08:51 (WEA ZB06_vpd)   07:04 09:16 (WEA ZB06_vpd)   17:33	06:00 18:23	07:53 (WEA ZB04_vpd)   18:00 08:06 (WEA ZB04_vpd)   18:23	04:57 21:07	04:42 21:31
25	07:58 16:36	08:53 (WEA ZB06_vpd)   07:02 09:16 (WEA ZB06_vpd)   17:35	05:58 18:25	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:56 21:08	04:42 21:32
26	07:56 16:38	08:53 (WEA ZB06_vpd)   07:00 09:16 (WEA ZB06_vpd)   17:37	05:55 18:27	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:55 21:09	04:43 21:32
27	07:55 16:40	08:53 (WEA ZB06_vpd)   06:58 09:15 (WEA ZB06_vpd)   17:38	05:53 18:29	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:54 21:10	04:43 21:31
28	07:54 16:42	08:55 (WEA ZB06_vpd)   06:55 09:15 (WEA ZB06_vpd)   17:40	05:51 18:30	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:53 21:12	04:44 21:31
29	07:52 16:44	08:56 (WEA ZB06_vpd)   06:53 09:14 (WEA ZB06_vpd)   17:42	05:48 18:32	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:52 21:13	04:44 21:31
30	07:51 16:46	08:58 (WEA ZB06_vpd)   06:51 09:13 (WEA ZB06_vpd)   17:44	05:46 18:34	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:51 21:14	04:45 21:31
31	07:49 16:47	08:59 (WEA ZB06_vpd)   06:49 09:11 (WEA ZB06_vpd)   17:46	05:44 18:36	07:55 (WEA ZB04_vpd)   18:05 08:04 (WEA ZB04_vpd)   18:25	04:50 21:15	04:45 21:31
	Sonnenscheinstunden astr.max.mögl.Beschattung	256 624	276 265	367 164	417 488	502

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-39 - SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:51 (WEA ZB02_wpd)	07:01
	21:30	20:56	19:52	18:42	8 07:59 (WEA ZB02_wpd)	16:35
3	04:47	05:26	06:17	07:07	07:48 (WEA ZB02_wpd)	07:03
	21:30	20:55	19:50	18:39	13 08:01 (WEA ZB02_wpd)	16:33
4	04:48	05:28	06:19	07:09	07:47 (WEA ZB02_wpd)	07:05
	21:30	20:53	19:48	18:37	15 08:02 (WEA ZB02_wpd)	16:31
5	04:48	05:29	06:21	07:11	07:46 (WEA ZB02_wpd)	07:06
	21:29	20:51	19:45	18:35	17 08:03 (WEA ZB02_wpd)	16:29
6	04:49	05:31	06:22	07:13	07:45 (WEA ZB02_wpd)	07:08
	21:28	20:49	19:43	18:32	18 08:03 (WEA ZB02_wpd)	16:27
7	04:50	05:32	06:24	07:14	07:44 (WEA ZB02_wpd)	07:10
	21:28	20:47	19:41	18:30	19 08:03 (WEA ZB02_wpd)	16:26
8	04:51	05:34	06:26	07:16	07:44 (WEA ZB02_wpd)	07:12
	21:27	20:45	19:38	18:28	19 08:03 (WEA ZB02_wpd)	16:24
9	04:52	05:36	06:27	07:18	07:45 (WEA ZB02_wpd)	07:14
	21:27	20:44	19:36	18:25	17 08:02 (WEA ZB02_wpd)	16:22
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB02_wpd)	07:16
	21:26	20:42	19:34	18:23	16 08:01 (WEA ZB02_wpd)	16:21
11	04:54	05:39	06:30	07:21	07:47 (WEA ZB02_wpd)	07:17
	21:25	20:40	19:31	18:21	13 08:00 (WEA ZB02_wpd)	16:19
12	04:55	05:41	06:32	07:23	07:49 (WEA ZB02_wpd)	07:19
	21:24	20:38	19:29	18:19	9 07:58 (WEA ZB02_wpd)	16:17
13	04:56	05:42	06:34	07:25	07:51 (WEA ZB02_wpd)	07:21
	21:23	20:36	19:27	18:16	4 07:55 (WEA ZB02_wpd)	16:16
14	04:58	05:44	06:35	07:27		07:23
	21:22	20:34	19:24	18:14		16:14
15	04:59	05:46	06:37	07:28		07:25
	21:21	20:32	19:22	18:12		16:13
16	05:00	05:47	06:39	07:30		07:26
	21:20	20:30	19:20	18:10		16:11
17	05:01	05:49	06:40	07:32	08:25 (WEA ZB04_wpd)	07:28
	21:19	20:28	19:17	18:07	11 08:36 (WEA ZB04_wpd)	16:10
18	05:03	05:51	06:42	07:34	08:23 (WEA ZB04_wpd)	07:30
	21:18	20:25	19:15	18:05	15 08:38 (WEA ZB04_wpd)	16:09
19	05:04	05:52	06:44	07:35	08:22 (WEA ZB04_wpd)	07:32
	21:17	20:23	19:12	18:03	17 08:39 (WEA ZB04_wpd)	16:07
20	05:05	05:54	06:45	07:37	08:21 (WEA ZB04_wpd)	07:33
	21:16	20:21	19:10	18:01	19 08:40 (WEA ZB04_wpd)	16:06
21	05:07	05:55	06:47	07:39	08:20 (WEA ZB04_wpd)	07:35
	21:14	20:19	19:08	17:59	21 08:41 (WEA ZB04_wpd)	16:05
22	05:08	05:57	06:49	07:41	08:20 (WEA ZB04_wpd)	07:37
	21:13	20:17	19:05	17:57	21 08:41 (WEA ZB04_wpd)	16:04
23	05:09	05:59	06:51	07:43	08:20 (WEA ZB04_wpd)	07:38
	21:12	20:15	19:03	17:55	21 08:41 (WEA ZB04_wpd)	16:03
24	05:11	06:00	06:52	07:44	08:20 (WEA ZB04_wpd)	07:40
	21:10	20:13	19:01	17:53	21 08:41 (WEA ZB04_wpd)	16:01
25	05:12	06:02	06:54	06:46	07:20 (WEA ZB04_wpd)	07:42
	21:09	20:10	18:58	16:50	21 07:41 (WEA ZB04_wpd)	16:00
26	05:14	06:04	06:56	06:48	07:20 (WEA ZB04_wpd)	07:43
	21:07	20:08	18:56	16:48	21 07:41 (WEA ZB04_wpd)	15:59
27	05:15	06:06	06:57	06:50	07:20 (WEA ZB04_wpd)	07:45
	21:06	20:06	18:53	16:46	19 07:39 (WEA ZB04_wpd)	15:58
28	05:17	06:07	06:59	06:52	07:20 (WEA ZB04_wpd)	07:47
	21:04	20:04	18:51	16:44	18 07:38 (WEA ZB04_wpd)	15:58
29	05:18	06:09	07:01	06:54	07:22 (WEA ZB04_wpd)	07:48
	21:03	20:01	18:49	16:42	15 07:37 (WEA ZB04_wpd)	15:57
30	05:20	06:11	07:02	06:55	07:23 (WEA ZB04_wpd)	07:50
	21:01	19:59	18:46	16:40	12 07:35 (WEA ZB04_wpd)	15:56
31	05:21	06:12		06:57	07:25 (WEA ZB04_wpd)	
	21:00	19:57		16:39	6 07:32 (WEA ZB04_wpd)	
Sonnenscheinstunden	505	455	381	311		264
astr.max.mögl.Beschattung				426		464
						175

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-40 - SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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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	08:15	08:51 (WEA ZB06_vpd)	07:48	06:53	07:17 (WEA ZB02_vpd)	06:41	05:35	04:49	
	16:01	13 09:04 (WEA ZB06_vpd)	16:49	17:42	9 07:26 (WEA ZB02_vpd)	19:37	20:29	21:16	
2	08:15	08:51 (WEA ZB06_vpd)	07:46	06:51	07:15 (WEA ZB02_vpd)	06:39	05:33	04:48	
	16:02	14 09:05 (WEA ZB06_vpd)	16:51	17:44	13 07:28 (WEA ZB02_vpd)	19:39	20:31	21:18	
3	08:15	08:51 (WEA ZB06_vpd)	07:44	06:49	07:12 (WEA ZB02_vpd)	06:37	05:31	04:47	
	16:03	15 09:06 (WEA ZB06_vpd)	16:53	17:46	16 07:28 (WEA ZB02_vpd)	19:41	20:33	21:19	
4	08:15	08:50 (WEA ZB06_vpd)	07:43	06:46	07:11 (WEA ZB02_vpd)	06:34	05:29	04:46	
	16:04	17 09:07 (WEA ZB06_vpd)	16:55	17:48	18 07:29 (WEA ZB02_vpd)	19:43	20:35	21:20	
5	08:15	08:51 (WEA ZB06_vpd)	07:41	06:44	07:11 (WEA ZB02_vpd)	06:32	05:28	04:46	
	16:05	17 09:08 (WEA ZB06_vpd)	16:57	17:49	18 07:29 (WEA ZB02_vpd)	19:44	20:36	21:21	
6	08:14	08:51 (WEA ZB06_vpd)	07:39	06:42	07:10 (WEA ZB02_vpd)	06:30	05:26	04:45	
	16:06	19 09:10 (WEA ZB06_vpd)	16:59	17:51	18 07:28 (WEA ZB02_vpd)	19:46	20:38	21:22	
7	08:14	08:51 (WEA ZB06_vpd)	07:38	06:40	07:10 (WEA ZB02_vpd)	06:27	05:24	04:44	
	16:08	19 09:10 (WEA ZB06_vpd)	17:01	17:53	18 07:28 (WEA ZB02_vpd)	19:48	20:40	21:23	
8	08:13	08:50 (WEA ZB06_vpd)	07:36	06:37	07:11 (WEA ZB02_vpd)	06:25	05:22	04:44	
	16:09	21 09:11 (WEA ZB06_vpd)	17:03	17:55	16 07:27 (WEA ZB02_vpd)	19:50	20:41	21:24	
9	08:13	08:51 (WEA ZB06_vpd)	07:34	06:35	07:11 (WEA ZB02_vpd)	06:23	05:20	04:43	
	16:10	21 09:12 (WEA ZB06_vpd)	17:04	17:57	15 07:26 (WEA ZB02_vpd)	19:51	20:43	21:24	
10	08:12	08:51 (WEA ZB06_vpd)	07:32	06:33	07:12 (WEA ZB02_vpd)	06:20	05:18	04:43	
	16:12	22 09:13 (WEA ZB06_vpd)	17:06	7 08:06 (WEA ZB04_vpd)	12 07:24 (WEA ZB02_vpd)	19:53	20:45	21:25	
11	08:12	08:50 (WEA ZB06_vpd)	07:30	06:30	07:15 (WEA ZB02_vpd)	06:18	05:17	04:42	
	16:13	23 09:13 (WEA ZB06_vpd)	17:08	13 08:09 (WEA ZB04_vpd)	7 07:22 (WEA ZB02_vpd)	19:55	20:46	21:26	
12	08:11	08:50 (WEA ZB06_vpd)	07:28	06:28	07:55 (WEA ZB04_vpd)	06:28	06:16	05:15	04:42
	16:15	24 09:14 (WEA ZB06_vpd)	17:10	15 08:10 (WEA ZB04_vpd)	18:02	19:57	20:48	21:27	
13	08:10	08:50 (WEA ZB06_vpd)	07:26	06:26	07:54 (WEA ZB04_vpd)	06:26	06:14	05:13	04:42
	16:16	25 09:15 (WEA ZB06_vpd)	17:12	18 08:12 (WEA ZB04_vpd)	18:04	19:58	20:50	21:27	
14	08:10	08:50 (WEA ZB06_vpd)	07:25	06:23	07:52 (WEA ZB04_vpd)	06:23	06:11	05:12	04:42
	16:18	25 09:15 (WEA ZB06_vpd)	17:14	19 08:11 (WEA ZB04_vpd)	18:06	20:00	20:51	21:28	
15	08:09	08:51 (WEA ZB06_vpd)	07:23	06:21	07:51 (WEA ZB04_vpd)	06:21	06:09	05:10	04:41
	16:19	25 09:16 (WEA ZB06_vpd)	17:16	21 08:12 (WEA ZB04_vpd)	18:07	20:02	20:53	21:29	
16	08:08	08:51 (WEA ZB06_vpd)	07:21	06:19	07:51 (WEA ZB04_vpd)	06:19	06:07	05:09	04:41
	16:21	25 09:16 (WEA ZB06_vpd)	17:18	21 08:12 (WEA ZB04_vpd)	18:09	20:03	20:54	21:29	
17	08:07	08:51 (WEA ZB06_vpd)	07:19	06:16	07:51 (WEA ZB04_vpd)	06:16	06:05	05:07	04:41
	16:23	26 09:17 (WEA ZB06_vpd)	17:20	22 08:13 (WEA ZB04_vpd)	18:11	20:05	20:56	21:30	
18	08:06	08:52 (WEA ZB06_vpd)	07:17	06:14	07:51 (WEA ZB04_vpd)	06:14	06:02	05:06	04:41
	16:24	26 09:18 (WEA ZB06_vpd)	17:22	22 08:13 (WEA ZB04_vpd)	18:13	20:07	20:57	21:30	
19	08:05	08:52 (WEA ZB06_vpd)	07:15	06:12	07:51 (WEA ZB04_vpd)	06:12	06:00	05:04	04:41
	16:26	26 09:18 (WEA ZB06_vpd)	17:23	22 08:13 (WEA ZB04_vpd)	18:14	20:09	20:59	21:30	
20	08:04	08:52 (WEA ZB06_vpd)	07:12	06:09	07:52 (WEA ZB04_vpd)	06:09	05:58	05:03	04:41
	16:28	26 09:18 (WEA ZB06_vpd)	17:25	20 08:12 (WEA ZB04_vpd)	18:16	20:10	21:00	21:31	
21	08:03	08:52 (WEA ZB06_vpd)	07:10	06:07	07:52 (WEA ZB04_vpd)	06:07	05:56	05:01	04:41
	16:29	26 09:18 (WEA ZB06_vpd)	17:27	20 08:12 (WEA ZB04_vpd)	18:18	20:12	21:02	21:31	
22	08:02	08:53 (WEA ZB06_vpd)	07:08	06:05	07:52 (WEA ZB04_vpd)	06:05	05:54	05:00	04:41
	16:31	25 09:18 (WEA ZB06_vpd)	17:29	18 08:10 (WEA ZB04_vpd)	18:20	20:14	21:03	21:31	
23	08:00	08:53 (WEA ZB06_vpd)	07:06	06:02	07:54 (WEA ZB04_vpd)	06:02	05:52	04:59	04:42
	16:33	25 09:18 (WEA ZB06_vpd)	17:31	15 08:09 (WEA ZB04_vpd)	18:22	20:16	21:05	21:31	
24	07:59	08:54 (WEA ZB06_vpd)	07:04	06:00	07:56 (WEA ZB04_vpd)	06:00	05:50	04:57	04:42
	16:35	24 09:18 (WEA ZB06_vpd)	17:33	11 08:07 (WEA ZB04_vpd)	18:23	20:17	21:06	21:31	
25	07:58	08:55 (WEA ZB06_vpd)	07:02	05:58	07:57 (WEA ZB04_vpd)	05:58	05:47	04:56	04:42
	16:36	23 09:18 (WEA ZB06_vpd)	17:35	18:25	18:25	20:19	21:08	21:32	
26	07:56	08:56 (WEA ZB06_vpd)	07:00	05:55	07:58 (WEA ZB04_vpd)	05:55	05:45	04:55	04:43
	16:38	22 09:18 (WEA ZB06_vpd)	17:37	18:27	18:27	20:21	21:09	21:32	
27	07:55	08:56 (WEA ZB06_vpd)	06:58	05:53	07:59 (WEA ZB04_vpd)	05:53	05:43	04:54	04:43
	16:40	20 09:16 (WEA ZB06_vpd)	17:38	18:29	18:29	20:23	21:10	21:31	
28	07:54	08:58 (WEA ZB06_vpd)	06:55	05:51	07:19 (WEA ZB02_vpd)	05:51	05:41	04:53	04:44
	16:42	18 09:16 (WEA ZB06_vpd)	17:40	4 07:23 (WEA ZB02_vpd)	18:30	20:24	21:12	21:31	
29	07:52	08:59 (WEA ZB06_vpd)	07:40	06:48	07:20 (WEA ZB02_vpd)	06:48	05:39	04:52	04:44
	16:44	16 09:15 (WEA ZB06_vpd)	17:40	19:32	19:32	20:26	21:13	21:31	
30	07:51	09:02 (WEA ZB06_vpd)	07:39	06:46	07:21 (WEA ZB02_vpd)	06:46	05:37	04:51	04:45
	16:46	12 09:14 (WEA ZB06_vpd)	17:40	19:34	19:34	20:28	21:14	21:31	
31	07:49	09:05 (WEA ZB06_vpd)	07:37	06:44	07:20 (WEA ZB02_vpd)	06:44	05:50	04:50	04:45
	16:47	5 09:10 (WEA ZB06_vpd)	17:40	19:36	19:36	20:30	21:15	21:31	
Sonnenscheinstunden	256								
astr.max.mögl.Beschattung	645	276	268	367	160	417	488	502	

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

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- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	July	August	September	Oktober	November	Dezember
1	04:45	05:23	06:14	07:04	06:59	07:29 (WEA ZB04_wpd) 07:51 08:33 (WEA ZB06_wpd)
	21:31	20:58	19:55	18:44	16:37	5 07:34 (WEA ZB04_wpd) 15:55 23 08:56 (WEA ZB06_wpd)
2	04:46	05:24	06:16	07:06	07:55 (WEA ZB02_wpd) 07:01	07:53 08:34 (WEA ZB06_wpd)
	21:30	20:56	19:52	18:42	3 07:58 (WEA ZB02_wpd) 16:35	15:54 22 08:56 (WEA ZB06_wpd)
3	04:47	05:26	06:17	07:07	07:51 (WEA ZB02_wpd) 07:03	07:54 08:34 (WEA ZB06_wpd)
	21:30	20:55	19:50	18:39	10 08:01 (WEA ZB02_wpd) 16:33	15:54 21 08:55 (WEA ZB06_wpd)
4	04:48	05:28	06:19	07:09	07:49 (WEA ZB02_wpd) 07:05	07:55 08:35 (WEA ZB06_wpd)
	21:30	20:53	19:48	18:37	14 08:03 (WEA ZB02_wpd) 16:31	15:53 21 08:56 (WEA ZB06_wpd)
5	04:48	05:29	06:21	07:11	07:48 (WEA ZB02_wpd) 07:06	07:57 08:36 (WEA ZB06_wpd)
	21:29	20:51	19:45	18:35	16 08:04 (WEA ZB02_wpd) 16:29	15:53 19 08:55 (WEA ZB06_wpd)
6	04:49	05:31	06:22	07:13	07:46 (WEA ZB02_wpd) 07:08	07:58 08:36 (WEA ZB06_wpd)
	21:28	20:49	19:43	18:32	18 08:04 (WEA ZB02_wpd) 16:27	15:52 19 08:55 (WEA ZB06_wpd)
7	04:50	05:32	06:24	07:14	07:46 (WEA ZB02_wpd) 07:10	07:59 08:38 (WEA ZB06_wpd)
	21:28	20:47	19:41	18:30	18 08:04 (WEA ZB02_wpd) 16:26	15:52 17 08:55 (WEA ZB06_wpd)
8	04:51	05:34	06:26	07:16	07:46 (WEA ZB02_wpd) 07:12	08:01 08:38 (WEA ZB06_wpd)
	21:27	20:45	19:38	18:28	18 08:04 (WEA ZB02_wpd) 16:24	15:51 17 08:55 (WEA ZB06_wpd)
9	04:52	05:36	06:27	07:18	07:46 (WEA ZB02_wpd) 07:14	08:02 08:39 (WEA ZB06_wpd)
	21:27	20:44	19:36	18:25	18 08:04 (WEA ZB02_wpd) 16:22	15:51 16 08:55 (WEA ZB06_wpd)
10	04:53	05:37	06:29	07:20	07:45 (WEA ZB02_wpd) 07:16	08:03 08:41 (WEA ZB06_wpd)
	21:26	20:42	19:34	18:23	17 08:02 (WEA ZB02_wpd) 16:21	15:51 14 08:55 (WEA ZB06_wpd)
11	04:54	05:39	06:30	07:21	07:47 (WEA ZB02_wpd) 07:17	5 08:36 (WEA ZB06_wpd) 08:04 08:42 (WEA ZB06_wpd)
	21:25	20:40	19:31	18:21	15 08:02 (WEA ZB02_wpd) 16:19	15:51 13 08:55 (WEA ZB06_wpd)
12	04:55	05:41	06:32	07:23	07:49 (WEA ZB02_wpd) 07:19	08:33 (WEA ZB06_wpd) 08:05 08:43 (WEA ZB06_wpd)
	21:24	20:38	19:29	18:19	11 08:00 (WEA ZB02_wpd) 16:17	12 08:45 (WEA ZB06_wpd) 15:51 12 08:55 (WEA ZB06_wpd)
13	04:56	05:42	06:34	07:25	07:51 (WEA ZB02_wpd) 07:21	08:31 (WEA ZB06_wpd) 08:06 08:44 (WEA ZB06_wpd)
	21:23	20:36	19:27	18:16	7 07:58 (WEA ZB02_wpd) 16:16	16 08:47 (WEA ZB06_wpd) 15:50 10 08:54 (WEA ZB06_wpd)
14	04:58	05:44	06:35	07:27	07:23	08:30 (WEA ZB06_wpd) 08:07 08:45 (WEA ZB06_wpd)
	21:22	20:34	19:24	18:14	18 08:48 (WEA ZB06_wpd) 16:14	18 08:48 (WEA ZB06_wpd) 15:50 9 08:54 (WEA ZB06_wpd)
15	04:59	05:46	06:37	07:28	07:25	20 08:29 (WEA ZB06_wpd) 08:08 08:46 (WEA ZB06_wpd)
	21:21	20:32	19:22	18:12	20 08:49 (WEA ZB06_wpd) 16:13	20 08:29 (WEA ZB06_wpd) 15:50 8 08:54 (WEA ZB06_wpd)
16	05:00	05:47	06:39	07:30	07:26	21 08:50 (WEA ZB06_wpd) 15:51 6 08:54 (WEA ZB06_wpd)
	21:20	20:30	19:20	18:10	16:11	21 08:50 (WEA ZB06_wpd) 15:51 6 08:54 (WEA ZB06_wpd)
17	05:01	05:49	06:40	07:32	08:30 (WEA ZB04_wpd) 07:28	08:28 (WEA ZB06_wpd) 08:10 08:48 (WEA ZB06_wpd)
	21:19	20:28	19:17	18:07	6 08:36 (WEA ZB04_wpd) 16:10	23 08:51 (WEA ZB06_wpd) 15:51 5 08:53 (WEA ZB06_wpd)
18	05:03	05:51	06:42	07:34	08:26 (WEA ZB04_wpd) 07:30	08:28 (WEA ZB06_wpd) 08:10 08:50 (WEA ZB06_wpd)
	21:18	20:25	19:15	18:05	13 08:39 (WEA ZB04_wpd) 16:09	24 08:52 (WEA ZB06_wpd) 15:51 2 08:52 (WEA ZB06_wpd)
19	05:04	05:52	06:44	07:35	08:25 (WEA ZB04_wpd) 07:32	08:28 (WEA ZB06_wpd) 08:11 08:51 (WEA ZB06_wpd)
	21:17	20:23	19:12	18:03	15 08:40 (WEA ZB04_wpd) 16:07	25 08:53 (WEA ZB06_wpd) 15:51 08:12 15:52
20	05:05	05:54	06:45	07:37	08:23 (WEA ZB04_wpd) 07:33	26 08:28 (WEA ZB06_wpd) 08:12 15:52
	21:16	20:21	19:10	18:01	19 08:42 (WEA ZB04_wpd) 16:06	26 08:54 (WEA ZB06_wpd) 08:12 15:52
21	05:07	05:55	06:47	07:39	08:23 (WEA ZB04_wpd) 07:35	26 08:28 (WEA ZB06_wpd) 08:12 15:52
	21:14	20:19	19:08	17:59	19 08:42 (WEA ZB04_wpd) 16:05	26 08:54 (WEA ZB06_wpd) 08:13 15:53
22	05:08	05:57	06:49	07:41	08:22 (WEA ZB04_wpd) 07:37	26 08:29 (WEA ZB06_wpd) 08:13 15:53
	21:13	20:17	19:05	17:57	21 08:43 (WEA ZB04_wpd) 16:04	26 08:55 (WEA ZB06_wpd) 08:14 15:53
23	05:09	05:59	06:50	07:43	08:22 (WEA ZB04_wpd) 07:38	26 08:29 (WEA ZB06_wpd) 08:14 15:53
	21:12	20:15	19:03	17:55	21 08:43 (WEA ZB04_wpd) 16:03	26 08:54 (WEA ZB06_wpd) 08:14 15:53
24	05:11	06:00	06:52	07:44	08:21 (WEA ZB04_wpd) 07:40	26 08:29 (WEA ZB06_wpd) 08:14 15:54
	21:10	20:13	19:01	17:53	22 08:43 (WEA ZB04_wpd) 16:01	26 08:55 (WEA ZB06_wpd) 08:14 15:54
25	05:12	06:02	06:54	06:46	07:21 (WEA ZB04_wpd) 07:42	26 08:29 (WEA ZB06_wpd) 08:14 15:54
	21:09	20:10	18:58	16:50	22 07:43 (WEA ZB04_wpd) 16:00	26 08:55 (WEA ZB06_wpd) 08:15 15:54
26	05:14	06:04	06:56	06:48	07:22 (WEA ZB04_wpd) 07:43	25 08:30 (WEA ZB06_wpd) 08:15 15:55
	21:07	20:08	18:56	16:48	21 07:43 (WEA ZB04_wpd) 15:59	25 08:55 (WEA ZB06_wpd) 08:15 15:55
27	05:15	06:06	06:57	06:50	07:21 (WEA ZB04_wpd) 07:45	25 08:30 (WEA ZB06_wpd) 08:15 15:56
	21:06	20:06	18:53	16:46	20 07:41 (WEA ZB04_wpd) 15:58	25 08:55 (WEA ZB06_wpd) 08:15 15:56
28	05:17	06:07	06:59	06:52	07:22 (WEA ZB04_wpd) 07:47	25 08:30 (WEA ZB06_wpd) 08:15 15:56
	21:04	20:04	18:51	16:44	19 07:41 (WEA ZB04_wpd) 15:58	25 08:55 (WEA ZB06_wpd) 08:15 15:56
29	05:18	06:09	07:01	06:54	07:22 (WEA ZB04_wpd) 07:48	25 08:31 (WEA ZB06_wpd) 08:15 15:57
	21:03	20:01	18:49	16:42	18 07:40 (WEA ZB04_wpd) 15:57	25 08:56 (WEA ZB06_wpd) 08:15 15:57
30	05:20	06:11	07:02	06:55	07:24 (WEA ZB04_wpd) 07:50	24 08:31 (WEA ZB06_wpd) 08:15 15:58
	21:01	19:59	18:46	16:40	15 07:39 (WEA ZB04_wpd) 15:56	24 08:55 (WEA ZB06_wpd) 08:15 15:58
31	05:21	06:12	07:03	06:57	07:25 (WEA ZB04_wpd) 15:56	11 08:15 09:03 (WEA ZB06_wpd)
	21:00	19:57	18:43	16:39	12 07:37 (WEA ZB04_wpd) 15:59	11 09:03 (WEA ZB06_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				428	449	300

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-41 - SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:01	08:52 (WEA ZB06_vpd)   07:48 09:10 (WEA ZB06_vpd)   16:49	06:53 17:42	07:17 (WEA ZB02_vpd)   06:41 07:30 (WEA ZB02_vpd)   19:37	05:35 20:29	04:49 21:16
2	08:15 16:02	08:52 (WEA ZB06_vpd)   07:46 09:11 (WEA ZB06_vpd)   16:51	06:51 17:44	07:15 (WEA ZB02_vpd)   06:39 07:31 (WEA ZB02_vpd)   19:39	05:33 20:31	04:48 21:18
3	08:15 16:03	08:53 (WEA ZB06_vpd)   07:44 09:12 (WEA ZB06_vpd)   16:53	06:49 17:46	07:13 (WEA ZB02_vpd)   06:37 07:31 (WEA ZB02_vpd)   19:41	05:31 20:33	04:47 21:19
4	08:15 16:04	08:52 (WEA ZB06_vpd)   07:43 09:13 (WEA ZB06_vpd)   16:55	06:46 17:48	07:13 (WEA ZB02_vpd)   06:34 07:31 (WEA ZB02_vpd)   19:43	05:29 20:35	04:46 21:20
5	08:15 16:05	08:53 (WEA ZB06_vpd)   07:41 09:14 (WEA ZB06_vpd)   16:57	06:44 17:49	07:13 (WEA ZB02_vpd)   06:32 07:32 (WEA ZB02_vpd)   19:44	05:28 20:36	04:46 21:21
6	08:14 16:06	08:53 (WEA ZB06_vpd)   07:39 09:15 (WEA ZB06_vpd)   16:59	06:42 17:51	07:12 (WEA ZB02_vpd)   06:30 07:30 (WEA ZB02_vpd)   19:46	05:26 20:38	04:45 21:22
7	08:14 16:08	08:53 (WEA ZB06_vpd)   07:38 09:15 (WEA ZB06_vpd)   17:01	06:40 17:53	07:13 (WEA ZB02_vpd)   06:27 07:30 (WEA ZB02_vpd)   19:48	05:24 20:40	04:44 21:23
8	08:13 16:09	08:53 (WEA ZB06_vpd)   07:36 09:16 (WEA ZB06_vpd)   17:03	06:37 17:55	07:14 (WEA ZB02_vpd)   06:25 07:29 (WEA ZB02_vpd)   19:50	05:22 20:41	04:44 21:24
9	08:13 16:10	08:54 (WEA ZB06_vpd)   07:34 09:17 (WEA ZB06_vpd)   17:04	06:35 17:57	07:15 (WEA ZB02_vpd)   06:23 07:27 (WEA ZB02_vpd)   19:51	05:20 20:43	04:43 21:24
10	08:12 16:12	08:53 (WEA ZB06_vpd)   07:32 09:18 (WEA ZB06_vpd)   17:06	06:33 17:58	07:17 (WEA ZB02_vpd)   06:20 07:24 (WEA ZB02_vpd)   19:53	05:18 20:45	04:43 21:25
11	08:12 16:13	08:53 (WEA ZB06_vpd)   07:30 09:18 (WEA ZB06_vpd)   17:08	06:30 18:00	07:17 (WEA ZB02_vpd)   06:18 07:24 (WEA ZB02_vpd)   19:55	05:17 20:46	04:42 21:26
12	08:11 16:15	08:53 (WEA ZB06_vpd)   07:28 09:19 (WEA ZB06_vpd)   17:10	06:28 18:02	07:17 (WEA ZB02_vpd)   06:16 07:24 (WEA ZB02_vpd)   19:57	05:15 20:48	04:42 21:27
13	08:10 16:16	08:54 (WEA ZB06_vpd)   07:26 09:19 (WEA ZB06_vpd)   17:12	06:26 18:04	07:17 (WEA ZB02_vpd)   06:14 07:24 (WEA ZB02_vpd)   19:58	05:13 20:50	04:42 21:27
14	08:10 16:18	08:54 (WEA ZB06_vpd)   07:25 09:19 (WEA ZB06_vpd)   17:14	06:23 18:06	07:17 (WEA ZB02_vpd)   06:11 07:24 (WEA ZB02_vpd)   19:59	05:12 20:51	04:41 21:28
15	08:09 16:19	08:54 (WEA ZB06_vpd)   07:23 09:20 (WEA ZB06_vpd)   17:16	06:21 18:07	07:17 (WEA ZB02_vpd)   06:09 07:24 (WEA ZB02_vpd)   20:00	05:10 20:53	04:41 21:29
16	08:08 16:21	08:54 (WEA ZB06_vpd)   07:21 09:20 (WEA ZB06_vpd)   17:18	06:19 18:09	07:17 (WEA ZB02_vpd)   06:07 07:24 (WEA ZB02_vpd)   20:03	05:09 20:54	04:41 21:29
17	08:07 16:23	08:55 (WEA ZB06_vpd)   07:19 09:21 (WEA ZB06_vpd)   17:20	06:16 18:11	07:17 (WEA ZB02_vpd)   06:05 07:24 (WEA ZB02_vpd)   20:05	05:07 20:56	04:41 21:30
18	08:06 16:24	08:55 (WEA ZB06_vpd)   07:17 09:21 (WEA ZB06_vpd)   17:22	06:14 18:13	07:17 (WEA ZB02_vpd)   06:02 07:24 (WEA ZB02_vpd)   20:07	05:06 20:57	04:41 21:30
19	08:05 16:26	08:55 (WEA ZB06_vpd)   07:15 09:22 (WEA ZB06_vpd)   17:23	06:12 18:14	07:17 (WEA ZB02_vpd)   06:00 07:24 (WEA ZB02_vpd)   20:09	05:04 20:59	04:41 21:30
20	08:04 16:28	08:56 (WEA ZB06_vpd)   07:12 09:21 (WEA ZB06_vpd)   17:25	06:09 18:16	07:17 (WEA ZB02_vpd)   05:58 07:24 (WEA ZB02_vpd)   20:10	05:03 21:00	04:41 21:31
21	08:03 16:29	08:57 (WEA ZB06_vpd)   07:10 09:21 (WEA ZB06_vpd)   17:27	06:07 18:18	07:17 (WEA ZB02_vpd)   05:56 07:24 (WEA ZB02_vpd)   20:12	05:01 21:02	04:41 21:31
22	08:02 16:31	08:58 (WEA ZB06_vpd)   07:08 09:22 (WEA ZB06_vpd)   17:29	06:05 18:20	07:17 (WEA ZB02_vpd)   05:54 07:24 (WEA ZB02_vpd)   20:14	05:00 21:03	04:41 21:31
23	08:00 16:33	08:58 (WEA ZB06_vpd)   07:06 09:21 (WEA ZB06_vpd)   17:31	06:02 18:22	07:17 (WEA ZB02_vpd)   05:52 07:24 (WEA ZB02_vpd)   20:16	04:59 21:05	04:42 21:31
24	07:59 16:35	08:59 (WEA ZB06_vpd)   07:04 09:21 (WEA ZB06_vpd)   17:33	06:00 18:23	07:17 (WEA ZB02_vpd)   05:50 07:24 (WEA ZB02_vpd)   20:17	04:57 21:06	04:42 21:31
25	07:58 16:36	09:01 (WEA ZB06_vpd)   07:02 09:21 (WEA ZB06_vpd)   17:35	05:58 18:25	07:17 (WEA ZB02_vpd)   05:47 07:24 (WEA ZB02_vpd)   20:19	04:56 21:08	04:42 21:32
26	07:56 16:38	09:01 (WEA ZB06_vpd)   07:00 09:20 (WEA ZB06_vpd)   17:37	05:55 18:27	07:17 (WEA ZB02_vpd)   05:45 07:24 (WEA ZB02_vpd)   20:21	04:55 21:09	04:43 21:32
27	07:55 16:40	09:02 (WEA ZB06_vpd)   06:58 09:18 (WEA ZB06_vpd)   17:38	05:53 18:29	07:17 (WEA ZB02_vpd)   05:43 07:24 (WEA ZB02_vpd)   20:23	04:54 21:10	04:43 21:31
28	07:54 16:42	09:05 (WEA ZB06_vpd)   06:55 09:17 (WEA ZB06_vpd)   17:40	05:51 18:30	07:17 (WEA ZB02_vpd)   05:41 07:24 (WEA ZB02_vpd)   20:24	04:53 21:12	04:44 21:31
29	07:52 16:44	09:08 (WEA ZB06_vpd)   06:48 09:14 (WEA ZB06_vpd)   17:42	05:48 18:32	07:17 (WEA ZB02_vpd)   05:39 07:24 (WEA ZB02_vpd)   20:26	04:52 21:13	04:44 21:31
30	07:51 16:46	09:11 (WEA ZB06_vpd)   06:46 09:17 (WEA ZB06_vpd)   17:44	05:46 18:34	07:17 (WEA ZB02_vpd)   05:37 07:24 (WEA ZB02_vpd)   20:28	04:51 21:14	04:45 21:31
31	07:49 16:47	09:14 (WEA ZB06_vpd)   06:44 09:19 (WEA ZB06_vpd)   17:46	05:44 18:36	07:17 (WEA ZB02_vpd)   05:35 07:24 (WEA ZB02_vpd)   20:30	04:50 21:15	04:45 21:31
	Sonnenscheinstunden astr.max.mögl.Beschattung	256 635	276 283	367 153	417 488	502 502

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-41 - SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:27 (WEA ZB04_wpd) 07:51 08:35 (WEA ZB06_wpd)
	21:31	20:58	19:55	18:44	16:37	14 07:41 (WEA ZB04_wpd) 15:55 25 09:00 (WEA ZB06_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:29 (WEA ZB04_wpd) 07:53 08:36 (WEA ZB06_wpd)
	21:30	20:56	19:52	18:42	16:35	10 07:39 (WEA ZB04_wpd) 15:54 25 09:01 (WEA ZB06_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:54 08:37 (WEA ZB06_wpd)
	21:30	20:55	19:50	18:39	16:33	21 09:00 (WEA ZB06_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:55 23 08:38 (WEA ZB06_wpd)
	21:30	20:53	19:48	18:37	16:31	10 08:04 (WEA ZB02_wpd) 16:31 23 09:01 (WEA ZB06_wpd)
5	04:48	05:29	06:21	07:11	07:06	07:57 23 08:38 (WEA ZB06_wpd)
	21:29	20:51	19:45	18:35	16:29	13 08:05 (WEA ZB02_wpd) 16:29 23 09:01 (WEA ZB06_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:58 23 08:38 (WEA ZB06_wpd)
	21:28	20:49	19:43	18:32	16:27	16 08:05 (WEA ZB02_wpd) 16:27 22 09:00 (WEA ZB06_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:59 23 08:40 (WEA ZB06_wpd)
	21:28	20:47	19:41	18:30	16:26	17 08:06 (WEA ZB02_wpd) 16:26 21 09:01 (WEA ZB06_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:58 23 08:40 (WEA ZB06_wpd)
	21:27	20:45	19:38	18:28	16:24	18 08:06 (WEA ZB02_wpd) 16:24 21 09:01 (WEA ZB06_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:59 23 08:41 (WEA ZB06_wpd)
	21:27	20:44	19:36	18:25	16:22	19 08:07 (WEA ZB02_wpd) 16:22 20 09:01 (WEA ZB06_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:59 23 08:42 (WEA ZB06_wpd)
	21:26	20:42	19:34	18:23	16:21	18 08:05 (WEA ZB02_wpd) 16:21 19 09:01 (WEA ZB06_wpd)
11	04:54	05:39	06:30	07:21	07:17	07:59 23 08:43 (WEA ZB06_wpd)
	21:25	20:40	19:31	18:21	16:19	18 08:05 (WEA ZB02_wpd) 16:19 18 09:01 (WEA ZB06_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:59 23 08:44 (WEA ZB06_wpd)
	21:24	20:38	19:29	18:19	16:17	15 08:04 (WEA ZB02_wpd) 16:17 17 09:01 (WEA ZB06_wpd)
13	04:56	05:42	06:34	07:25	07:21	07:59 23 08:44 (WEA ZB06_wpd)
	21:23	20:36	19:27	18:16	16:16	12 08:03 (WEA ZB02_wpd) 16:16 17 09:01 (WEA ZB06_wpd)
14	04:58	05:44	06:35	07:27	07:23	07:59 23 08:45 (WEA ZB06_wpd)
	21:22	20:34	19:24	18:14	16:14	8 08:01 (WEA ZB02_wpd) 16:14 12 08:49 (WEA ZB06_wpd)
15	04:59	05:46	06:37	07:28	07:25	07:59 23 08:46 (WEA ZB06_wpd)
	21:21	20:32	19:22	18:12	16:13	16 08:51 (WEA ZB06_wpd) 15:50 16 09:02 (WEA ZB06_wpd)
16	05:00	05:47	06:39	07:30	07:26	07:59 23 08:47 (WEA ZB06_wpd)
	21:20	20:30	19:20	18:10	16:11	19 08:53 (WEA ZB06_wpd) 15:51 15 09:02 (WEA ZB06_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:34 (WEA ZB06_wpd) 08:10 15 09:02 (WEA ZB06_wpd)
	21:19	20:28	19:17	18:07	16:10	20 08:54 (WEA ZB06_wpd) 15:51 15 09:02 (WEA ZB06_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:33 (WEA ZB06_wpd) 08:10 14 09:02 (WEA ZB06_wpd)
	21:18	20:25	19:15	18:05	16:09	22 08:55 (WEA ZB06_wpd) 15:51 14 09:02 (WEA ZB06_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:33 (WEA ZB06_wpd) 08:11 14 09:02 (WEA ZB06_wpd)
	21:17	20:23	19:12	18:03	16:07	23 08:56 (WEA ZB06_wpd) 15:51 14 09:03 (WEA ZB06_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:33 (WEA ZB06_wpd) 08:12 14 09:03 (WEA ZB06_wpd)
	21:16	20:21	19:10	18:01	16:06	24 08:57 (WEA ZB06_wpd) 15:52 13 09:02 (WEA ZB06_wpd)
21	05:07	05:55	06:47	07:39	07:35	08:33 (WEA ZB06_wpd) 08:12 13 09:02 (WEA ZB06_wpd)
	21:14	20:19	19:08	17:59	16:05	24 08:57 (WEA ZB06_wpd) 15:52 13 09:03 (WEA ZB06_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:33 (WEA ZB06_wpd) 08:13 13 09:03 (WEA ZB06_wpd)
	21:13	20:17	19:05	17:57	16:04	25 08:58 (WEA ZB06_wpd) 15:53 13 09:03 (WEA ZB06_wpd)
23	05:09	05:59	06:50	07:43	07:38	08:32 (WEA ZB06_wpd) 08:14 13 09:04 (WEA ZB06_wpd)
	21:12	20:15	19:03	17:55	16:03	26 08:58 (WEA ZB06_wpd) 15:53 13 09:04 (WEA ZB06_wpd)
24	05:11	06:00	06:52	07:44	07:40	08:33 (WEA ZB06_wpd) 08:14 14 09:05 (WEA ZB06_wpd)
	21:10	20:13	19:01	17:53	16:01	25 08:58 (WEA ZB06_wpd) 15:54 14 09:05 (WEA ZB06_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:33 (WEA ZB06_wpd) 08:14 14 09:05 (WEA ZB06_wpd)
	21:09	20:10	18:58	16:50	16:00	26 08:59 (WEA ZB06_wpd) 15:54 14 09:05 (WEA ZB06_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:33 (WEA ZB06_wpd) 08:15 14 09:06 (WEA ZB06_wpd)
	21:07	20:08	18:56	16:48	15:59	26 08:59 (WEA ZB06_wpd) 15:55 14 09:06 (WEA ZB06_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:33 (WEA ZB06_wpd) 08:15 15 09:07 (WEA ZB06_wpd)
	21:06	20:06	18:53	16:46	15:58	26 08:59 (WEA ZB06_wpd) 15:56 15 09:07 (WEA ZB06_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:34 (WEA ZB06_wpd) 08:15 15 09:08 (WEA ZB06_wpd)
	21:04	20:04	18:51	16:44	15:58	26 09:00 (WEA ZB06_wpd) 15:56 16 09:08 (WEA ZB06_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:35 (WEA ZB06_wpd) 08:15 16 09:08 (WEA ZB06_wpd)
	21:03	20:01	18:49	16:42	15:57	25 09:00 (WEA ZB06_wpd) 15:57 16 09:08 (WEA ZB06_wpd)
30	05:20	06:11	07:02	07:56	07:50	08:34 (WEA ZB06_wpd) 08:15 17 09:09 (WEA ZB06_wpd)
	21:01	19:59	18:46	16:40	15:56	26 09:00 (WEA ZB06_wpd) 15:58 17 09:09 (WEA ZB06_wpd)
31	05:21	06:12	7:03	07:57	7:51	08:35 (WEA ZB06_wpd) 08:15 17 09:10 (WEA ZB06_wpd)
	21:00	19:57	18:43	16:39	15:59	17 09:10 (WEA ZB06_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				413	422	540

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-42 - SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:51 (WEA ZB07_vpd)	07:48	08:14 (WEA ZB06_vpd)	06:53	07:23 (WEA ZB04_vpd)	06:41	05:35	04:49
	16:01	20 09:11 (WEA ZB07_vpd)	16:49	17 08:31 (WEA ZB06_vpd)	17:42	18 07:41 (WEA ZB04_vpd)	19:37	20:29	21:16
2	08:15	08:51 (WEA ZB07_vpd)	07:46	08:14 (WEA ZB06_vpd)	06:51	07:23 (WEA ZB04_vpd)	06:39	05:33	04:48
	16:02	21 09:12 (WEA ZB07_vpd)	16:51	18 08:32 (WEA ZB06_vpd)	17:44	18 07:41 (WEA ZB04_vpd)	19:39	20:31	21:18
3	08:15	08:52 (WEA ZB07_vpd)	07:44	08:14 (WEA ZB06_vpd)	06:49	07:23 (WEA ZB04_vpd)	06:37	05:31	04:47
	16:03	21 09:13 (WEA ZB07_vpd)	16:53	19 08:33 (WEA ZB06_vpd)	17:46	16 07:39 (WEA ZB04_vpd)	19:41	20:33	21:19
4	08:15	08:51 (WEA ZB07_vpd)	07:43	08:13 (WEA ZB06_vpd)	06:46	07:24 (WEA ZB04_vpd)	06:34	05:29	04:46
	16:04	22 09:13 (WEA ZB07_vpd)	16:55	21 08:34 (WEA ZB06_vpd)	17:48	14 07:38 (WEA ZB04_vpd)	19:43	20:35	21:20
5	08:15	08:52 (WEA ZB07_vpd)	07:41	08:12 (WEA ZB06_vpd)	06:44	07:26 (WEA ZB04_vpd)	06:32	05:28	04:46
	16:05	22 09:14 (WEA ZB07_vpd)	16:57	22 08:34 (WEA ZB06_vpd)	17:49	11 07:37 (WEA ZB04_vpd)	19:44	20:36	21:21
6	08:14	08:53 (WEA ZB07_vpd)	07:39	08:12 (WEA ZB06_vpd)	06:42	07:28 (WEA ZB04_vpd)	06:30	05:26	04:45
	16:06	22 09:15 (WEA ZB07_vpd)	16:59	22 08:34 (WEA ZB06_vpd)	17:51	4 07:32 (WEA ZB04_vpd)	19:46	20:38	21:22
7	08:14	08:53 (WEA ZB07_vpd)	07:38	08:12 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44
	16:08	22 09:15 (WEA ZB07_vpd)	17:01	22 08:34 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23
8	08:13	08:53 (WEA ZB07_vpd)	07:36	08:12 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44
	16:09	22 09:15 (WEA ZB07_vpd)	17:03	22 08:34 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24
9	08:13	08:54 (WEA ZB07_vpd)	07:34	08:13 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43
	16:10	22 09:16 (WEA ZB07_vpd)	17:04	22 08:35 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24
10	08:12	08:54 (WEA ZB07_vpd)	07:32	08:14 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43
	16:12	23 09:17 (WEA ZB07_vpd)	17:06	21 08:35 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25
11	08:12	08:54 (WEA ZB07_vpd)	07:30	08:14 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42
	16:13	23 09:17 (WEA ZB07_vpd)	17:08	20 08:34 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26
12	08:11	08:54 (WEA ZB07_vpd)	07:28	08:15 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42
	16:15	23 09:17 (WEA ZB07_vpd)	17:10	18 08:33 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27
13	08:10	08:55 (WEA ZB07_vpd)	07:26	08:16 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42
	16:16	22 09:17 (WEA ZB07_vpd)	17:12	16 08:32 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27
14	08:10	08:55 (WEA ZB07_vpd)	07:25	08:18 (WEA ZB06_vpd)	06:24		06:11	05:12	04:42
	16:18	22 09:17 (WEA ZB07_vpd)	17:14	12 08:30 (WEA ZB06_vpd)	18:06		20:00	20:51	21:28
15	08:09	08:56 (WEA ZB07_vpd)	07:23	08:20 (WEA ZB06_vpd)	06:21		06:09	05:10	04:41
	16:19	21 09:17 (WEA ZB07_vpd)	17:16	6 08:26 (WEA ZB06_vpd)	18:07		20:02	20:53	21:29
16	08:08	08:57 (WEA ZB07_vpd)	07:21	06:19			06:07	05:09	04:41
	16:21	21 09:18 (WEA ZB07_vpd)	17:18	18:09			20:03	20:54	21:29
17	08:07	08:57 (WEA ZB07_vpd)	07:19	06:17			06:05	05:07	04:41
	16:23	21 09:18 (WEA ZB07_vpd)	17:20	18:11			20:05	20:56	21:30
18	08:06	08:58 (WEA ZB07_vpd)	07:17	06:14			06:02	05:06	04:41
	16:24	20 09:18 (WEA ZB07_vpd)	17:22	18:13			20:07	20:57	21:30
19	08:05	09:00 (WEA ZB07_vpd)	07:15	06:12			06:00	05:04	04:41
	16:26	18 09:18 (WEA ZB07_vpd)	17:23	18:15			20:09	20:59	21:30
20	08:04	09:00 (WEA ZB07_vpd)	07:12	06:09			05:58	05:03	04:41
	16:28	16 09:16 (WEA ZB07_vpd)	17:25	18:16			20:10	21:00	21:31
21	08:03	09:01 (WEA ZB07_vpd)	07:10	06:07			05:56	05:01	04:41
	16:29	15 09:16 (WEA ZB07_vpd)	17:27	18:18			20:12	21:02	21:31
22	08:02	09:03 (WEA ZB07_vpd)	07:08	07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:42
	16:31	12 09:15 (WEA ZB07_vpd)	17:29	1 07:33 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31
23	08:00	09:05 (WEA ZB07_vpd)	07:06	07:30 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42
	16:33	8 09:13 (WEA ZB07_vpd)	17:31	7 07:37 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31
24	07:59		07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42
	16:35		17:33	11 07:39 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31
25	07:58		07:02	07:26 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42
	16:36		17:35	14 07:40 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32
26	07:56		07:00	07:24 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43
	16:38		17:37	17 07:41 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32
27	07:55		06:58	07:22 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43
	16:40		17:38	19 07:41 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31
28	07:54		06:55	07:22 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44
	16:42		17:40	19 07:41 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31
29	07:52				06:48		05:39	04:52	04:44
	16:44				19:32		20:26	21:13	21:31
30	07:51	08:18 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45
	16:46	10 08:28 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31
31	07:49	08:16 (WEA ZB06_vpd)			06:44			04:50	
	16:47	13 08:29 (WEA ZB06_vpd)			19:36			21:15	
Sonnenscheinstunden	256				367		417	488	502
astr.max.mögl.Beschattung	482	276	366		81				

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-42 - SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:42 (WEA ZB06_wpd) 07:51 08:36 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	21 08:03 (WEA ZB06_wpd) 15:55 23 08:59 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:42 (WEA ZB06_wpd) 07:53 08:37 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	22 08:04 (WEA ZB06_wpd) 15:54 23 09:00 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:42 (WEA ZB06_wpd) 07:54 08:37 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	22 08:04 (WEA ZB06_wpd) 15:54 22 08:59 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:42 (WEA ZB06_wpd) 07:55 08:38 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	22 08:04 (WEA ZB06_wpd) 15:53 22 09:00 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:42 (WEA ZB06_wpd) 07:57 08:38 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	22 08:04 (WEA ZB06_wpd) 15:53 22 09:00 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:42 (WEA ZB06_wpd) 07:58 08:38 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:04 (WEA ZB06_wpd) 15:52 22 09:00 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:43 (WEA ZB06_wpd) 07:59 08:39 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	20 08:03 (WEA ZB06_wpd) 15:52 22 09:01 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:43 (WEA ZB06_wpd) 08:01 08:39 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	20 08:03 (WEA ZB06_wpd) 15:51 22 09:01 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:44 (WEA ZB06_wpd) 08:02 08:40 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	18 08:02 (WEA ZB06_wpd) 15:51 21 09:01 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:45 (WEA ZB06_wpd) 08:03 08:41 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	16 08:01 (WEA ZB06_wpd) 15:51 21 09:02 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:47 (WEA ZB06_wpd) 08:04 08:42 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	13 08:00 (WEA ZB06_wpd) 15:51 20 09:02 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:49 (WEA ZB06_wpd) 08:05 08:42 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	9 07:58 (WEA ZB06_wpd) 15:51 20 09:02 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	08:06 08:43 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	18 08:14 (WEA ZB04_wpd) 15:50 20 09:03 (WEA ZB07_wpd)
14	04:58	05:44	06:36	07:27	07:23	08:07 08:43 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	18 08:14 (WEA ZB04_wpd) 15:50 20 09:03 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	08:08 08:44 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	18 08:14 (WEA ZB04_wpd) 15:51 19 09:03 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:09 08:45 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	16 08:12 (WEA ZB04_wpd) 15:51 19 09:04 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:10 08:44 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	13 08:11 (WEA ZB04_wpd) 15:51 19 09:03 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:11 08:45 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	10 08:10 (WEA ZB04_wpd) 15:51 19 09:04 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:12 (WEA ZB04_wpd) 08:11 08:46 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	8 08:48 (WEA ZB07_wpd) 15:51 19 09:05 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:38 (WEA ZB07_wpd) 08:12 08:46 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	12 08:50 (WEA ZB07_wpd) 15:52 18 09:04 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:37 (WEA ZB07_wpd) 08:12 08:47 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15 08:52 (WEA ZB07_wpd) 15:52 18 09:05 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:37 (WEA ZB07_wpd) 08:13 08:47 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	16 08:53 (WEA ZB07_wpd) 15:53 18 09:05 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:36 (WEA ZB07_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	18 08:54 (WEA ZB07_wpd) 15:53 18 09:06 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:35 (WEA ZB07_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	20 08:55 (WEA ZB07_wpd) 15:54 19 09:07 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:36 (WEA ZB07_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	20 08:56 (WEA ZB07_wpd) 15:54 19 09:07 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:36 (WEA ZB07_wpd) 08:15 08:49 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	21 08:57 (WEA ZB07_wpd) 15:55 19 09:08 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:35 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	22 08:57 (WEA ZB07_wpd) 15:56 19 09:09 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:35 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	22 08:57 (WEA ZB07_wpd) 15:57 19 09:09 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:36 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	22 08:58 (WEA ZB07_wpd) 15:57 20 09:10 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56	07:50	08:36 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	22 08:58 (WEA ZB07_wpd) 15:58 19 09:10 (WEA ZB07_wpd)
31	05:21	06:12	7:03	07:57	07:43	08:35 (WEA ZB06_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	20 08:03 (WEA ZB06_wpd) 15:59 20 09:11 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				245	445	621

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-43 - SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:53 (WEA ZB07_vpd)	07:48	08:16 (WEA ZB06_vpd)	06:53	07:26 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	21 09:14 (WEA ZB07_vpd)	16:49	19 08:35 (WEA ZB06_vpd)	17:42	17 07:43 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	08:53 (WEA ZB07_vpd)	07:46	08:16 (WEA ZB06_vpd)	06:51	07:27 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	22 09:15 (WEA ZB07_vpd)	16:51	21 08:37 (WEA ZB06_vpd)	17:44	15 07:42 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	08:54 (WEA ZB07_vpd)	07:44	08:16 (WEA ZB06_vpd)	06:49	07:27 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	22 09:16 (WEA ZB07_vpd)	16:53	21 08:37 (WEA ZB06_vpd)	17:46	13 07:40 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	08:54 (WEA ZB07_vpd)	07:43	08:15 (WEA ZB06_vpd)	06:46	07:29 (WEA ZB04_vpd)	06:34	05:29	04:46		
	16:04	22 09:16 (WEA ZB07_vpd)	16:55	22 08:37 (WEA ZB06_vpd)	17:48	10 07:39 (WEA ZB04_vpd)	19:43	20:35	21:20		
5	08:15	08:55 (WEA ZB07_vpd)	07:41	08:15 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	22 09:17 (WEA ZB07_vpd)	16:57	22 08:37 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	08:56 (WEA ZB07_vpd)	07:39	08:15 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	22 09:18 (WEA ZB07_vpd)	16:59	22 08:37 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	08:56 (WEA ZB07_vpd)	07:38	08:15 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	22 09:18 (WEA ZB07_vpd)	17:01	22 08:37 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	08:56 (WEA ZB07_vpd)	07:36	08:16 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	22 09:18 (WEA ZB07_vpd)	17:03	21 08:37 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	08:57 (WEA ZB07_vpd)	07:34	08:17 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	22 09:19 (WEA ZB07_vpd)	17:04	20 08:37 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	08:57 (WEA ZB07_vpd)	07:32	08:18 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	22 09:19 (WEA ZB07_vpd)	17:06	19 08:37 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	08:57 (WEA ZB07_vpd)	07:30	08:19 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42		
	16:13	22 09:19 (WEA ZB07_vpd)	17:08	17 08:36 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26		
12	08:11	08:58 (WEA ZB07_vpd)	07:28	08:20 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42		
	16:15	21 09:19 (WEA ZB07_vpd)	17:10	14 08:34 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27		
13	08:10	08:58 (WEA ZB07_vpd)	07:26	08:22 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42		
	16:16	21 09:19 (WEA ZB07_vpd)	17:12	10 08:32 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27		
14	08:10	08:59 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	21 09:20 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	08:59 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	21 09:20 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:00 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	20 09:20 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07	09:01 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41		
	16:23	18 09:19 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30		
18	08:06	09:03 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41		
	16:24	16 09:19 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30		
19	08:05	09:04 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41		
	16:26	15 09:19 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30		
20	08:04	09:05 (WEA ZB07_vpd)	07:12		06:09		05:58	05:03	04:41		
	16:28	12 09:17 (WEA ZB07_vpd)	17:25		18:16		20:10	21:00	21:31		
21	08:03	09:07 (WEA ZB07_vpd)	07:10		06:07		05:56	05:01	04:41		
	16:29	9 09:16 (WEA ZB07_vpd)	17:27	4	07:35 (WEA ZB04_vpd)	18:18	20:12	21:02	21:31		
22	08:02	09:12 (WEA ZB07_vpd)	07:08		06:05		05:54	05:00	04:42		
	16:31	1 09:13 (WEA ZB07_vpd)	17:29	8	07:40 (WEA ZB04_vpd)	18:20	20:14	21:03	21:31		
23	08:00		07:06		06:02		05:52	04:59	04:42		
	16:33		17:31	12	07:42 (WEA ZB04_vpd)	18:22	20:16	21:05	21:31		
24	07:59		07:04		06:00		05:50	04:57	04:42		
	16:35		17:33	15	07:43 (WEA ZB04_vpd)	18:23	20:17	21:06	21:31		
25	07:58		07:02		05:58		05:47	04:56	04:42		
	16:36		17:35	18	07:44 (WEA ZB04_vpd)	18:25	20:19	21:08	21:32		
26	07:56		07:00		05:55		05:45	04:55	04:43		
	16:38		17:37	18	07:44 (WEA ZB04_vpd)	18:27	20:21	21:09	21:32		
27	07:55		06:58		05:53		05:43	04:54	04:43		
	16:40		17:38	18	07:43 (WEA ZB04_vpd)	18:29	20:23	21:10	21:31		
28	07:54	08:21 (WEA ZB06_vpd)	06:55		05:51		05:41	04:53	04:44		
	16:42	8 08:29 (WEA ZB06_vpd)	17:40	18	07:43 (WEA ZB04_vpd)	18:30	20:24	21:12	21:31		
29	07:52	08:19 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	12 08:31 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:18 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	16 08:34 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:17 (WEA ZB06_vpd)			06:44			04:50			
	16:47	17 08:34 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	469		361		55						

**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) Schatteneende	Schattenanfang (WEA mit erstem Schatten)	Schatteneende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-43 - SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:46 (WEA ZB06_wpd) 07:51 08:39 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	19 08:05 (WEA ZB06_wpd) 15:55 22 09:01 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:46 (WEA ZB06_wpd) 07:53 08:40 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	20 08:06 (WEA ZB06_wpd) 15:54 22 09:02 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:45 (WEA ZB06_wpd) 07:54 08:40 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	22 08:07 (WEA ZB06_wpd) 15:54 22 09:02 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:45 (WEA ZB06_wpd) 07:55 08:41 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	22 08:07 (WEA ZB06_wpd) 15:53 22 09:03 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:45 (WEA ZB06_wpd) 07:57 08:41 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	22 08:07 (WEA ZB06_wpd) 15:53 22 09:03 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:45 (WEA ZB06_wpd) 07:58 08:41 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:07 (WEA ZB06_wpd) 15:52 22 09:03 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:45 (WEA ZB06_wpd) 07:59 08:42 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	22 08:07 (WEA ZB06_wpd) 15:52 22 09:04 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:46 (WEA ZB06_wpd) 08:01 08:42 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	21 08:07 (WEA ZB06_wpd) 15:51 22 09:04 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:46 (WEA ZB06_wpd) 08:02 08:42 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	6 08:12 (WEA ZB04_wpd) 16:22 20 08:06 (WEA ZB06_wpd) 15:51 22 09:04 (WEA ZB07_wpd)	
10	04:53	05:37	06:29	07:20	08:02 (WEA ZB04_wpd) 07:16	07:47 (WEA ZB06_wpd) 08:03 08:44 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	12 08:14 (WEA ZB04_wpd) 16:21	19 08:06 (WEA ZB06_wpd) 15:51 21 09:05 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	08:00 (WEA ZB04_wpd) 07:17	07:48 (WEA ZB06_wpd) 08:04 08:44 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	15 08:15 (WEA ZB04_wpd) 16:19	17 08:05 (WEA ZB06_wpd) 15:51 22 09:06 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:59 (WEA ZB04_wpd) 07:19	07:49 (WEA ZB06_wpd) 08:05 08:44 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	17 08:16 (WEA ZB04_wpd) 16:17	15 08:04 (WEA ZB06_wpd) 15:51 22 09:06 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:59 (WEA ZB04_wpd) 07:21	07:51 (WEA ZB06_wpd) 08:06 08:45 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	17 08:16 (WEA ZB04_wpd) 16:16	12 08:03 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)
14	04:58	05:44	06:36	07:27	07:58 (WEA ZB04_wpd) 07:23	07:53 (WEA ZB06_wpd) 08:07 08:45 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	19 08:17 (WEA ZB04_wpd) 16:14	8 08:01 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:58 (WEA ZB04_wpd) 07:25	08:08 08:46 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	19 08:17 (WEA ZB04_wpd) 16:13	08:11 09:07 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:57 (WEA ZB04_wpd) 07:26	08:09 08:47 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	18 08:15 (WEA ZB04_wpd) 16:11	15:51 20 09:07 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 07:28	08:10 08:47 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	17 08:15 (WEA ZB04_wpd) 16:10	15:51 20 09:07 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:00 (WEA ZB04_wpd) 07:30	08:11 08:47 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	14 08:14 (WEA ZB04_wpd) 16:09	15:51 21 09:08 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:02 (WEA ZB04_wpd) 07:32	08:11 08:48 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	11 08:13 (WEA ZB04_wpd) 16:07	15:51 20 09:08 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:04 (WEA ZB04_wpd) 07:33	08:12 08:48 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	7 08:11 (WEA ZB04_wpd) 16:06	1 08:48 (WEA ZB07_wpd) 15:52 20 09:08 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	08:06 (WEA ZB04_wpd) 07:35	08:43 (WEA ZB07_wpd) 08:12 08:49 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	1 08:07 (WEA ZB04_wpd) 16:05	9 08:52 (WEA ZB07_wpd) 15:52 20 09:09 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:42 (WEA ZB07_wpd) 08:13 08:49 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	12 08:54 (WEA ZB07_wpd) 15:53 20 09:09 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:40 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	15 08:55 (WEA ZB07_wpd) 15:53 20 09:10 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:40 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	16 08:56 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:39 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	18 08:57 (WEA ZB07_wpd) 15:54 21 09:11 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:39 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	20 08:59 (WEA ZB07_wpd) 15:55 21 09:12 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	20 08:59 (WEA ZB07_wpd) 15:56 20 09:12 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	3 07:57 (WEA ZB06_wpd) 15:58 21 09:00 (WEA ZB07_wpd) 15:57 21 09:13 (WEA ZB07_wpd)	
29	05:18	06:09	07:01	07:54	07:50 (WEA ZB06_wpd) 07:48	08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	11 08:01 (WEA ZB06_wpd) 15:57 22 09:01 (WEA ZB07_wpd) 15:57 21 09:13 (WEA ZB07_wpd)	
30	05:20	06:11	07:02	07:55	07:48 (WEA ZB06_wpd) 07:50	08:39 (WEA ZB07_wpd) 08:15 08:53 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15 08:03 (WEA ZB06_wpd) 15:56 21 09:00 (WEA ZB07_wpd) 15:58 21 09:14 (WEA ZB07_wpd)	
31	05:21	06:12	07:03	07:56	07:47 (WEA ZB06_wpd) 07:49	08:39 (WEA ZB07_wpd) 08:15 08:53 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	18 08:05 (WEA ZB06_wpd) 15:59 22 09:15 (WEA ZB07_wpd)	
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				220	436	654

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-44 - SR-44, Rehweg 1, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	08:15	08:53 (WEA ZB07_vpd)	07:48	08:16 (WEA ZB06_vpd)	06:53	07:27 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	21 09:14 (WEA ZB07_vpd)	16:49	19 08:35 (WEA ZB06_vpd)	17:42	16 07:43 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	08:53 (WEA ZB07_vpd)	07:46	08:16 (WEA ZB06_vpd)	06:51	07:28 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	22 09:15 (WEA ZB07_vpd)	16:51	21 08:37 (WEA ZB06_vpd)	17:44	14 07:42 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	08:54 (WEA ZB07_vpd)	07:44	08:16 (WEA ZB06_vpd)	06:49	07:28 (WEA ZB04_vpd)	06:37	05:31	04:47		
	16:03	22 09:16 (WEA ZB07_vpd)	16:53	21 08:37 (WEA ZB06_vpd)	17:46	12 07:40 (WEA ZB04_vpd)	19:41	20:33	21:19		
4	08:15	08:54 (WEA ZB07_vpd)	07:43	08:16 (WEA ZB06_vpd)	06:46	07:31 (WEA ZB04_vpd)	06:34	05:29	04:46		
	16:04	21 09:15 (WEA ZB07_vpd)	16:55	21 08:37 (WEA ZB06_vpd)	17:48	6 07:37 (WEA ZB04_vpd)	19:43	20:35	21:20		
5	08:15	08:54 (WEA ZB07_vpd)	07:41	08:15 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	22 09:16 (WEA ZB07_vpd)	16:57	22 08:37 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	08:55 (WEA ZB07_vpd)	07:39	08:15 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	22 09:17 (WEA ZB07_vpd)	16:59	22 08:37 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	08:55 (WEA ZB07_vpd)	07:38	08:16 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	22 09:17 (WEA ZB07_vpd)	17:01	21 08:37 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	08:55 (WEA ZB07_vpd)	07:36	08:16 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	22 09:17 (WEA ZB07_vpd)	17:03	21 08:37 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	08:56 (WEA ZB07_vpd)	07:34	08:18 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	22 09:18 (WEA ZB07_vpd)	17:04	19 08:37 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	08:57 (WEA ZB07_vpd)	07:32	08:18 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	22 09:19 (WEA ZB07_vpd)	17:06	18 08:36 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	08:57 (WEA ZB07_vpd)	07:30	08:20 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42		
	16:13	22 09:19 (WEA ZB07_vpd)	17:08	15 08:35 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26		
12	08:11	08:57 (WEA ZB07_vpd)	07:28	08:21 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42		
	16:15	22 09:19 (WEA ZB07_vpd)	17:10	13 08:34 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27		
13	08:10	08:58 (WEA ZB07_vpd)	07:26	08:24 (WEA ZB06_vpd)	06:26		06:14	05:13	04:42		
	16:16	21 09:19 (WEA ZB07_vpd)	17:12	7 08:24 (WEA ZB06_vpd)	18:04		19:58	20:50	21:27		
14	08:10	08:58 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	21 09:19 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	08:59 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	20 09:19 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:00 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	19 09:19 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07	09:01 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41		
	16:23	18 09:19 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30		
18	08:06	09:02 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41		
	16:24	16 09:18 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30		
19	08:05	09:04 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41		
	16:26	14 09:18 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30		
20	08:04	09:05 (WEA ZB07_vpd)	07:12		06:09		05:58	05:03	04:41		
	16:28	11 09:16 (WEA ZB07_vpd)	17:25		18:16		20:10	21:00	21:31		
21	08:03	09:07 (WEA ZB07_vpd)	07:10	6 07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29	8 09:15 (WEA ZB07_vpd)	17:27		18:18		20:12	21:02	21:31		
22	08:02		07:08	10 07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:42		
	16:31		17:29	07:42 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00		07:06	07:30 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33		17:31	13 07:43 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59		07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35		17:33	16 07:44 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58		07:02	07:27 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36		17:35	18 07:45 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56		07:00	07:27 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38		17:37	18 07:45 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:24 (WEA ZB06_vpd)	06:58	07:26 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	3 08:27 (WEA ZB06_vpd)	17:38	18 07:44 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:21 (WEA ZB06_vpd)	06:55	18 07:26 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	9 08:30 (WEA ZB06_vpd)	17:40	18 07:44 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:19 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	13 08:32 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:18 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	16 08:34 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:17 (WEA ZB06_vpd)			06:44			04:50			
	16:47	18 08:35 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	469		357		48						

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-44 - SR-44, Rehweg 1, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:47 (WEA ZB06_wpd) 07:51 08:39 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	18 08:05 (WEA ZB06_wpd) 15:55 22 09:01 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:46 (WEA ZB06_wpd) 07:53 08:40 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	20 08:06 (WEA ZB06_wpd) 15:54 22 09:02 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:46 (WEA ZB06_wpd) 07:54 08:39 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	20 08:06 (WEA ZB06_wpd) 15:54 23 09:02 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:45 (WEA ZB06_wpd) 07:55 08:40 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	22 08:07 (WEA ZB06_wpd) 15:53 23 09:03 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:45 (WEA ZB06_wpd) 07:57 08:40 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	22 08:07 (WEA ZB06_wpd) 15:53 22 09:02 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:45 (WEA ZB06_wpd) 07:58 08:40 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:07 (WEA ZB06_wpd) 15:52 22 09:02 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:45 (WEA ZB06_wpd) 07:59 08:41 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	22 08:07 (WEA ZB06_wpd) 15:52 22 09:03 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:46 (WEA ZB06_wpd) 08:01 08:42 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	21 08:07 (WEA ZB06_wpd) 15:51 22 09:04 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:46 (WEA ZB06_wpd) 08:02 08:42 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	21 08:07 (WEA ZB06_wpd) 15:51 22 09:04 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:47 (WEA ZB06_wpd) 08:03 08:43 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	9 08:13 (WEA ZB04_wpd) 16:21 19 08:06 (WEA ZB06_wpd) 15:51 22 09:05 (WEA ZB07_wpd)	
11	04:54	05:39	06:31	07:21	08:02 (WEA ZB04_wpd) 07:17 07:48 (WEA ZB06_wpd) 08:04 08:44 (WEA ZB07_wpd)	
	21:25	20:40	19:31	18:21	16:19	18 08:06 (WEA ZB06_wpd) 15:51 21 09:05 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	08:00 (WEA ZB04_wpd) 07:19 07:49 (WEA ZB06_wpd) 08:05 08:44 (WEA ZB07_wpd)	
	21:24	20:38	19:29	18:19	16 08:16 (WEA ZB04_wpd) 16:17 16 08:05 (WEA ZB06_wpd) 15:51 21 09:05 (WEA ZB07_wpd)	
13	04:57	05:42	06:34	07:25	08:00 (WEA ZB04_wpd) 07:21 07:51 (WEA ZB06_wpd) 08:06 08:45 (WEA ZB07_wpd)	
	21:23	20:36	19:27	18:16	17 08:17 (WEA ZB04_wpd) 16:16 13 08:04 (WEA ZB06_wpd) 15:50 20 09:05 (WEA ZB07_wpd)	
14	04:58	05:44	06:36	07:27	07:59 (WEA ZB04_wpd) 07:23 07:53 (WEA ZB06_wpd) 08:07 08:45 (WEA ZB07_wpd)	
	21:22	20:34	19:24	18:14	18 08:17 (WEA ZB04_wpd) 16:14 9 08:02 (WEA ZB06_wpd) 15:50 21 09:06 (WEA ZB07_wpd)	
15	04:59	05:46	06:37	07:28	07:59 (WEA ZB04_wpd) 07:25 07:57 (WEA ZB06_wpd) 08:08 08:46 (WEA ZB07_wpd)	
	21:21	20:32	19:22	18:12	18 08:17 (WEA ZB04_wpd) 16:13 1 07:58 (WEA ZB06_wpd) 15:51 20 09:06 (WEA ZB07_wpd)	
16	05:00	05:47	06:39	07:30	07:58 (WEA ZB04_wpd) 07:26 07:58 (WEA ZB06_wpd) 08:09 08:46 (WEA ZB07_wpd)	
	21:20	20:30	19:20	18:10	18 08:16 (WEA ZB04_wpd) 16:11 15:51 21 09:07 (WEA ZB07_wpd)	
17	05:01	05:49	06:40	07:32	07:58 (WEA ZB04_wpd) 07:28 08:10 08:46 (WEA ZB07_wpd)	
	21:19	20:28	19:17	18:07	18 08:16 (WEA ZB04_wpd) 16:10 15:51 20 09:06 (WEA ZB07_wpd)	
18	05:03	05:51	06:42	07:34	08:00 (WEA ZB04_wpd) 07:30 08:11 08:47 (WEA ZB07_wpd)	
	21:18	20:26	19:15	18:05	15 08:15 (WEA ZB04_wpd) 16:09 15:51 20 09:07 (WEA ZB07_wpd)	
19	05:04	05:52	06:44	07:35	08:02 (WEA ZB04_wpd) 07:32 08:11 08:48 (WEA ZB07_wpd)	
	21:17	20:23	19:12	18:03	12 08:14 (WEA ZB04_wpd) 16:07 15:51 20 09:08 (WEA ZB07_wpd)	
20	05:05	05:54	06:45	07:37	08:04 (WEA ZB04_wpd) 07:33 08:12 08:48 (WEA ZB07_wpd)	
	21:16	20:21	19:10	18:01	9 08:13 (WEA ZB04_wpd) 16:06 15:52 20 09:08 (WEA ZB07_wpd)	
21	05:07	05:56	06:47	07:39	08:06 (WEA ZB04_wpd) 07:35 08:12 08:49 (WEA ZB07_wpd)	
	21:14	20:19	19:08	17:59	4 08:10 (WEA ZB04_wpd) 16:05 8 08:51 (WEA ZB07_wpd) 15:52 20 09:09 (WEA ZB07_wpd)	
22	05:08	05:57	06:49	07:41	07:37 08:42 (WEA ZB07_wpd) 08:13 08:49 (WEA ZB07_wpd)	
	21:13	20:17	19:05	17:57	16:04 11 08:53 (WEA ZB07_wpd) 15:53 19 09:08 (WEA ZB07_wpd)	
23	05:09	05:59	06:51	07:43	07:39 08:40 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)	
	21:12	20:15	19:03	17:55	16:03 14 08:54 (WEA ZB07_wpd) 15:53 20 09:10 (WEA ZB07_wpd)	
24	05:11	06:01	06:52	07:44	07:40 08:39 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)	
	21:10	20:13	19:01	17:53	16:01 16 08:55 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)	
25	05:12	06:02	06:54	06:46	07:42 08:39 (WEA ZB07_wpd) 08:14 08:50 (WEA ZB07_wpd)	
	21:09	20:10	18:58	16:50	16:00 18 08:57 (WEA ZB07_wpd) 15:54 20 09:10 (WEA ZB07_wpd)	
26	05:14	06:04	06:56	06:48	07:43 08:39 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)	
	21:07	20:08	18:56	16:48	15:59 19 08:58 (WEA ZB07_wpd) 15:55 20 09:11 (WEA ZB07_wpd)	
27	05:15	06:06	06:57	06:50	07:45 08:38 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)	
	21:06	20:06	18:53	16:46	15:58 20 08:58 (WEA ZB07_wpd) 15:56 21 09:12 (WEA ZB07_wpd)	
28	05:17	06:07	06:59	06:52	07:47 08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)	
	21:04	20:04	18:51	16:44	15:58 20 08:59 (WEA ZB07_wpd) 15:57 20 09:12 (WEA ZB07_wpd)	
29	05:18	06:09	07:01	06:54	07:48 08:39 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)	
	21:03	20:01	18:49	16:42	8 08:00 (WEA ZB06_wpd) 15:57 21 09:13 (WEA ZB07_wpd)	
30	05:20	06:11	07:02	06:55	07:49 (WEA ZB06_wpd) 07:50 08:38 (WEA ZB07_wpd) 08:15 08:52 (WEA ZB07_wpd)	
	21:01	19:59	18:46	16:40	14 08:03 (WEA ZB06_wpd) 15:56 22 09:00 (WEA ZB07_wpd) 15:58 21 09:13 (WEA ZB07_wpd)	
31	05:21	06:12	07:03	06:57	07:48 (WEA ZB06_wpd) 08:15 08:53 (WEA ZB07_wpd)	
	21:00	19:57	18:39	16:39	16 08:04 (WEA ZB06_wpd) 15:59 21 09:14 (WEA ZB07_wpd)	
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				205	433	649

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-45 - SR-45, Rehweg 2, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

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	08:15	08:51 (WEA ZB07_wpd)	07:48	08:15 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49
	16:01	21 09:12 (WEA ZB07_wpd)	16:49	19 08:34 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16
2	08:15	08:52 (WEA ZB07_wpd)	07:46	08:16 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48
	16:02	21 09:13 (WEA ZB07_wpd)	16:51	19 08:35 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18
3	08:15	08:52 (WEA ZB07_wpd)	07:44	08:15 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47
	16:03	22 09:14 (WEA ZB07_wpd)	16:53	21 08:36 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19
4	08:15	08:52 (WEA ZB07_wpd)	07:43	08:15 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46
	16:04	21 09:13 (WEA ZB07_wpd)	16:55	21 08:36 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20
5	08:15	08:53 (WEA ZB07_wpd)	07:41	08:15 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46
	16:05	21 09:14 (WEA ZB07_wpd)	16:57	21 08:36 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21
6	08:14	08:54 (WEA ZB07_wpd)	07:39	08:15 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45
	16:06	21 09:15 (WEA ZB07_wpd)	16:59	21 08:36 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22
7	08:14	08:54 (WEA ZB07_wpd)	07:38	08:15 (WEA ZB06_wpd)	06:40	06:27	05:24	04:44
	16:08	22 09:16 (WEA ZB07_wpd)	17:01	21 08:36 (WEA ZB06_wpd)	17:53	19:48	20:40	21:23
8	08:13	08:54 (WEA ZB07_wpd)	07:36	08:15 (WEA ZB06_wpd)	06:37	06:25	05:22	04:44
	16:09	22 09:16 (WEA ZB07_wpd)	17:03	21 08:36 (WEA ZB06_wpd)	17:55	19:50	20:41	21:24
9	08:13	08:55 (WEA ZB07_wpd)	07:34	08:17 (WEA ZB06_wpd)	06:35	06:23	05:20	04:43
	16:10	22 09:17 (WEA ZB07_wpd)	17:04	19 08:36 (WEA ZB06_wpd)	17:57	19:51	20:43	21:24
10	08:12	08:55 (WEA ZB07_wpd)	07:32	08:17 (WEA ZB06_wpd)	06:33	06:20	05:18	04:43
	16:12	22 09:17 (WEA ZB07_wpd)	17:06	18 08:35 (WEA ZB06_wpd)	17:58	19:53	20:45	21:25
11	08:12	08:55 (WEA ZB07_wpd)	07:30	08:18 (WEA ZB06_wpd)	06:30	06:18	05:17	04:42
	16:13	22 09:17 (WEA ZB07_wpd)	17:08	16 08:34 (WEA ZB06_wpd)	18:00	19:55	20:46	21:26
12	08:11	08:56 (WEA ZB07_wpd)	07:28	08:20 (WEA ZB06_wpd)	06:28	06:16	05:15	04:42
	16:15	21 09:17 (WEA ZB07_wpd)	17:10	13 08:33 (WEA ZB06_wpd)	18:02	19:57	20:48	21:27
13	08:10	08:56 (WEA ZB07_wpd)	07:26	08:23 (WEA ZB06_wpd)	06:26	06:14	05:13	04:42
	16:16	21 09:17 (WEA ZB07_wpd)	17:12	7 08:30 (WEA ZB06_wpd)	18:04	19:58	20:50	21:27
14	08:10	08:57 (WEA ZB07_wpd)	07:25	06:24	06:11	05:12	04:42	
	16:18	20 09:17 (WEA ZB07_wpd)	17:14	18:06	20:00	20:51	21:28	
15	08:09	08:57 (WEA ZB07_wpd)	07:23	06:21	06:09	05:10	04:41	
	16:19	20 09:17 (WEA ZB07_wpd)	17:16	18:07	20:02	20:53	21:29	
16	08:08	08:58 (WEA ZB07_wpd)	07:21	06:19	06:07	05:09	04:41	
	16:21	19 09:17 (WEA ZB07_wpd)	17:18	18:09	20:03	20:54	21:29	
17	08:07	08:59 (WEA ZB07_wpd)	07:19	06:17	06:05	05:07	04:41	
	16:23	18 09:17 (WEA ZB07_wpd)	17:20	18:11	20:05	20:56	21:30	
18	08:06	09:00 (WEA ZB07_wpd)	07:17	06:14	06:02	05:06	04:41	
	16:24	17 09:17 (WEA ZB07_wpd)	17:22	18:13	20:07	20:57	21:30	
19	08:05	09:02 (WEA ZB07_wpd)	07:15	06:12	06:00	05:04	04:41	
	16:26	15 09:17 (WEA ZB07_wpd)	17:23	18:15	20:09	20:59	21:30	
20	08:04	09:02 (WEA ZB07_wpd)	07:12	06:09	05:58	05:03	04:41	
	16:28	13 09:15 (WEA ZB07_wpd)	17:25	18:16	20:10	21:00	21:31	
21	08:03	09:05 (WEA ZB07_wpd)	07:10	06:07	05:56	05:01	04:41	
	16:29	9 09:14 (WEA ZB07_wpd)	17:27	18:18	20:12	21:02	21:31	
22	08:02	09:08 (WEA ZB07_wpd)	07:08	06:05	05:54	05:00	04:42	
	16:31	4 09:12 (WEA ZB07_wpd)	17:29	18:20	20:14	21:03	21:31	
23	08:00		07:06	06:02	05:52	04:59	04:42	
	16:33		17:31	18:22	20:16	21:05	21:31	
24	07:59		07:04	06:00	05:50	04:57	04:42	
	16:35		17:33	18:23	20:17	21:06	21:31	
25	07:58		07:02	05:58	05:47	04:56	04:42	
	16:36		17:35	18:25	20:19	21:08	21:32	
26	07:56		07:00	05:55	05:45	04:55	04:43	
	16:38		17:37	18:27	20:21	21:09	21:32	
27	07:55		06:58	05:53	05:43	04:54	04:43	
	16:40		17:38	18:29	20:23	21:10	21:31	
28	07:54	08:21 (WEA ZB06_wpd)	06:55	05:51	05:41	04:53	04:44	
	16:42	7 08:28 (WEA ZB06_wpd)	17:40	18:30	20:24	21:12	21:31	
29	07:52	08:19 (WEA ZB06_wpd)		06:48	05:39	04:52	04:44	
	16:44	11 08:30 (WEA ZB06_wpd)		19:32	20:26	21:13	21:31	
30	07:51	08:18 (WEA ZB06_wpd)		06:46	05:37	04:51	04:45	
	16:46	14 08:32 (WEA ZB06_wpd)		19:34	20:28	21:14	21:31	
31	07:49	08:16 (WEA ZB06_wpd)		06:44		04:50		
	16:47	17 08:33 (WEA ZB06_wpd)		19:36		21:15		
Sonnenscheinstunden	256		276	367	417	488	502	
astr.max.mögl.Beschattung	463		237					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-45 - SR-45, Rehweg 2, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:46 (WEA ZB06_wpd) 07:51 08:37 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	18 08:04 (WEA ZB06_wpd) 15:55 22 08:59 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:45 (WEA ZB06_wpd) 07:53 08:38 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	20 08:05 (WEA ZB06_wpd) 15:54 22 09:00 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:45 (WEA ZB06_wpd) 07:54 08:38 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	20 08:05 (WEA ZB06_wpd) 15:54 22 09:00 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:44 (WEA ZB06_wpd) 07:55 08:39 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	20 08:06 (WEA ZB06_wpd) 15:53 22 09:01 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:44 (WEA ZB06_wpd) 07:57 08:39 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	22 08:06 (WEA ZB06_wpd) 15:53 22 09:01 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:44 (WEA ZB06_wpd) 07:58 08:39 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:06 (WEA ZB06_wpd) 15:52 22 09:01 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:45 (WEA ZB06_wpd) 07:59 08:40 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	21 08:06 (WEA ZB06_wpd) 15:52 22 09:02 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:45 (WEA ZB06_wpd) 08:01 08:40 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	21 08:06 (WEA ZB06_wpd) 15:51 22 09:02 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:45 (WEA ZB06_wpd) 08:02 08:40 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	20 08:05 (WEA ZB06_wpd) 15:51 22 09:02 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:46 (WEA ZB06_wpd) 08:03 08:42 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	19 08:05 (WEA ZB06_wpd) 15:51 21 09:03 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:47 (WEA ZB06_wpd) 08:04 08:42 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	17 08:04 (WEA ZB06_wpd) 15:51 21 09:03 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:49 (WEA ZB06_wpd) 08:05 08:43 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	14 08:03 (WEA ZB06_wpd) 15:51 20 09:03 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	07:51 (WEA ZB06_wpd) 08:06 08:43 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	11 08:02 (WEA ZB06_wpd) 15:50 20 09:03 (WEA ZB07_wpd)
14	04:58	05:44	06:36	07:27	07:23	07:53 (WEA ZB06_wpd) 08:07 08:44 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	7 08:00 (WEA ZB06_wpd) 15:50 20 09:04 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	08:08 08:44 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	20 09:04 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:09 08:45 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	20 09:05 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:10 08:45 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	19 09:04 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:11 08:46 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	19 09:05 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:11 08:46 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	15 09:05 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:12 08:46 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	4 08:47 (WEA ZB07_wpd) 15:52 19 09:05 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:41 (WEA ZB07_wpd) 08:12 08:47 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	9 08:50 (WEA ZB07_wpd) 15:52 19 09:06 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:39 (WEA ZB07_wpd) 08:13 08:47 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	13 08:52 (WEA ZB07_wpd) 15:53 19 09:06 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:38 (WEA ZB07_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	15 08:53 (WEA ZB07_wpd) 15:53 19 09:07 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:37 (WEA ZB07_wpd) 08:14 08:48 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	17 08:54 (WEA ZB07_wpd) 15:54 20 09:08 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:37 (WEA ZB07_wpd) 08:14 08:49 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	18 08:55 (WEA ZB07_wpd) 15:54 19 09:08 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:37 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	19 08:56 (WEA ZB07_wpd) 15:55 19 09:09 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:36 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	20 08:56 (WEA ZB07_wpd) 15:56 20 09:10 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:37 (WEA ZB07_wpd) 08:15 08:50 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	20 08:57 (WEA ZB07_wpd) 15:57 20 09:10 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:37 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	21 08:58 (WEA ZB07_wpd) 15:57 20 09:11 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56	07:50	08:37 (WEA ZB07_wpd) 08:15 08:51 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	21 08:58 (WEA ZB07_wpd) 15:58 20 09:11 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:47 (WEA ZB06_wpd)	08:15 08:51 (WEA ZB07_wpd)
	21:00	19:57	16:39	16	08:03 (WEA ZB06_wpd)	15:59 21 09:12 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				39	431	633

**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)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-46 - SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:55 (WEA ZB07_vpd)   07:48	08:17 (WEA ZB06_vpd)   06:53	07:26 (WEA ZB04_vpd)   06:41	05:35	04:49		
	16:01	22 09:17 (WEA ZB07_vpd)   16:49	20 08:37 (WEA ZB06_vpd)   17:42	18 07:44 (WEA ZB04_vpd)   19:37	20:29	21:16		
2	08:15	08:55 (WEA ZB07_vpd)   07:46	08:17 (WEA ZB06_vpd)   06:51	07:27 (WEA ZB04_vpd)   06:39	05:33	04:48		
	16:02	23 09:18 (WEA ZB07_vpd)   16:51	21 08:38 (WEA ZB06_vpd)   17:44	16 07:43 (WEA ZB04_vpd)   19:39	20:31	21:18		
3	08:15	08:56 (WEA ZB07_vpd)   07:44	08:17 (WEA ZB06_vpd)   06:49	07:27 (WEA ZB04_vpd)   06:37	05:31	04:47		
	16:03	23 09:19 (WEA ZB07_vpd)   16:53	22 08:39 (WEA ZB06_vpd)   17:46	14 07:41 (WEA ZB04_vpd)   19:41	20:33	21:19		
4	08:15	08:56 (WEA ZB07_vpd)   07:43	08:17 (WEA ZB06_vpd)   06:46	07:29 (WEA ZB04_vpd)   06:34	05:29	04:46		
	16:04	22 09:18 (WEA ZB07_vpd)   16:55	22 08:39 (WEA ZB06_vpd)   17:48	10 07:39 (WEA ZB04_vpd)   19:43	20:35	21:20		
5	08:15	08:57 (WEA ZB07_vpd)   07:41	08:16 (WEA ZB06_vpd)   06:44	07:34 (WEA ZB04_vpd)   06:32	05:28	04:46		
	16:05	22 09:19 (WEA ZB07_vpd)   16:57	23 08:39 (WEA ZB06_vpd)   17:49	1 07:35 (WEA ZB04_vpd)   19:44	20:36	21:21		
6	08:14	08:58 (WEA ZB07_vpd)   07:39	08:16 (WEA ZB06_vpd)   06:42		06:30	05:26	04:45	
	16:06	22 09:20 (WEA ZB07_vpd)   16:59	23 08:39 (WEA ZB06_vpd)   17:51		19:46	20:38	21:22	
7	08:14	08:58 (WEA ZB07_vpd)   07:38	08:17 (WEA ZB06_vpd)   06:40		06:27	05:24	04:44	
	16:08	22 09:20 (WEA ZB07_vpd)   17:01	22 08:39 (WEA ZB06_vpd)   17:53		19:48	20:40	21:23	
8	08:13	08:58 (WEA ZB07_vpd)   07:36	08:17 (WEA ZB06_vpd)   06:37		06:25	05:22	04:44	
	16:09	22 09:20 (WEA ZB07_vpd)   17:03	21 08:38 (WEA ZB06_vpd)   17:55		19:50	20:41	21:24	
9	08:13	08:59 (WEA ZB07_vpd)   07:34	08:18 (WEA ZB06_vpd)   06:35		06:23	05:20	04:43	
	16:10	22 09:21 (WEA ZB07_vpd)   17:04	21 08:39 (WEA ZB06_vpd)   17:57		19:51	20:43	21:24	
10	08:12	08:59 (WEA ZB07_vpd)   07:32	08:19 (WEA ZB06_vpd)   06:33		06:20	05:18	04:43	
	16:12	22 09:21 (WEA ZB07_vpd)   17:06	19 08:38 (WEA ZB06_vpd)   17:58		19:53	20:45	21:25	
11	08:12	08:59 (WEA ZB07_vpd)   07:30	08:20 (WEA ZB06_vpd)   06:30		06:18	05:17	04:42	
	16:13	23 09:22 (WEA ZB07_vpd)   17:08	17 08:37 (WEA ZB06_vpd)   18:00		19:55	20:46	21:26	
12	08:11	09:00 (WEA ZB07_vpd)   07:28	08:22 (WEA ZB06_vpd)   06:28		06:16	05:15	04:42	
	16:15	22 09:22 (WEA ZB07_vpd)   17:10	14 08:36 (WEA ZB06_vpd)   18:02		19:57	20:48	21:27	
13	08:10	09:00 (WEA ZB07_vpd)   07:26	08:24 (WEA ZB06_vpd)   06:26		06:14	05:13	04:42	
	16:16	22 09:22 (WEA ZB07_vpd)   17:12	9 08:33 (WEA ZB06_vpd)   18:04		19:58	20:50	21:27	
14	08:10	09:01 (WEA ZB07_vpd)   07:25		06:24	06:11	05:12	04:42	
	16:18	21 09:22 (WEA ZB07_vpd)   17:14		18:06	20:00	20:51	21:28	
15	08:09	09:02 (WEA ZB07_vpd)   07:23		06:21	06:09	05:10	04:41	
	16:19	20 09:22 (WEA ZB07_vpd)   17:16		18:07	20:02	20:53	21:29	
16	08:08	09:03 (WEA ZB07_vpd)   07:21		06:19	06:07	05:09	04:41	
	16:21	18 09:21 (WEA ZB07_vpd)   17:18		18:09	20:03	20:54	21:29	
17	08:07	09:04 (WEA ZB07_vpd)   07:19		06:17	06:05	05:07	04:41	
	16:23	17 09:21 (WEA ZB07_vpd)   17:20		18:11	20:05	20:56	21:30	
18	08:06	09:05 (WEA ZB07_vpd)   07:17		06:14	06:02	05:06	04:41	
	16:24	16 09:21 (WEA ZB07_vpd)   17:22		18:13	20:07	20:57	21:30	
19	08:05	09:07 (WEA ZB07_vpd)   07:15		06:12	06:00	05:04	04:41	
	16:26	13 09:20 (WEA ZB07_vpd)   17:23		18:15	20:09	20:59	21:30	
20	08:04	09:08 (WEA ZB07_vpd)   07:12		06:09	05:58	05:03	04:41	
	16:28	11 09:19 (WEA ZB07_vpd)   17:25		18:16	20:10	21:00	21:31	
21	08:03	09:11 (WEA ZB07_vpd)   07:10		06:07	05:56	05:01	04:41	
	16:29	6 09:17 (WEA ZB07_vpd)   17:27	4 07:35 (WEA ZB04_vpd)   18:18		20:12	21:02	21:31	
22	08:02		07:32 (WEA ZB04_vpd)   06:05		05:54	05:00	04:42	
	16:31		9 07:41 (WEA ZB04_vpd)   18:20		20:14	21:03	21:31	
23	08:00		07:30 (WEA ZB04_vpd)   06:02		05:52	04:59	21:29	
	16:33		13 07:43 (WEA ZB04_vpd)   18:22		20:16	21:05	21:31	
24	07:59		07:28 (WEA ZB04_vpd)   06:00		05:50	04:57	04:42	
	16:35		16 07:44 (WEA ZB04_vpd)   18:23		20:17	21:06	21:31	
25	07:58		07:27 (WEA ZB04_vpd)   05:58		05:47	04:56	04:42	
	16:36		17 07:44 (WEA ZB04_vpd)   18:25		20:19	21:08	21:32	
26	07:56		07:26 (WEA ZB04_vpd)   05:55		05:45	04:55	04:43	
	16:38		19 07:45 (WEA ZB04_vpd)   18:27		20:21	21:09	21:32	
27	07:55	08:23 (WEA ZB06_vpd)   06:58		05:53	05:43	04:54	04:43	
	16:40	5 08:28 (WEA ZB06_vpd)   17:38		18:29	20:23	21:10	21:31	
28	07:54	08:21 (WEA ZB06_vpd)   06:55		05:51	05:41	04:53	04:44	
	16:42	11 08:32 (WEA ZB06_vpd)   17:40	18 07:44 (WEA ZB04_vpd)   18:30		20:24	21:12	21:31	
29	07:52	08:19 (WEA ZB06_vpd)		06:48	05:39	04:52	04:44	
	16:44	15 08:34 (WEA ZB06_vpd)		19:32	20:26	21:13	21:31	
30	07:51	08:19 (WEA ZB06_vpd)		06:46	05:37	04:51	04:45	
	16:46	17 08:36 (WEA ZB06_vpd)		19:34	20:28	21:14	21:31	
31	07:49	08:18 (WEA ZB06_vpd)		06:44		04:50		
	16:47	18 08:36 (WEA ZB06_vpd)		19:36		21:15		
	Sonnenscheinstunden					417	488	502
	astr.max.mögl.Beschattung	477	276	369	367	59		

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-46 - SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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

	Juli	August	September	Oktober		November		Dezember		
1	04:45	05:23	06:14	07:04		06:59	07:48 (WEA ZB06_wpd)	07:51	08:42 (WEA ZB07_wpd)	
	21:31	20:58	19:55	18:44		16:37	19 08:07 (WEA ZB06_wpd)	15:55	22 09:04 (WEA ZB07_wpd)	
2	04:46	05:24	06:16	07:06		07:01	07:47 (WEA ZB06_wpd)	07:53	08:42 (WEA ZB07_wpd)	
	21:30	20:56	19:52	18:42		16:35	21 08:08 (WEA ZB06_wpd)	15:54	23 09:05 (WEA ZB07_wpd)	
3	04:47	05:26	06:17	07:07		07:03	07:47 (WEA ZB06_wpd)	07:54	08:42 (WEA ZB07_wpd)	
	21:30	20:55	19:50	18:39		16:33	21 08:08 (WEA ZB06_wpd)	15:54	22 09:04 (WEA ZB07_wpd)	
4	04:48	05:28	06:19	07:09		07:05	07:46 (WEA ZB06_wpd)	07:55	08:43 (WEA ZB07_wpd)	
	21:30	20:53	19:48	18:37		16:31	22 08:08 (WEA ZB06_wpd)	15:53	22 09:05 (WEA ZB07_wpd)	
5	04:49	05:29	06:21	07:11		07:06	07:46 (WEA ZB06_wpd)	07:57	08:43 (WEA ZB07_wpd)	
	21:29	20:51	19:45	18:35		16:29	23 08:09 (WEA ZB06_wpd)	15:53	22 09:05 (WEA ZB07_wpd)	
6	04:49	05:31	06:22	07:13		07:08	07:46 (WEA ZB06_wpd)	07:58	08:43 (WEA ZB07_wpd)	
	21:28	20:49	19:43	18:32		16:27	23 08:09 (WEA ZB06_wpd)	15:52	22 09:05 (WEA ZB07_wpd)	
7	04:50	05:32	06:24	07:14		07:10	07:46 (WEA ZB06_wpd)	07:59	08:44 (WEA ZB07_wpd)	
	21:28	20:47	19:41	18:30		16:26	23 08:09 (WEA ZB06_wpd)	15:52	22 09:06 (WEA ZB07_wpd)	
8	04:51	05:34	06:26	07:16		07:12	07:47 (WEA ZB06_wpd)	08:01	08:44 (WEA ZB07_wpd)	
	21:27	20:45	19:38	18:28		16:24	22 08:09 (WEA ZB06_wpd)	15:51	23 09:07 (WEA ZB07_wpd)	
9	04:52	05:36	06:27	07:18		07:14	07:47 (WEA ZB06_wpd)	08:02	08:44 (WEA ZB07_wpd)	
	21:27	20:44	19:36	18:25	7	08:13 (WEA ZB04_wpd)	16:22	21 08:08 (WEA ZB06_wpd)	15:51	23 09:07 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20		08:02 (WEA ZB04_wpd)	07:16	07:48 (WEA ZB06_wpd)	08:03	08:45 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	12	08:14 (WEA ZB04_wpd)	16:21	20 08:08 (WEA ZB06_wpd)	15:51	23 09:08 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21		08:01 (WEA ZB04_wpd)	07:17	07:49 (WEA ZB06_wpd)	08:04	08:46 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	15	08:16 (WEA ZB04_wpd)	16:19	18 08:07 (WEA ZB06_wpd)	15:51	22 09:08 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23		08:00 (WEA ZB04_wpd)	07:19	07:50 (WEA ZB06_wpd)	08:05	08:46 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	17	08:17 (WEA ZB04_wpd)	16:17	16 08:06 (WEA ZB06_wpd)	15:51	22 09:08 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25		07:59 (WEA ZB04_wpd)	07:21	07:51 (WEA ZB06_wpd)	08:06	08:47 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	18	08:17 (WEA ZB04_wpd)	16:16	14 08:05 (WEA ZB06_wpd)	15:50	22 09:09 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27		07:59 (WEA ZB04_wpd)	07:23	07:53 (WEA ZB06_wpd)	08:07	08:47 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	18	08:17 (WEA ZB04_wpd)	16:14	11 08:04 (WEA ZB06_wpd)	15:50	22 09:09 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28		07:58 (WEA ZB04_wpd)	07:25	07:56 (WEA ZB06_wpd)	08:08	08:48 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	19	08:17 (WEA ZB04_wpd)	16:13	5 08:01 (WEA ZB06_wpd)	15:51	21 09:09 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30		07:58 (WEA ZB04_wpd)	07:26	08:09	08:09	08:49 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	18	08:16 (WEA ZB04_wpd)	16:11	15:51	21 09:10 (WEA ZB07_wpd)	
17	05:01	05:49	06:40	07:32		07:58 (WEA ZB04_wpd)	07:28	08:10	08:48 (WEA ZB07_wpd)	
	21:19	20:28	19:17	18:07	17	08:15 (WEA ZB04_wpd)	16:10	15:51	22 09:10 (WEA ZB07_wpd)	
18	05:03	05:51	06:42	07:34		08:00 (WEA ZB04_wpd)	07:30	08:11	08:49 (WEA ZB07_wpd)	
	21:18	20:26	19:15	18:05	15	08:15 (WEA ZB04_wpd)	16:09	15:51	21 09:10 (WEA ZB07_wpd)	
19	05:04	05:52	06:44	07:35		08:02 (WEA ZB04_wpd)	07:32	08:11	08:50 (WEA ZB07_wpd)	
	21:17	20:23	19:12	18:03	11	08:13 (WEA ZB04_wpd)	16:07	15:51	21 09:11 (WEA ZB07_wpd)	
20	05:05	05:54	06:45	07:37		08:04 (WEA ZB04_wpd)	07:33	08:12	08:50 (WEA ZB07_wpd)	
	21:16	20:21	19:10	18:01	8	08:12 (WEA ZB04_wpd)	16:06	15:52	21 09:11 (WEA ZB07_wpd)	
21	05:07	05:56	06:47	07:39		08:06 (WEA ZB04_wpd)	07:35	08:12	08:51 (WEA ZB07_wpd)	
	21:14	20:19	19:08	17:59	2	08:08 (WEA ZB04_wpd)	16:05	6 08:53 (WEA ZB07_wpd)	15:52	21 09:12 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41		07:37	08:45 (WEA ZB07_wpd)	08:13	08:51 (WEA ZB07_wpd)	
	21:13	20:17	19:05	17:57		16:04	11 08:56 (WEA ZB07_wpd)	15:53	21 09:12 (WEA ZB07_wpd)	
23	05:09	05:59	06:51	07:43		07:39	08:43 (WEA ZB07_wpd)	08:14	08:52 (WEA ZB07_wpd)	
	21:12	20:15	19:03	17:55		16:03	13 08:56 (WEA ZB07_wpd)	15:53	21 09:13 (WEA ZB07_wpd)	
24	05:11	06:01	06:52	07:44		07:40	08:42 (WEA ZB07_wpd)	08:14	08:52 (WEA ZB07_wpd)	
	21:10	20:13	19:01	17:53		16:01	16 08:58 (WEA ZB07_wpd)	15:54	21 09:13 (WEA ZB07_wpd)	
25	05:12	06:02	06:54	07:46		07:42	08:42 (WEA ZB07_wpd)	08:14	08:52 (WEA ZB07_wpd)	
	21:09	20:10	18:58	16:50		16:00	17 08:59 (WEA ZB07_wpd)	15:54	21 09:13 (WEA ZB07_wpd)	
26	05:14	06:04	06:56	07:48		07:43	08:42 (WEA ZB07_wpd)	08:15	08:53 (WEA ZB07_wpd)	
	21:07	20:08	18:56	16:48		15:59	19 09:01 (WEA ZB07_wpd)	15:55	21 09:14 (WEA ZB07_wpd)	
27	05:15	06:06	06:57	07:50		07:45	08:41 (WEA ZB07_wpd)	08:15	08:53 (WEA ZB07_wpd)	
	21:06	20:06	18:53	16:46		15:58	20 09:01 (WEA ZB07_wpd)	15:56	22 09:15 (WEA ZB07_wpd)	
28	05:17	06:07	06:59	07:52		07:47	08:41 (WEA ZB07_wpd)	08:15	08:54 (WEA ZB07_wpd)	
	21:04	20:04	18:51	16:44		15:58	21 09:02 (WEA ZB07_wpd)	15:57	21 09:15 (WEA ZB07_wpd)	
29	05:18	06:09	07:01	07:54		07:48	08:41 (WEA ZB07_wpd)	08:15	08:54 (WEA ZB07_wpd)	
	21:03	20:01	18:49	16:42	10	08:02 (WEA ZB06_wpd)	15:57	22 09:03 (WEA ZB07_wpd)	15:57	22 09:16 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:56		07:50 (WEA ZB06_wpd)	07:50	08:41 (WEA ZB07_wpd)	08:15	08:55 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	14	08:04 (WEA ZB06_wpd)	15:56	22 09:03 (WEA ZB07_wpd)	15:58	21 09:16 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57		07:49 (WEA ZB06_wpd)	15:56	08:15	08:55 (WEA ZB07_wpd)	
	21:00	19:57	18:43	16:39	17	08:06 (WEA ZB06_wpd)	15:59	22 09:17 (WEA ZB07_wpd)		
Sonnenscheinstunden	505	455	381	331		264		241		
astr.max.mögl.Beschattung					218		446		673	

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-47 - SR-47, Rehweg 17, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

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	08:15	08:57 (WEA ZB07_vpd)	07:48	08:19 (WEA ZB06_vpd)	06:53	07:31 (WEA ZB04_vpd)	06:41	05:35	04:49
	16:01	22 09:19 (WEA ZB07_vpd)	16:49	22 08:41 (WEA ZB06_vpd)	17:42	14 07:45 (WEA ZB04_vpd)	19:37	20:29	21:16
2	08:15	08:57 (WEA ZB07_vpd)	07:46	08:20 (WEA ZB06_vpd)	06:51	07:32 (WEA ZB04_vpd)	06:39	05:33	04:48
	16:02	23 09:20 (WEA ZB07_vpd)	16:51	22 08:42 (WEA ZB06_vpd)	17:44	12 07:44 (WEA ZB04_vpd)	19:39	20:31	21:18
3	08:15	08:58 (WEA ZB07_vpd)	07:44	08:20 (WEA ZB06_vpd)	06:49	07:34 (WEA ZB04_vpd)	06:37	05:31	04:47
	16:03	22 09:20 (WEA ZB07_vpd)	16:53	22 08:42 (WEA ZB06_vpd)	17:46	6 07:40 (WEA ZB04_vpd)	19:41	20:33	21:19
4	08:15	08:58 (WEA ZB07_vpd)	07:43	08:20 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46
	16:04	22 09:20 (WEA ZB07_vpd)	16:55	22 08:42 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20
5	08:15	08:59 (WEA ZB07_vpd)	07:41	08:20 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46
	16:05	22 09:21 (WEA ZB07_vpd)	16:57	22 08:42 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21
6	08:14	09:00 (WEA ZB07_vpd)	07:39	08:20 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45
	16:06	22 09:22 (WEA ZB07_vpd)	16:59	21 08:41 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22
7	08:14	09:00 (WEA ZB07_vpd)	07:38	08:20 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44
	16:08	22 09:22 (WEA ZB07_vpd)	17:01	21 08:41 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23
8	08:13	09:00 (WEA ZB07_vpd)	07:36	08:21 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44
	16:09	22 09:22 (WEA ZB07_vpd)	17:03	19 08:40 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24
9	08:13	09:01 (WEA ZB07_vpd)	07:34	08:23 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43
	16:10	22 09:23 (WEA ZB07_vpd)	17:04	17 08:40 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24
10	08:12	09:02 (WEA ZB07_vpd)	07:32	08:24 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43
	16:12	21 09:23 (WEA ZB07_vpd)	17:06	15 08:39 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25
11	08:12	09:02 (WEA ZB07_vpd)	07:30	08:25 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42
	16:13	21 09:23 (WEA ZB07_vpd)	17:08	11 08:37 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26
12	08:11	09:03 (WEA ZB07_vpd)	07:28		06:28		06:16	05:15	04:42
	16:15	20 09:23 (WEA ZB07_vpd)	17:10		18:02		19:57	20:48	21:27
13	08:10	09:03 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42
	16:16	20 09:23 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27
14	08:10	09:04 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42
	16:18	18 09:22 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28
15	08:09	09:05 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41
	16:19	17 09:22 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29
16	08:08	09:06 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41
	16:21	16 09:22 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29
17	08:07	09:08 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41
	16:23	13 09:21 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30
18	08:06	09:09 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41
	16:24	12 09:21 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30
19	08:05	09:12 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41
	16:26	7 09:19 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30
20	08:04		07:12	07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41
	16:28		17:25	7 07:44 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31
21	08:03		07:10	07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41
	16:29		17:27	11 07:46 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31
22	08:02		07:08	07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:42
	16:31		17:29	14 07:46 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31
23	08:00		07:06	07:30 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42
	16:33		17:31	17 07:47 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31
24	07:59		07:04	07:30 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42
	16:35		17:33	18 07:48 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31
25	07:58	08:28 (WEA ZB06_vpd)	07:02	07:29 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42
	16:36	3 08:31 (WEA ZB06_vpd)	17:35	19 07:48 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32
26	07:56	08:24 (WEA ZB06_vpd)	07:00	07:30 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43
	16:38	10 08:34 (WEA ZB06_vpd)	17:37	18 07:48 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32
27	07:55	08:23 (WEA ZB06_vpd)	06:58	07:29 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43
	16:40	13 08:36 (WEA ZB06_vpd)	17:38	18 07:47 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31
28	07:54	08:22 (WEA ZB06_vpd)	06:55	07:30 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44
	16:42	15 08:37 (WEA ZB06_vpd)	17:40	16 07:46 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31
29	07:52	08:20 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44
	16:44	18 08:38 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31
30	07:51	08:21 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45
	16:46	19 08:40 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31
31	07:49	08:20 (WEA ZB06_vpd)			06:44			04:50	
	16:47	20 08:40 (WEA ZB06_vpd)			19:36			21:15	
Sonnenscheinstunden	256				367		417	488	502
astr.max.mögl.Beschattung	462	276	352		32				

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-47 - SR-47, Rehweg 17, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:53 (WEA ZB06_wpd) 07:51 08:44 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	15 08:08 (WEA ZB06_wpd) 15:55 21 09:05 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:51 (WEA ZB06_wpd) 07:53 08:45 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	18 08:09 (WEA ZB06_wpd) 15:54 21 09:06 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:51 (WEA ZB06_wpd) 07:54 08:44 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	19 08:10 (WEA ZB06_wpd) 15:54 22 09:06 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:50 (WEA ZB06_wpd) 07:55 08:45 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	20 08:10 (WEA ZB06_wpd) 15:53 22 09:07 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:50 (WEA ZB06_wpd) 07:57 08:45 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	21 08:11 (WEA ZB06_wpd) 15:53 22 09:07 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:49 (WEA ZB06_wpd) 07:58 08:45 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	22 08:11 (WEA ZB06_wpd) 15:52 22 09:07 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:49 (WEA ZB06_wpd) 07:59 08:46 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	22 08:11 (WEA ZB06_wpd) 15:52 22 09:08 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:50 (WEA ZB06_wpd) 08:01 08:46 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	22 08:12 (WEA ZB06_wpd) 15:51 22 09:08 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:50 (WEA ZB06_wpd) 08:02 08:46 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	21 08:11 (WEA ZB06_wpd) 15:51 22 09:08 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:50 (WEA ZB06_wpd) 08:03 08:47 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	21 08:11 (WEA ZB06_wpd) 15:51 23 09:10 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:51 (WEA ZB06_wpd) 08:04 08:48 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	20 08:11 (WEA ZB06_wpd) 15:51 22 09:10 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:51 (WEA ZB06_wpd) 08:05 08:48 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	20 08:11 (WEA ZB06_wpd) 15:51 22 09:10 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	07:52 (WEA ZB06_wpd) 08:06 08:49 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	18 08:10 (WEA ZB06_wpd) 15:50 22 09:11 (WEA ZB07_wpd)
14	04:58	05:44	06:36	07:27	07:23	07:54 (WEA ZB06_wpd) 08:07 08:49 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	15 08:09 (WEA ZB06_wpd) 15:50 22 09:11 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	07:55 (WEA ZB06_wpd) 08:08 08:50 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	13 08:08 (WEA ZB06_wpd) 15:51 22 09:12 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	07:57 (WEA ZB06_wpd) 08:09 08:50 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	10 08:07 (WEA ZB06_wpd) 15:51 22 09:12 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:01 (WEA ZB06_wpd) 08:10 08:50 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	3 08:04 (WEA ZB06_wpd) 15:51 22 09:12 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:01 (WEA ZB06_wpd) 08:11 08:51 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	18 08:19 (WEA ZB04_wpd) 16:09 15:51 21 09:12 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:02 (WEA ZB04_wpd) 07:32 08:11 08:52 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	16 08:18 (WEA ZB04_wpd) 16:07 15:51 21 09:13 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:04 (WEA ZB04_wpd) 07:33 08:12 08:51 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	13 08:17 (WEA ZB04_wpd) 16:06 15:52 22 09:13 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:06 (WEA ZB04_wpd) 07:35 08:12 08:52 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	10 08:16 (WEA ZB04_wpd) 16:05 15:52 22 09:14 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:08 (WEA ZB04_wpd) 07:37 08:13 08:52 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	6 08:14 (WEA ZB04_wpd) 16:04 15:53 22 09:14 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:48 (WEA ZB07_wpd) 08:14 08:53 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	7 08:55 (WEA ZB07_wpd) 15:53 22 09:15 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:46 (WEA ZB07_wpd) 08:14 08:54 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	12 08:58 (WEA ZB07_wpd) 15:54 21 09:15 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:46 (WEA ZB07_wpd) 08:14 08:54 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	13 08:59 (WEA ZB07_wpd) 15:54 21 09:15 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:45 (WEA ZB07_wpd) 08:15 08:55 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	16 09:01 (WEA ZB07_wpd) 15:55 22 09:17 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:44 (WEA ZB07_wpd) 08:15 08:55 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	17 09:01 (WEA ZB07_wpd) 15:56 22 09:17 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:44 (WEA ZB07_wpd) 08:15 08:56 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	18 09:02 (WEA ZB07_wpd) 15:57 21 09:17 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:44 (WEA ZB07_wpd) 08:15 08:56 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	20 09:04 (WEA ZB07_wpd) 15:57 22 09:18 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	08:44 (WEA ZB07_wpd) 08:15 08:56 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	20 09:04 (WEA ZB07_wpd) 15:58 22 09:18 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:54 (WEA ZB06_wpd)	08:15 08:57 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	12 08:06 (WEA ZB06_wpd) 15:59 22 09:19 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				188	423	676

**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)		Schattenende (WEA mit letztem Schatten)	
	SS:MM	SS:MM		SS:MM	SS:MM	SS:MM	SS:MM	SS:MM	SS:MM



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-48 - SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	08:15	08:57 (WEA ZB07_vpd)	07:48	08:19 (WEA ZB06_vpd)	06:53	07:28 (WEA ZB04_vpd)	06:41	05:35	04:49
	16:01	23 09:20 (WEA ZB07_vpd)	16:49	21 08:40 (WEA ZB06_vpd)	17:42	17 07:45 (WEA ZB04_vpd)	19:37	20:29	21:16
2	08:15	08:58 (WEA ZB07_vpd)	07:46	08:19 (WEA ZB06_vpd)	06:51	07:29 (WEA ZB04_vpd)	06:39	05:33	04:48
	16:02	23 09:21 (WEA ZB07_vpd)	16:51	22 08:41 (WEA ZB06_vpd)	17:44	15 07:44 (WEA ZB04_vpd)	19:39	20:31	21:18
3	08:15	08:59 (WEA ZB07_vpd)	07:44	08:19 (WEA ZB06_vpd)	06:49	07:30 (WEA ZB04_vpd)	06:37	05:31	04:47
	16:03	23 09:22 (WEA ZB07_vpd)	16:53	22 08:41 (WEA ZB06_vpd)	17:46	12 07:42 (WEA ZB04_vpd)	19:41	20:33	21:19
4	08:15	08:58 (WEA ZB07_vpd)	07:43	08:19 (WEA ZB06_vpd)	06:46	07:32 (WEA ZB04_vpd)	06:34	05:29	04:46
	16:04	23 09:21 (WEA ZB07_vpd)	16:55	23 08:42 (WEA ZB06_vpd)	17:48	7 07:39 (WEA ZB04_vpd)	19:43	20:35	21:20
5	08:15	08:59 (WEA ZB07_vpd)	07:41	08:19 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46
	16:05	23 09:22 (WEA ZB07_vpd)	16:57	22 08:41 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21
6	08:14	09:00 (WEA ZB07_vpd)	07:39	08:19 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45
	16:06	23 09:23 (WEA ZB07_vpd)	16:59	22 08:41 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22
7	08:14	09:00 (WEA ZB07_vpd)	07:38	08:19 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44
	16:08	23 09:23 (WEA ZB07_vpd)	17:01	22 08:41 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23
8	08:13	09:01 (WEA ZB07_vpd)	07:36	08:20 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44
	16:09	22 09:23 (WEA ZB07_vpd)	17:03	20 08:40 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24
9	08:13	09:02 (WEA ZB07_vpd)	07:34	08:22 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43
	16:10	22 09:24 (WEA ZB07_vpd)	17:04	19 08:41 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24
10	08:12	09:02 (WEA ZB07_vpd)	07:32	08:23 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43
	16:12	22 09:24 (WEA ZB07_vpd)	17:06	17 08:40 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25
11	08:12	09:02 (WEA ZB07_vpd)	07:30	08:24 (WEA ZB06_vpd)	06:30		06:18	05:17	04:42
	16:13	22 09:24 (WEA ZB07_vpd)	17:08	14 08:38 (WEA ZB06_vpd)	18:00		19:55	20:46	21:26
12	08:11	09:03 (WEA ZB07_vpd)	07:28	08:26 (WEA ZB06_vpd)	06:28		06:16	05:15	04:42
	16:15	21 09:24 (WEA ZB07_vpd)	17:10	10 08:36 (WEA ZB06_vpd)	18:02		19:57	20:48	21:27
13	08:10	09:04 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42
	16:16	20 09:24 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27
14	08:10	09:04 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42
	16:18	20 09:24 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28
15	08:09	09:05 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41
	16:19	19 09:24 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29
16	08:08	09:06 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41
	16:21	17 09:23 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29
17	08:07	09:08 (WEA ZB07_vpd)	07:19		06:17		06:05	05:07	04:41
	16:23	15 09:23 (WEA ZB07_vpd)	17:20		18:11		20:05	20:56	21:30
18	08:06	09:09 (WEA ZB07_vpd)	07:17		06:14		06:02	05:06	04:41
	16:24	13 09:22 (WEA ZB07_vpd)	17:22		18:13		20:07	20:57	21:30
19	08:05	09:11 (WEA ZB07_vpd)	07:15		06:12		06:00	05:04	04:41
	16:26	10 09:21 (WEA ZB07_vpd)	17:23		18:15		20:09	20:59	21:30
20	08:04	09:14 (WEA ZB07_vpd)	07:12	07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41
	16:28	4 09:18 (WEA ZB07_vpd)	17:25	2 07:39 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31
21	08:03		07:10	07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41
	16:29		17:27	8 07:43 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31
22	08:02		07:08	07:32 (WEA ZB04_vpd)	06:05		05:54	05:00	04:42
	16:31		17:29	12 07:44 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31
23	08:00		07:06	07:30 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42
	16:33		17:31	15 07:45 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31
24	07:59		07:04	07:28 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42
	16:35		17:33	18 07:46 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31
25	07:58		07:02	07:28 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42
	16:36		17:35	18 07:46 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32
26	07:56	08:25 (WEA ZB06_vpd)	07:00	07:28 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43
	16:38	7 08:32 (WEA ZB06_vpd)	17:37	19 07:47 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32
27	07:55	08:22 (WEA ZB06_vpd)	06:58	07:27 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43
	16:40	12 08:34 (WEA ZB06_vpd)	17:38	19 07:46 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31
28	07:54	08:22 (WEA ZB06_vpd)	06:55	07:27 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44
	16:42	14 08:36 (WEA ZB06_vpd)	17:40	18 07:45 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31
29	07:52	08:20 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44
	16:44	17 08:37 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31
30	07:51	08:20 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45
	16:46	19 08:39 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31
31	07:49	08:19 (WEA ZB06_vpd)			06:44			04:50	
	16:47	21 08:40 (WEA ZB06_vpd)			19:36			21:15	
Sonnenscheinstunden	256				367		417	488	502
astr.max.mögl.Beschattung	478	276	363		51				

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-48 - SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04		06:59	07:51 (WEA ZB06_wpd)	07:51	08:45 (WEA ZB07_wpd)	
	21:31	20:58	19:55	18:44		16:37	17 08:08 (WEA ZB06_wpd)	15:55	21 09:06 (WEA ZB07_wpd)	
2	04:46	05:24	06:16	07:06		07:01	07:50 (WEA ZB06_wpd)	07:53	08:45 (WEA ZB07_wpd)	
	21:30	20:56	19:52	18:42		16:35	19 08:09 (WEA ZB06_wpd)	15:54	22 09:07 (WEA ZB07_wpd)	
3	04:47	05:26	06:17	07:07		07:03	07:49 (WEA ZB06_wpd)	07:54	08:45 (WEA ZB07_wpd)	
	21:30	20:55	19:50	18:39		16:33	21 08:10 (WEA ZB06_wpd)	15:54	22 09:07 (WEA ZB07_wpd)	
4	04:48	05:28	06:19	07:09		07:05	07:49 (WEA ZB06_wpd)	07:55	08:46 (WEA ZB07_wpd)	
	21:30	20:53	19:48	18:37		16:31	22 08:11 (WEA ZB06_wpd)	15:53	22 09:08 (WEA ZB07_wpd)	
5	04:49	05:29	06:21	07:11		07:06	07:49 (WEA ZB06_wpd)	07:57	08:45 (WEA ZB07_wpd)	
	21:29	20:51	19:45	18:35		16:29	22 08:11 (WEA ZB06_wpd)	15:53	23 09:08 (WEA ZB07_wpd)	
6	04:49	05:31	06:22	07:13		07:08	07:49 (WEA ZB06_wpd)	07:58	08:45 (WEA ZB07_wpd)	
	21:28	20:49	19:43	18:32		16:27	22 08:11 (WEA ZB06_wpd)	15:52	23 09:08 (WEA ZB07_wpd)	
7	04:50	05:32	06:24	07:14		07:10	07:49 (WEA ZB06_wpd)	07:59	08:46 (WEA ZB07_wpd)	
	21:28	20:47	19:41	18:30		16:26	22 08:11 (WEA ZB06_wpd)	15:52	23 09:09 (WEA ZB07_wpd)	
8	04:51	05:34	06:26	07:16		07:12	07:49 (WEA ZB06_wpd)	08:01	08:47 (WEA ZB07_wpd)	
	21:27	20:45	19:38	18:28		16:24	22 08:11 (WEA ZB06_wpd)	15:51	22 09:09 (WEA ZB07_wpd)	
9	04:52	05:36	06:27	07:18		07:14	07:49 (WEA ZB06_wpd)	08:02	08:47 (WEA ZB07_wpd)	
	21:27	20:44	19:36	18:25		16:22	22 08:11 (WEA ZB06_wpd)	15:51	23 09:10 (WEA ZB07_wpd)	
10	04:53	05:37	06:29	07:20		07:16	07:50 (WEA ZB06_wpd)	08:03	08:48 (WEA ZB07_wpd)	
	21:26	20:42	19:34	18:23	10	16:21	21 08:11 (WEA ZB06_wpd)	15:51	23 09:11 (WEA ZB07_wpd)	
11	04:54	05:39	06:31	07:21		07:17	07:50 (WEA ZB06_wpd)	08:04	08:48 (WEA ZB07_wpd)	
	21:25	20:40	19:31	18:21	14	16:19	20 08:10 (WEA ZB06_wpd)	15:51	23 09:11 (WEA ZB07_wpd)	
12	04:55	05:41	06:32	07:23		07:19	07:51 (WEA ZB06_wpd)	08:05	08:49 (WEA ZB07_wpd)	
	21:24	20:38	19:29	18:19	16	16:17	19 08:10 (WEA ZB06_wpd)	15:51	22 09:11 (WEA ZB07_wpd)	
13	04:57	05:42	06:34	07:25		07:21	07:52 (WEA ZB06_wpd)	08:06	08:49 (WEA ZB07_wpd)	
	21:23	20:36	19:27	18:16	17	16:16	17 08:09 (WEA ZB06_wpd)	15:50	23 09:12 (WEA ZB07_wpd)	
14	04:58	05:44	06:35	07:27		07:23	07:53 (WEA ZB06_wpd)	08:07	08:50 (WEA ZB07_wpd)	
	21:22	20:34	19:24	18:14	19	16:14	15 08:08 (WEA ZB06_wpd)	15:50	22 09:12 (WEA ZB07_wpd)	
15	04:59	05:46	06:37	07:28		07:25	07:55 (WEA ZB06_wpd)	08:08	08:50 (WEA ZB07_wpd)	
	21:21	20:32	19:22	18:12	19	16:13	12 08:07 (WEA ZB06_wpd)	15:51	23 09:13 (WEA ZB07_wpd)	
16	05:00	05:47	06:39	07:30		07:26	07:58 (WEA ZB06_wpd)	08:09	08:51 (WEA ZB07_wpd)	
	21:20	20:30	19:20	18:10	19	16:11	7 08:05 (WEA ZB06_wpd)	15:51	22 09:13 (WEA ZB07_wpd)	
17	05:01	05:49	06:40	07:32		07:28		08:10	08:51 (WEA ZB07_wpd)	
	21:19	20:28	19:17	18:07	18	16:10		15:51	22 09:13 (WEA ZB07_wpd)	
18	05:03	05:51	06:42	07:34		07:30		08:11	08:51 (WEA ZB07_wpd)	
	21:18	20:26	19:15	18:05	17	16:09		15:51	22 09:13 (WEA ZB07_wpd)	
19	05:04	05:52	06:44	07:35		07:32		08:11	08:52 (WEA ZB07_wpd)	
	21:17	20:23	19:12	18:03	14	16:07		15:51	22 09:14 (WEA ZB07_wpd)	
20	05:05	05:54	06:45	07:37		07:33		08:12	08:52 (WEA ZB07_wpd)	
	21:16	20:21	19:10	18:01	11	16:06		15:52	22 09:14 (WEA ZB07_wpd)	
21	05:07	05:56	06:47	07:39		07:35		08:12	08:53 (WEA ZB07_wpd)	
	21:14	20:19	19:08	17:59	7	16:05		15:52	22 09:15 (WEA ZB07_wpd)	
22	05:08	05:57	06:49	07:41		07:37		08:13	08:53 (WEA ZB07_wpd)	
	21:13	20:17	19:05	17:57		16:04	4	08:55 (WEA ZB07_wpd)	15:53	22 09:15 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43		07:39		08:14	08:54 (WEA ZB07_wpd)	
	21:12	20:15	19:03	17:55		16:03	9	08:57 (WEA ZB07_wpd)	15:53	22 09:16 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44		07:40		08:14	08:54 (WEA ZB07_wpd)	
	21:10	20:13	19:01	17:53		16:01	13	08:59 (WEA ZB07_wpd)	15:54	22 09:16 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46		07:42		08:14	08:54 (WEA ZB07_wpd)	
	21:09	20:10	18:58	16:50		16:00	15	09:01 (WEA ZB07_wpd)	15:54	22 09:16 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48		07:43		08:15	08:55 (WEA ZB07_wpd)	
	21:07	20:08	18:56	16:48		15:59	16	09:02 (WEA ZB07_wpd)	15:55	23 09:18 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50		07:45		08:15	08:56 (WEA ZB07_wpd)	
	21:06	20:06	18:53	16:46		15:58	19	09:03 (WEA ZB07_wpd)	15:56	22 09:18 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52		07:47		08:15	08:56 (WEA ZB07_wpd)	
	21:04	20:04	18:51	16:44		15:58	19	09:04 (WEA ZB07_wpd)	15:57	22 09:18 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54		07:48		08:15	08:56 (WEA ZB07_wpd)	
	21:03	20:01	18:49	16:42	1	15:57	20	09:05 (WEA ZB07_wpd)	15:57	23 09:19 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55		07:50		08:15	08:57 (WEA ZB07_wpd)	
	21:01	19:59	18:46	16:40	11	15:56	21	09:05 (WEA ZB07_wpd)	15:58	23 09:20 (WEA ZB07_wpd)
31	05:21	06:12		07:57		07:52 (WEA ZB06_wpd)		08:15	08:57 (WEA ZB07_wpd)	
	21:00	19:57		16:39	15	08:07 (WEA ZB06_wpd)		15:59	23 09:20 (WEA ZB07_wpd)	
Sonnenscheinstunden	505	455	381	331		264		241		
astr.max.mögl.Beschattung					208		436		693	

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-49 - SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:05 (WEA ZB07_wpd)	07:48	08:27 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49
	16:01	21 09:26 (WEA ZB07_wpd)	16:49	21 08:48 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16
2	08:15	09:05 (WEA ZB07_wpd)	07:46	08:28 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48
	16:02	21 09:26 (WEA ZB07_wpd)	16:51	21 08:49 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18
3	08:15	09:06 (WEA ZB07_wpd)	07:44	08:29 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47
	16:03	21 09:27 (WEA ZB07_wpd)	16:53	19 08:48 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19
4	08:15	09:06 (WEA ZB07_wpd)	07:43	08:29 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46
	16:04	20 09:26 (WEA ZB07_wpd)	16:55	19 08:48 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20
5	08:15	09:07 (WEA ZB07_wpd)	07:41	08:30 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46
	16:05	20 09:27 (WEA ZB07_wpd)	16:57	17 08:47 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21
6	08:14	09:09 (WEA ZB07_wpd)	07:39	08:31 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45
	16:06	19 09:28 (WEA ZB07_wpd)	16:59	14 08:45 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22
7	08:14	09:09 (WEA ZB07_wpd)	07:38	08:33 (WEA ZB06_wpd)	06:40	06:27	05:24	04:44
	16:08	18 09:27 (WEA ZB07_wpd)	17:01	10 08:43 (WEA ZB06_wpd)	17:53	19:48	20:40	21:23
8	08:13	09:09 (WEA ZB07_wpd)	07:36		06:37	06:25	05:22	04:44
	16:09	18 09:27 (WEA ZB07_wpd)	17:03		17:55	19:50	20:41	21:24
9	08:13	09:11 (WEA ZB07_wpd)	07:34		06:35	06:23	05:20	04:43
	16:10	17 09:28 (WEA ZB07_wpd)	17:04		17:57	19:51	20:43	21:24
10	08:12	09:12 (WEA ZB07_wpd)	07:32		06:33	06:20	05:18	04:43
	16:12	15 09:27 (WEA ZB07_wpd)	17:06		17:58	19:53	20:45	21:25
11	08:12	09:13 (WEA ZB07_wpd)	07:30		06:30	06:18	05:17	04:42
	16:13	14 09:27 (WEA ZB07_wpd)	17:08		18:00	19:55	20:46	21:26
12	08:11	09:14 (WEA ZB07_wpd)	07:28		06:28	06:16	05:15	04:42
	16:15	12 09:26 (WEA ZB07_wpd)	17:10		18:02	19:57	20:48	21:27
13	08:10	09:15 (WEA ZB07_wpd)	07:26		06:26	06:14	05:13	04:42
	16:16	10 09:25 (WEA ZB07_wpd)	17:12		18:04	19:58	20:50	21:27
14	08:10	09:18 (WEA ZB07_wpd)	07:25		06:24	06:11	05:12	04:42
	16:18	5 09:23 (WEA ZB07_wpd)	17:14		18:06	20:00	20:51	21:28
15	08:09		07:23		06:21	06:09	05:10	04:41
	16:19		17:16		18:07	20:02	20:53	21:29
16	08:08		07:21	07:45 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41
	16:21		17:18	4 07:49 (WEA ZB04_wpd)	18:09	20:03	20:54	21:29
17	08:07		07:19	07:43 (WEA ZB04_wpd)	06:17	06:05	05:07	04:41
	16:23		17:20	9 07:52 (WEA ZB04_wpd)	18:11	20:05	20:56	21:30
18	08:06		07:17	07:41 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41
	16:24		17:22	12 07:53 (WEA ZB04_wpd)	18:13	20:07	20:57	21:30
19	08:05		07:15	07:39 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41
	16:26		17:23	15 07:54 (WEA ZB04_wpd)	18:15	20:09	20:59	21:30
20	08:04	08:32 (WEA ZB06_wpd)	07:12	07:37 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41
	16:28	6 08:38 (WEA ZB06_wpd)	17:25	18 07:55 (WEA ZB04_wpd)	18:16	20:10	21:00	21:31
21	08:03	08:31 (WEA ZB06_wpd)	07:10	07:37 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41
	16:29	10 08:41 (WEA ZB06_wpd)	17:27	18 07:55 (WEA ZB04_wpd)	18:18	20:12	21:02	21:31
22	08:02	08:30 (WEA ZB06_wpd)	07:08	07:36 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41
	16:31	13 08:43 (WEA ZB06_wpd)	17:29	18 07:54 (WEA ZB04_wpd)	18:20	20:14	21:03	21:31
23	08:00	08:28 (WEA ZB06_wpd)	07:06	07:36 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42
	16:33	15 08:43 (WEA ZB06_wpd)	17:31	18 07:54 (WEA ZB04_wpd)	18:22	20:16	21:05	21:31
24	07:59	08:28 (WEA ZB06_wpd)	07:04	07:37 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42
	16:35	17 08:45 (WEA ZB06_wpd)	17:33	17 07:54 (WEA ZB04_wpd)	18:23	20:17	21:06	21:31
25	07:58	08:28 (WEA ZB06_wpd)	07:02	07:37 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42
	16:36	18 08:46 (WEA ZB06_wpd)	17:35	16 07:53 (WEA ZB04_wpd)	18:25	20:19	21:08	21:32
26	07:56	08:27 (WEA ZB06_wpd)	07:00	07:39 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43
	16:38	20 08:47 (WEA ZB06_wpd)	17:37	13 07:52 (WEA ZB04_wpd)	18:27	20:21	21:09	21:32
27	07:55	08:27 (WEA ZB06_wpd)	06:58	07:39 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43
	16:40	21 08:48 (WEA ZB06_wpd)	17:38	11 07:50 (WEA ZB04_wpd)	18:29	20:23	21:10	21:31
28	07:54	08:27 (WEA ZB06_wpd)	06:55	07:44 (WEA ZB04_wpd)	05:51	05:41	04:53	04:44
	16:42	21 08:48 (WEA ZB06_wpd)	17:40	2 07:46 (WEA ZB04_wpd)	18:30	20:24	21:12	21:31
29	07:52	08:26 (WEA ZB06_wpd)			06:48	05:39	04:52	04:44
	16:44	22 08:48 (WEA ZB06_wpd)			19:32	20:26	21:13	21:31
30	07:51	08:27 (WEA ZB06_wpd)			06:46	05:37	04:51	04:45
	16:46	22 08:49 (WEA ZB06_wpd)			19:34	20:28	21:14	21:31
31	07:49	08:27 (WEA ZB06_wpd)			06:44		04:50	
	16:47	22 08:49 (WEA ZB06_wpd)			19:36		21:15	
Sonnenscheinstunden		256	276		367	417	488	502
astr.max.mögl.Beschattung		438		292				

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-49 - SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	14
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	10
5	04:49	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	14
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	17
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	19
8	04:51	05:34	06:26	07:16	07:12	07:58
	21:27	20:45	19:38	18:28	16:24	20
9	04:52	05:36	06:27	07:18	07:14	07:58
	21:27	20:44	19:36	18:25	16:22	21
10	04:53	05:37	06:29	07:20	07:16	07:58
	21:26	20:42	19:34	18:23	16:21	21
11	04:54	05:39	06:31	07:21	07:17	07:58
	21:25	20:40	19:31	18:21	16:19	22
12	04:55	05:41	06:32	07:23	07:19	07:58
	21:24	20:38	19:29	18:19	16:17	22
13	04:57	05:42	06:34	07:25	07:21	07:58
	21:23	20:36	19:27	18:16	16:16	22
14	04:58	05:44	06:35	07:27	07:23	07:59
	21:22	20:34	19:24	18:14	16:14	21
15	04:59	05:46	06:37	07:28	07:25	07:59
	21:21	20:32	19:22	18:12	16:13	21
16	05:00	05:47	06:39	07:30	07:26	08:00
	21:20	20:30	19:20	18:10	16:11	20
17	05:01	05:49	06:40	07:32	07:28	08:01
	21:19	20:28	19:17	18:07	16:10	18
18	05:03	05:51	06:42	07:34	07:30	08:02
	21:18	20:26	19:15	18:05	16:09	17
19	05:04	05:52	06:44	07:35	07:32	08:03
	21:17	20:23	19:12	18:03	16:07	15
20	05:05	05:54	06:45	07:37	07:33	08:05
	21:16	20:21	19:10	18:01	16:06	13
21	05:07	05:56	06:47	07:39	07:35	08:07
	21:14	20:19	19:08	17:59	16:05	10
22	05:08	05:57	06:49	07:41	07:37	08:09
	21:13	20:17	19:05	17:57	16:04	6
23	05:09	05:59	06:51	07:43	07:39	08:10
	21:12	20:15	19:03	17:55	16:03	14
24	05:11	06:01	06:52	07:44	07:40	08:12
	21:10	20:13	19:01	17:53	16:01	11
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	8
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	3
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	5
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	9
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	12
31	05:21	06:12		07:57		
	21:00	19:57		16:39		
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				178	359	631

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-50 - SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:01 (WEA ZB07_vpd)   07:48	08:23 (WEA ZB06_vpd)   06:53	07:34 (WEA ZB04_vpd)   06:41	05:35	04:49	
	16:01	23 09:24 (WEA ZB07_vpd)   16:49	22 08:45 (WEA ZB06_vpd)   17:42	13 07:47 (WEA ZB04_vpd)   19:37	20:29	21:16	
2	08:15	09:02 (WEA ZB07_vpd)   07:46	08:23 (WEA ZB06_vpd)   06:51	07:36 (WEA ZB04_vpd)   06:39	05:33	04:48	
	16:02	23 09:25 (WEA ZB07_vpd)   16:51	23 08:46 (WEA ZB06_vpd)   17:44	9 07:45 (WEA ZB04_vpd)   19:39	20:31	21:18	
3	08:15	09:03 (WEA ZB07_vpd)   07:44	08:23 (WEA ZB06_vpd)   06:49		06:37	05:31	04:47
	16:03	22 09:25 (WEA ZB07_vpd)   16:53	23 08:46 (WEA ZB06_vpd)   17:46		19:41	20:33	21:19
4	08:15	09:03 (WEA ZB07_vpd)   07:43	08:24 (WEA ZB06_vpd)   06:46		06:34	05:29	04:46
	16:04	22 09:25 (WEA ZB07_vpd)   16:55	22 08:46 (WEA ZB06_vpd)   17:48		19:43	20:35	21:20
5	08:15	09:04 (WEA ZB07_vpd)   07:41	08:24 (WEA ZB06_vpd)   06:44		06:32	05:28	04:46
	16:05	22 09:26 (WEA ZB07_vpd)   16:57	21 08:45 (WEA ZB06_vpd)   17:49		19:44	20:36	21:21
6	08:14	09:05 (WEA ZB07_vpd)   07:39	08:24 (WEA ZB06_vpd)   06:42		06:30	05:26	04:45
	16:06	22 09:27 (WEA ZB07_vpd)   16:59	21 08:45 (WEA ZB06_vpd)   17:51		19:46	20:38	21:22
7	08:14	09:05 (WEA ZB07_vpd)   07:38	08:25 (WEA ZB06_vpd)   06:40		06:27	05:24	04:44
	16:08	22 09:27 (WEA ZB07_vpd)   17:01	19 08:44 (WEA ZB06_vpd)   17:53		19:48	20:40	21:23
8	08:13	09:05 (WEA ZB07_vpd)   07:36	08:26 (WEA ZB06_vpd)   06:37		06:25	05:22	04:44
	16:09	21 09:26 (WEA ZB07_vpd)   17:03	17 08:43 (WEA ZB06_vpd)   17:55		19:50	20:41	21:24
9	08:13	09:07 (WEA ZB07_vpd)   07:34	08:29 (WEA ZB06_vpd)   06:35		06:23	05:20	04:43
	16:10	20 09:27 (WEA ZB07_vpd)   17:04	13 08:42 (WEA ZB06_vpd)   17:57		19:51	20:43	21:24
10	08:12	09:07 (WEA ZB07_vpd)   07:32	08:31 (WEA ZB06_vpd)   06:33		06:20	05:18	04:43
	16:12	20 09:27 (WEA ZB07_vpd)   17:06	9 08:40 (WEA ZB06_vpd)   17:58		19:53	20:45	21:25
11	08:12	09:08 (WEA ZB07_vpd)   07:30	08:30		06:18	05:17	04:42
	16:13	19 09:27 (WEA ZB07_vpd)   17:08	18:00		19:55	20:46	21:26
12	08:11	09:09 (WEA ZB07_vpd)   07:28	08:28		06:16	05:15	04:42
	16:15	18 09:27 (WEA ZB07_vpd)   17:10	18:02		19:57	20:48	21:27
13	08:10	09:10 (WEA ZB07_vpd)   07:26	08:26		06:14	05:13	04:42
	16:16	16 09:26 (WEA ZB07_vpd)   17:12	18:04		19:58	20:50	21:27
14	08:10	09:11 (WEA ZB07_vpd)   07:25	08:24		06:11	05:12	04:42
	16:18	15 09:26 (WEA ZB07_vpd)   17:14	18:06		20:00	20:51	21:28
15	08:09	09:12 (WEA ZB07_vpd)   07:23	08:21		06:09	05:10	04:41
	16:19	13 09:25 (WEA ZB07_vpd)   17:16	18:07		20:02	20:53	21:29
16	08:08	09:14 (WEA ZB07_vpd)   07:21	08:19		06:07	05:09	04:41
	16:21	10 09:24 (WEA ZB07_vpd)   17:18	18:09		20:03	20:54	21:29
17	08:07	09:16 (WEA ZB07_vpd)   07:19	08:17		06:05	05:07	04:41
	16:23	7 09:23 (WEA ZB07_vpd)   17:20	18:11		20:05	20:56	21:30
18	08:06	07:17	08:14		06:02	05:06	04:41
	16:24	17:22	18:13		20:07	20:57	21:30
19	08:05	07:15	07:39 (WEA ZB04_vpd)   08:12		06:00	05:04	04:41
	16:26	17:23	7 07:46 (WEA ZB04_vpd)   18:15		20:09	20:59	21:30
20	08:04	07:12	07:37 (WEA ZB04_vpd)   08:09		05:58	05:03	04:41
	16:28	17:25	11 07:48 (WEA ZB04_vpd)   18:16		20:10	21:00	21:31
21	08:03	07:10	07:35 (WEA ZB04_vpd)   08:07		05:56	05:01	04:41
	16:29	17:27	15 07:50 (WEA ZB04_vpd)   18:18		20:12	21:02	21:31
22	08:02	07:08	07:32 (WEA ZB04_vpd)   08:05		05:54	05:00	04:42
	16:31	17:29	17 07:49 (WEA ZB04_vpd)   18:20		20:14	21:03	21:31
23	08:00	07:06	07:32 (WEA ZB04_vpd)   08:02		05:52	04:59	04:42
	16:33	5 08:34 (WEA ZB06_vpd)   17:31	18 07:50 (WEA ZB04_vpd)   18:22		20:16	21:05	21:31
24	07:59	08:27 (WEA ZB06_vpd)   07:04	07:31 (WEA ZB04_vpd)   08:00		05:50	04:57	04:42
	16:35	11 08:38 (WEA ZB06_vpd)   17:33	19 07:50 (WEA ZB04_vpd)   18:23		20:17	21:06	21:31
25	07:58	08:26 (WEA ZB06_vpd)   07:02	07:31 (WEA ZB04_vpd)   08:00		05:47	04:56	04:42
	16:36	14 08:40 (WEA ZB06_vpd)   17:35	19 07:50 (WEA ZB04_vpd)   18:25		20:19	21:08	21:32
26	07:56	08:25 (WEA ZB06_vpd)   07:00	07:32 (WEA ZB04_vpd)   08:00		05:45	04:55	04:43
	16:38	16 08:41 (WEA ZB06_vpd)   17:37	18 07:50 (WEA ZB04_vpd)   18:27		20:21	21:09	21:32
27	07:55	08:24 (WEA ZB06_vpd)   06:58	07:31 (WEA ZB04_vpd)   08:03		05:43	04:54	04:43
	16:40	18 08:42 (WEA ZB06_vpd)   17:38	18 07:49 (WEA ZB04_vpd)   18:29		20:23	21:10	21:31
28	07:54	08:24 (WEA ZB06_vpd)   06:55	07:32 (WEA ZB04_vpd)   08:01		05:41	04:53	04:44
	16:42	19 08:43 (WEA ZB06_vpd)   17:40	16 07:48 (WEA ZB04_vpd)   18:30		20:24	21:12	21:31
29	07:52	08:23 (WEA ZB06_vpd)   06:48	06:48		05:39	04:52	04:44
	16:44	21 08:44 (WEA ZB06_vpd)   17:39	19:32		20:26	21:13	21:31
30	07:51	08:23 (WEA ZB06_vpd)   06:46	06:46		05:37	04:51	04:45
	16:46	22 08:45 (WEA ZB06_vpd)   17:41	19:34		20:28	21:14	21:31
31	07:49	08:23 (WEA ZB06_vpd)   06:44	06:44			04:50	
	16:47	22 08:45 (WEA ZB06_vpd)   17:41	19:36			21:15	
Sonnenscheinstunden	256	276	367	417	488	502	
astr.max.mögl.Beschattung	463	348	22				

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-50 - SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:59 (WEA ZB06_wpd) 07:51 08:50 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	10 08:09 (WEA ZB06_wpd) 15:55 19 09:09 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:57 (WEA ZB06_wpd) 07:53 08:50 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	14 08:11 (WEA ZB06_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:56 (WEA ZB06_wpd) 07:54 08:50 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	17 08:13 (WEA ZB06_wpd) 15:54 20 09:10 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:55 (WEA ZB06_wpd) 07:55 08:51 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	19 08:14 (WEA ZB06_wpd) 15:53 20 09:11 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:54 (WEA ZB06_wpd) 07:57 08:50 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	20 08:14 (WEA ZB06_wpd) 15:53 22 09:12 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:54 (WEA ZB06_wpd) 07:58 08:50 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	21 08:15 (WEA ZB06_wpd) 15:52 22 09:12 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:53 (WEA ZB06_wpd) 07:59 08:51 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	22 08:15 (WEA ZB06_wpd) 15:52 22 09:13 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:53 (WEA ZB06_wpd) 08:01 08:51 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	23 08:16 (WEA ZB06_wpd) 15:51 22 09:13 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:53 (WEA ZB06_wpd) 08:02 08:51 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	23 08:16 (WEA ZB06_wpd) 15:51 22 09:13 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:53 (WEA ZB06_wpd) 08:03 08:52 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	23 08:16 (WEA ZB06_wpd) 15:51 23 09:15 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:54 (WEA ZB06_wpd) 08:04 08:53 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	22 08:16 (WEA ZB06_wpd) 15:51 22 09:15 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	08:08 (WEA ZB04_wpd) 07:19	07:54 (WEA ZB06_wpd) 08:05 08:53 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	11 08:19 (WEA ZB04_wpd) 16:17	22 08:16 (WEA ZB06_wpd) 15:51 22 09:15 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	08:06 (WEA ZB04_wpd) 07:21	07:55 (WEA ZB06_wpd) 08:06 08:53 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	15 08:21 (WEA ZB04_wpd) 16:16	20 08:15 (WEA ZB06_wpd) 15:50 23 09:16 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	08:05 (WEA ZB04_wpd) 07:23	07:56 (WEA ZB06_wpd) 08:07 08:54 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	17 08:22 (WEA ZB04_wpd) 16:14	19 08:15 (WEA ZB06_wpd) 15:50 22 09:16 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	08:04 (WEA ZB04_wpd) 07:25	07:57 (WEA ZB06_wpd) 08:08 08:54 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	18 08:22 (WEA ZB04_wpd) 16:13	18 08:15 (WEA ZB06_wpd) 15:51 23 09:17 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	08:03 (WEA ZB04_wpd) 07:26	07:58 (WEA ZB06_wpd) 08:09 08:55 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	19 08:22 (WEA ZB04_wpd) 16:11	16 08:14 (WEA ZB06_wpd) 15:51 23 09:18 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	08:03 (WEA ZB04_wpd) 07:28	07:59 (WEA ZB06_wpd) 08:10 08:54 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	19 08:22 (WEA ZB04_wpd) 16:10	14 08:13 (WEA ZB06_wpd) 15:51 23 09:17 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	08:03 (WEA ZB04_wpd) 07:30	08:01 (WEA ZB06_wpd) 08:11 08:55 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	19 08:22 (WEA ZB04_wpd) 16:09	11 08:12 (WEA ZB06_wpd) 15:51 23 09:18 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	08:03 (WEA ZB04_wpd) 07:32	08:04 (WEA ZB06_wpd) 08:11 08:56 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	18 08:21 (WEA ZB04_wpd) 16:07	5 08:09 (WEA ZB06_wpd) 15:51 23 09:19 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	08:04 (WEA ZB04_wpd) 07:33	08:02 08:12 08:56 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	17 08:21 (WEA ZB04_wpd) 16:06	15:52 23 09:19 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	08:06 (WEA ZB04_wpd) 07:35	08:02 08:12 08:57 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	14 08:20 (WEA ZB04_wpd) 16:05	15:52 22 09:19 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	08:08 (WEA ZB04_wpd) 07:37	08:03 08:13 08:57 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	10 08:18 (WEA ZB04_wpd) 16:04	15:53 22 09:19 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	08:10 (WEA ZB04_wpd) 07:39	08:14 08:14 08:58 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	6 08:16 (WEA ZB04_wpd) 16:03	15:53 22 09:20 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:14 08:14 08:58 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	15:54 23 09:21 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:54 (WEA ZB07_wpd) 08:14 08:58 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	7 09:01 (WEA ZB07_wpd) 15:54 23 09:21 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	08:53 (WEA ZB07_wpd) 08:15 08:59 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	10 09:03 (WEA ZB07_wpd) 15:55 23 09:22 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	08:51 (WEA ZB07_wpd) 08:15 09:00 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	13 09:04 (WEA ZB07_wpd) 15:56 22 09:22 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	08:51 (WEA ZB07_wpd) 08:15 09:00 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	15 09:06 (WEA ZB07_wpd) 15:57 23 09:23 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	08:51 (WEA ZB07_wpd) 08:15 09:00 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	16 09:07 (WEA ZB07_wpd) 15:57 23 09:23 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	08:50 (WEA ZB07_wpd) 08:15 09:01 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	18 09:08 (WEA ZB07_wpd) 15:58 23 09:24 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:51	08:51 (WEA ZB07_wpd) 08:15 09:02 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	22 09:24 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				186	418	687

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-51 - SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg  
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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

Januar		Februar		März		April		Mai		Juni	
1	08:15	09:04 (WEA ZB07_vpd)	07:48	08:24 (WEA ZB06_vpd)	06:53	07:36 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	22 09:26 (WEA ZB07_vpd)	16:49	23 08:47 (WEA ZB06_vpd)	17:42	11 07:47 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:05 (WEA ZB07_vpd)	07:46	08:25 (WEA ZB06_vpd)	06:51	07:39 (WEA ZB04_vpd)	06:39	05:33	04:48		
	16:02	22 09:27 (WEA ZB07_vpd)	16:51	23 08:48 (WEA ZB06_vpd)	17:44	5 07:44 (WEA ZB04_vpd)	19:39	20:31	21:18		
3	08:15	09:05 (WEA ZB07_vpd)	07:44	08:25 (WEA ZB06_vpd)	06:49		06:37	05:31	04:47		
	16:03	23 09:28 (WEA ZB07_vpd)	16:53	23 08:48 (WEA ZB06_vpd)	17:46		19:41	20:33	21:19		
4	08:15	09:05 (WEA ZB07_vpd)	07:43	23 08:26 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46		
	16:04	22 09:27 (WEA ZB07_vpd)	16:55	21 08:47 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20		
5	08:15	09:06 (WEA ZB07_vpd)	07:41	21 08:26 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	22 09:28 (WEA ZB07_vpd)	16:57	21 08:47 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:08 (WEA ZB07_vpd)	07:39	19 08:27 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	21 09:29 (WEA ZB07_vpd)	16:59	19 08:46 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:08 (WEA ZB07_vpd)	07:38	17 08:28 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	21 09:29 (WEA ZB07_vpd)	17:01	17 08:45 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:08 (WEA ZB07_vpd)	07:36	17 08:29 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	20 09:28 (WEA ZB07_vpd)	17:03	15 08:44 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:10 (WEA ZB07_vpd)	07:34	15 08:32 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	19 09:29 (WEA ZB07_vpd)	17:04	11 08:43 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:10 (WEA ZB07_vpd)	07:32	11 08:36 (WEA ZB06_vpd)	06:33		06:20	05:18	04:43		
	16:12	19 09:29 (WEA ZB07_vpd)	17:06	2 08:38 (WEA ZB06_vpd)	17:58		19:53	20:45	21:25		
11	08:12	09:11 (WEA ZB07_vpd)	07:30		06:30		06:18	05:17	04:42		
	16:13	17 09:28 (WEA ZB07_vpd)	17:08		18:00		19:55	20:46	21:26		
12	08:11	09:12 (WEA ZB07_vpd)	07:28		06:28		06:16	05:15	04:42		
	16:15	16 09:28 (WEA ZB07_vpd)	17:10		18:02		19:57	20:48	21:27		
13	08:10	09:13 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42		
	16:16	15 09:28 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27		
14	08:10	09:14 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	13 09:27 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	09:16 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	10 09:26 (WEA ZB07_vpd)	17:16		18:07		20:02	20:53	21:29		
16	08:08	09:18 (WEA ZB07_vpd)	07:21		06:19		06:07	05:09	04:41		
	16:21	6 09:24 (WEA ZB07_vpd)	17:18		18:09		20:03	20:54	21:29		
17	08:07		07:19		06:17		06:05	05:07	04:41		
	16:23		17:20		18:11		20:05	20:56	21:30		
18	08:06		07:17		06:14		06:02	05:06	04:41		
	16:24		17:22	5 07:41 (WEA ZB04_vpd)	18:13		20:07	20:57	21:30		
19	08:05		07:15	5 07:46 (WEA ZB04_vpd)	18:13		06:00	05:04	04:41		
	16:26		17:23	10 07:39 (WEA ZB04_vpd)	06:12		20:09	20:59	21:30		
20	08:04		07:12	10 07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28		17:25	13 07:50 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03		07:10	13 07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29		17:27	16 07:51 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02	08:31 (WEA ZB06_vpd)	07:08	16 07:33 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31	6 08:37 (WEA ZB06_vpd)	17:29	18 07:51 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:28 (WEA ZB06_vpd)	07:06	18 07:33 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	11 08:39 (WEA ZB06_vpd)	17:31	18 07:51 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:27 (WEA ZB06_vpd)	07:04	18 07:32 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	14 08:41 (WEA ZB06_vpd)	17:33	20 07:52 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:27 (WEA ZB06_vpd)	07:02	20 07:32 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	16 08:43 (WEA ZB06_vpd)	17:35	19 07:52 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:26 (WEA ZB06_vpd)	07:00	19 07:33 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	18 08:44 (WEA ZB06_vpd)	17:37	18 07:51 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:25 (WEA ZB06_vpd)	06:58	17 07:33 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	19 08:44 (WEA ZB06_vpd)	17:38	17 07:50 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:25 (WEA ZB06_vpd)	06:55	15 07:34 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	21 08:46 (WEA ZB06_vpd)	17:40	15 07:49 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
	19:52	08:24 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	22 08:46 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:25 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	22 08:47 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:25 (WEA ZB06_vpd)			06:44			04:50			
	16:47	22 08:47 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden	256		276		367		417	488	502		
astr.max.mögl.Beschattung	459		344		16						

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-51 - SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg  
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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	04:45	05:23	06:14	07:04	06:59	08:03 (WEA ZB06_wpd) 07:51 08:53 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	6 08:09 (WEA ZB06_wpd) 15:55 17 09:10 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	08:00 (WEA ZB06_wpd) 07:53 08:53 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	12 08:12 (WEA ZB06_wpd) 15:54 19 09:12 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:58 (WEA ZB06_wpd) 07:54 08:53 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	16 08:14 (WEA ZB06_wpd) 15:54 19 09:12 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:57 (WEA ZB06_wpd) 07:55 08:53 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	18 08:15 (WEA ZB06_wpd) 15:53 20 09:13 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	07:56 (WEA ZB06_wpd) 07:57 08:53 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	20 08:16 (WEA ZB06_wpd) 15:53 21 09:14 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:56 (WEA ZB06_wpd) 07:58 08:53 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	21 08:17 (WEA ZB06_wpd) 15:52 21 09:14 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:55 (WEA ZB06_wpd) 07:59 08:54 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	22 08:17 (WEA ZB06_wpd) 15:52 21 09:15 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	07:55 (WEA ZB06_wpd) 08:01 08:53 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	23 08:18 (WEA ZB06_wpd) 15:51 22 09:15 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	07:55 (WEA ZB06_wpd) 08:02 08:54 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	23 08:18 (WEA ZB06_wpd) 15:51 22 09:16 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	07:55 (WEA ZB06_wpd) 08:03 08:55 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	23 08:18 (WEA ZB06_wpd) 15:51 22 09:17 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	07:55 (WEA ZB06_wpd) 08:04 08:55 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	23 08:18 (WEA ZB06_wpd) 15:51 22 09:17 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	07:56 (WEA ZB06_wpd) 08:05 08:55 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	22 08:18 (WEA ZB06_wpd) 15:51 23 09:18 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	07:56 (WEA ZB06_wpd) 08:06 08:56 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	22 08:18 (WEA ZB06_wpd) 15:50 22 09:18 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	07:57 (WEA ZB06_wpd) 08:07 08:56 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	21 08:18 (WEA ZB06_wpd) 15:50 23 09:19 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	07:58 (WEA ZB06_wpd) 08:08 08:56 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	19 08:17 (WEA ZB06_wpd) 15:51 23 09:19 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	07:59 (WEA ZB06_wpd) 08:09 08:57 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	18 08:17 (WEA ZB06_wpd) 15:51 23 09:20 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:00 (WEA ZB06_wpd) 08:10 08:57 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	16 08:16 (WEA ZB06_wpd) 15:51 23 09:20 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:01 (WEA ZB06_wpd) 08:11 08:57 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	14 08:15 (WEA ZB06_wpd) 15:51 23 09:20 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:03 (WEA ZB06_wpd) 08:11 08:58 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	11 08:14 (WEA ZB06_wpd) 15:51 23 09:21 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:06 (WEA ZB06_wpd) 08:12 08:58 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	6 08:12 (WEA ZB06_wpd) 15:52 23 09:21 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:06 (WEA ZB06_wpd) 08:12 08:59 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15 08:21 (WEA ZB06_wpd) 15:52 23 09:22 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:08 (WEA ZB06_wpd) 08:13 08:59 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	12 08:20 (WEA ZB06_wpd) 15:53 23 09:22 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:10 (WEA ZB06_wpd) 08:14 09:00 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	8 08:18 (WEA ZB06_wpd) 15:53 23 09:23 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:12 (WEA ZB06_wpd) 08:14 09:00 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	3 08:15 (WEA ZB06_wpd) 15:54 23 09:23 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	08:14 09:00 (WEA ZB07_wpd) 15:54 23 09:23 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	08:57 (WEA ZB07_wpd) 08:15 09:02 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	6 09:03 (WEA ZB07_wpd) 15:55 22 09:24 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	08:55 (WEA ZB07_wpd) 08:15 09:02 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	10 09:05 (WEA ZB07_wpd) 15:56 23 09:25 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	08:54 (WEA ZB07_wpd) 08:15 09:02 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	13 09:07 (WEA ZB07_wpd) 15:57 23 09:25 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	08:54 (WEA ZB07_wpd) 08:15 09:03 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	15 09:09 (WEA ZB07_wpd) 15:57 23 09:26 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	08:53 (WEA ZB07_wpd) 08:15 09:03 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	16 09:09 (WEA ZB07_wpd) 15:58 23 09:26 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	08:15 09:04 (WEA ZB07_wpd) 15:59 23 09:27 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:52	264 416 241 684
	21:00	19:57	18:43	16:39	15:55	
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				186	416	684

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-52 - SR-52, Hasenweg 1a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:09 (WEA ZB07_wpd)   07:48	08:28 (WEA ZB06_wpd)   06:53	07:42 (WEA ZB04_wpd)   06:41	05:35	04:49
	16:01	21 09:30 (WEA ZB07_wpd)   16:49	23 08:51 (WEA ZB06_wpd)   17:42	5 07:47 (WEA ZB04_wpd)   19:37	20:29	21:16
2	08:15	09:09 (WEA ZB07_wpd)   07:46	08:30 (WEA ZB06_wpd)   06:51		06:39	05:33
	16:02	22 09:31 (WEA ZB07_wpd)   16:51	22 08:52 (WEA ZB06_wpd)   17:44		19:39	20:31
3	08:15	09:10 (WEA ZB07_wpd)   07:44	08:30 (WEA ZB06_wpd)   06:49		06:37	05:31
	16:03	21 09:31 (WEA ZB07_wpd)   16:53	21 08:51 (WEA ZB06_wpd)   17:46		19:41	20:33
4	08:15	09:10 (WEA ZB07_wpd)   07:43	20 08:31 (WEA ZB06_wpd)   06:46		06:34	05:29
	16:04	21 09:31 (WEA ZB07_wpd)   16:55	20 08:51 (WEA ZB06_wpd)   17:48		19:43	20:35
5	08:15	09:12 (WEA ZB07_wpd)   07:41	08:31 (WEA ZB06_wpd)   06:44		06:32	05:28
	16:05	20 09:32 (WEA ZB07_wpd)   16:57	19 08:50 (WEA ZB06_wpd)   17:49		19:44	20:36
6	08:14	09:13 (WEA ZB07_wpd)   07:39	08:32 (WEA ZB06_wpd)   06:42		06:30	05:26
	16:06	19 09:32 (WEA ZB07_wpd)   16:59	17 08:49 (WEA ZB06_wpd)   17:51		19:46	20:38
7	08:14	09:13 (WEA ZB07_wpd)   07:38	08:34 (WEA ZB06_wpd)   06:40		06:27	05:24
	16:08	19 09:32 (WEA ZB07_wpd)   17:01	13 08:47 (WEA ZB06_wpd)   17:53		19:48	20:40
8	08:13	09:14 (WEA ZB07_wpd)   07:36	08:36 (WEA ZB06_wpd)   06:37		06:25	05:22
	16:09	17 09:31 (WEA ZB07_wpd)   17:03	8 08:44 (WEA ZB06_wpd)   17:55		19:50	20:41
9	08:13	09:15 (WEA ZB07_wpd)   07:34			06:23	05:20
	16:10	17 09:32 (WEA ZB07_wpd)   17:04			19:51	20:43
10	08:12	09:16 (WEA ZB07_wpd)   07:32			06:20	05:18
	16:12	16 09:32 (WEA ZB07_wpd)   17:06			19:53	20:45
11	08:12	09:17 (WEA ZB07_wpd)   07:30			06:18	05:17
	16:13	14 09:31 (WEA ZB07_wpd)   17:08			19:55	20:48
12	08:11	09:18 (WEA ZB07_wpd)   07:28			06:16	05:15
	16:15	12 09:30 (WEA ZB07_wpd)   17:10			19:57	20:48
13	08:10	09:20 (WEA ZB07_wpd)   07:26			06:14	05:13
	16:16	9 09:29 (WEA ZB07_wpd)   17:12			19:58	20:50
14	08:10	09:23 (WEA ZB07_wpd)   07:25			06:11	05:12
	16:18	4 09:27 (WEA ZB07_wpd)   17:14			20:00	20:51
15	08:09				06:09	05:10
	16:19				20:02	20:53
16	08:08				06:07	05:09
	16:21				20:03	20:54
17	08:07				06:05	05:07
	16:23				20:05	20:56
18	08:06				06:02	05:06
	16:24				20:07	20:57
19	08:05				06:00	05:04
	16:26				20:09	20:59
20	08:04				05:58	05:03
	16:28				20:10	21:00
21	08:03				05:56	05:01
	16:29				20:12	21:02
22	08:02				05:54	05:00
	16:31				20:14	21:03
23	08:00				05:52	04:59
	16:33				20:16	21:05
24	07:59				05:50	04:57
	16:35				20:17	21:06
25	07:58				05:47	04:56
	16:36				20:19	21:08
26	07:56				05:45	04:55
	16:38				20:21	21:09
27	07:55				05:43	04:54
	16:40				20:23	21:10
28	07:54				05:41	04:53
	16:42				20:24	21:12
29	07:52				05:39	04:52
	16:44				20:26	21:13
30	07:51				05:37	04:51
	16:46				20:28	21:14
31	07:49					04:50
	16:47					21:15
Sonnenscheinstunden	256				417	502
astr.max.mögl.Beschattung	454					

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-52 - SR-52, Hasenweg 1a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:49	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:11
	21:18	20:26	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	06:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	06:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	06:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	06:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	06:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	06:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	06:57	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				193	391	652

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-53 - SR-53, Hasenweg 1, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:04 (WEA ZB07_vpd)	07:48	08:26 (WEA ZB06_vpd)	06:53	07:39 (WEA ZB04_vpd)	06:41	05:35	04:49		
	16:01	23 09:27 (WEA ZB07_vpd)	16:49	22 08:48 (WEA ZB06_vpd)	17:42	8 07:47 (WEA ZB04_vpd)	19:37	20:29	21:16		
2	08:15	09:05 (WEA ZB07_vpd)	07:46	08:27 (WEA ZB06_vpd)	06:51		06:39	05:33	04:48		
	16:02	22 09:27 (WEA ZB07_vpd)	16:51	22 08:49 (WEA ZB06_vpd)	17:44		19:39	20:31	21:18		
3	08:15	09:06 (WEA ZB07_vpd)	07:44	08:27 (WEA ZB06_vpd)	06:49		06:37	05:31	04:47		
	16:03	22 09:28 (WEA ZB07_vpd)	16:53	21 08:48 (WEA ZB06_vpd)	17:46		19:41	20:33	21:19		
4	08:15	09:06 (WEA ZB07_vpd)	07:43	08:27 (WEA ZB06_vpd)	06:46		06:34	05:29	04:46		
	16:04	22 09:28 (WEA ZB07_vpd)	16:55	21 08:48 (WEA ZB06_vpd)	17:48		19:43	20:35	21:20		
5	08:15	09:07 (WEA ZB07_vpd)	07:41	08:28 (WEA ZB06_vpd)	06:44		06:32	05:28	04:46		
	16:05	21 09:28 (WEA ZB07_vpd)	16:57	19 08:47 (WEA ZB06_vpd)	17:49		19:44	20:36	21:21		
6	08:14	09:08 (WEA ZB07_vpd)	07:39	08:28 (WEA ZB06_vpd)	06:42		06:30	05:26	04:45		
	16:06	21 09:29 (WEA ZB07_vpd)	16:59	18 08:46 (WEA ZB06_vpd)	17:51		19:46	20:38	21:22		
7	08:14	09:09 (WEA ZB07_vpd)	07:38	08:30 (WEA ZB06_vpd)	06:40		06:27	05:24	04:44		
	16:08	20 09:29 (WEA ZB07_vpd)	17:01	15 08:45 (WEA ZB06_vpd)	17:53		19:48	20:40	21:23		
8	08:13	09:09 (WEA ZB07_vpd)	07:36	08:31 (WEA ZB06_vpd)	06:37		06:25	05:22	04:44		
	16:09	19 09:28 (WEA ZB07_vpd)	17:03	13 08:44 (WEA ZB06_vpd)	17:55		19:50	20:41	21:24		
9	08:13	09:10 (WEA ZB07_vpd)	07:34	08:35 (WEA ZB06_vpd)	06:35		06:23	05:20	04:43		
	16:10	19 09:29 (WEA ZB07_vpd)	17:04	7 08:42 (WEA ZB06_vpd)	17:57		19:51	20:43	21:24		
10	08:12	09:11 (WEA ZB07_vpd)	07:32		06:33		06:20	05:18	04:43		
	16:12	18 09:29 (WEA ZB07_vpd)	17:06		17:58		19:53	20:45	21:25		
11	08:12	09:12 (WEA ZB07_vpd)	07:30		06:30		06:18	05:17	04:42		
	16:13	16 09:28 (WEA ZB07_vpd)	17:08		18:00		19:55	20:46	21:26		
12	08:11	09:13 (WEA ZB07_vpd)	07:28		06:28		06:16	05:15	04:42		
	16:15	15 09:28 (WEA ZB07_vpd)	17:10		18:02		19:57	20:48	21:27		
13	08:10	09:14 (WEA ZB07_vpd)	07:26		06:26		06:14	05:13	04:42		
	16:16	13 09:27 (WEA ZB07_vpd)	17:12		18:04		19:58	20:50	21:27		
14	08:10	09:15 (WEA ZB07_vpd)	07:25		06:24		06:11	05:12	04:42		
	16:18	12 09:27 (WEA ZB07_vpd)	17:14		18:06		20:00	20:51	21:28		
15	08:09	09:17 (WEA ZB07_vpd)	07:23		06:21		06:09	05:10	04:41		
	16:19	8 09:25 (WEA ZB07_vpd)	07:21		18:07		20:02	20:53	21:29		
16	08:08		07:21		06:19		06:07	05:09	04:41		
	16:21		17:18		18:09		20:03	20:54	21:29		
17	08:07		07:19	07:43 (WEA ZB04_vpd)	06:17		06:05	05:07	04:41		
	16:23		17:20	2 07:45 (WEA ZB04_vpd)	18:11		20:05	20:56	21:30		
18	08:06		07:17	07:41 (WEA ZB04_vpd)	06:14		06:02	05:06	04:41		
	16:24		17:22	8 07:49 (WEA ZB04_vpd)	18:13		20:07	20:57	21:30		
19	08:05		07:15	07:39 (WEA ZB04_vpd)	06:12		06:00	05:04	04:41		
	16:26		17:23	12 07:51 (WEA ZB04_vpd)	18:15		20:09	20:59	21:30		
20	08:04		07:12	07:37 (WEA ZB04_vpd)	06:09		05:58	05:03	04:41		
	16:28		17:25	15 07:52 (WEA ZB04_vpd)	18:16		20:10	21:00	21:31		
21	08:03	08:33 (WEA ZB06_vpd)	07:10	07:35 (WEA ZB04_vpd)	06:07		05:56	05:01	04:41		
	16:29	3 08:36 (WEA ZB06_vpd)	17:27	18 07:53 (WEA ZB04_vpd)	18:18		20:12	21:02	21:31		
22	08:02	08:30 (WEA ZB06_vpd)	07:08	07:34 (WEA ZB04_vpd)	06:05		05:54	05:00	04:41		
	16:31	10 08:40 (WEA ZB06_vpd)	17:29	18 07:52 (WEA ZB04_vpd)	18:20		20:14	21:03	21:31		
23	08:00	08:28 (WEA ZB06_vpd)	07:06	07:34 (WEA ZB04_vpd)	06:02		05:52	04:59	04:42		
	16:33	13 08:41 (WEA ZB06_vpd)	17:31	19 07:53 (WEA ZB04_vpd)	18:22		20:16	21:05	21:31		
24	07:59	08:28 (WEA ZB06_vpd)	07:04	07:34 (WEA ZB04_vpd)	06:00		05:50	04:57	04:42		
	16:35	15 08:43 (WEA ZB06_vpd)	17:33	19 07:53 (WEA ZB04_vpd)	18:23		20:17	21:06	21:31		
25	07:58	08:27 (WEA ZB06_vpd)	07:02	07:34 (WEA ZB04_vpd)	05:58		05:47	04:56	04:42		
	16:36	18 08:45 (WEA ZB06_vpd)	17:35	19 07:53 (WEA ZB04_vpd)	18:25		20:19	21:08	21:32		
26	07:56	08:26 (WEA ZB06_vpd)	07:00	07:35 (WEA ZB04_vpd)	05:55		05:45	04:55	04:43		
	16:38	19 08:45 (WEA ZB06_vpd)	17:37	17 07:52 (WEA ZB04_vpd)	18:27		20:21	21:09	21:32		
27	07:55	08:26 (WEA ZB06_vpd)	06:58	07:35 (WEA ZB04_vpd)	05:53		05:43	04:54	04:43		
	16:40	21 08:47 (WEA ZB06_vpd)	17:38	15 07:50 (WEA ZB04_vpd)	18:29		20:23	21:10	21:31		
28	07:54	08:26 (WEA ZB06_vpd)	06:55	07:36 (WEA ZB04_vpd)	05:51		05:41	04:53	04:44		
	16:42	21 08:47 (WEA ZB06_vpd)	17:40	13 07:49 (WEA ZB04_vpd)	18:30		20:24	21:12	21:31		
29	07:52	08:25 (WEA ZB06_vpd)			06:48		05:39	04:52	04:44		
	16:44	22 08:47 (WEA ZB06_vpd)			19:32		20:26	21:13	21:31		
30	07:51	08:26 (WEA ZB06_vpd)			06:46		05:37	04:51	04:45		
	16:46	22 08:48 (WEA ZB06_vpd)			19:34		20:28	21:14	21:31		
31	07:49	08:26 (WEA ZB06_vpd)			06:44			04:50			
	16:47	22 08:48 (WEA ZB06_vpd)			19:36			21:15			
Sonnenscheinstunden		256			367		417	488	502		
astr.max.mögl.Beschattung		457	276	333		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	Zeitpunkt (SS:MM) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-53 - SR-53, Hasenweg 1, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	16
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	18
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	18
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:49	05:29	06:21	07:11	07:06	18
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	20
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	21
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	21
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	22
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	23
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	23
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	23
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	23
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	23
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	23
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	23
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	23
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	23
	21:18	20:26	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	23
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	23
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	23
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	23
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	23
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	23
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	23
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	23
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	23
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	23
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	23
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	23
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:03	07:56	15:56	15:58
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	311	264	241
astr.max.mögl.Beschattung				185	396	668

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-54 - SR-54, Hasenweg 2a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:10 (WEA ZB07_wpd)	07:48	08:30 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49
	16:01	20 09:30 (WEA ZB07_wpd)	16:49	22 08:52 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16
2	08:15	09:11 (WEA ZB07_wpd)	07:46	08:32 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48
	16:02	20 09:31 (WEA ZB07_wpd)	16:51	20 08:52 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18
3	08:15	09:11 (WEA ZB07_wpd)	07:44	08:32 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47
	16:03	20 09:31 (WEA ZB07_wpd)	16:53	20 08:52 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19
4	08:15	09:12 (WEA ZB07_wpd)	07:43	08:33 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46
	16:04	19 09:31 (WEA ZB07_wpd)	16:55	18 08:51 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20
5	08:15	09:13 (WEA ZB07_wpd)	07:41	08:34 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46
	16:05	18 09:31 (WEA ZB07_wpd)	16:57	16 08:50 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21
6	08:14	09:14 (WEA ZB07_wpd)	07:39	08:36 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45
	16:06	18 09:32 (WEA ZB07_wpd)	16:59	12 08:48 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22
7	08:14	09:14 (WEA ZB07_wpd)	07:38	08:38 (WEA ZB06_wpd)	06:40	06:27	05:24	04:44
	16:08	18 09:32 (WEA ZB07_wpd)	17:01	7 08:45 (WEA ZB06_wpd)	17:53	19:48	20:40	21:23
8	08:13	09:15 (WEA ZB07_wpd)	07:36		06:37	06:25	05:22	04:44
	16:09	16 09:31 (WEA ZB07_wpd)	17:03		17:55	19:50	20:41	21:24
9	08:13	09:17 (WEA ZB07_wpd)	07:34		06:35	06:23	05:20	04:43
	16:10	15 09:32 (WEA ZB07_wpd)	17:04		17:57	19:51	20:43	21:24
10	08:12	09:18 (WEA ZB07_wpd)	07:32		06:33	06:20	05:18	04:43
	16:12	13 09:31 (WEA ZB07_wpd)	17:06		17:58	19:53	20:45	21:25
11	08:12	09:19 (WEA ZB07_wpd)	07:30		06:30	06:18	05:17	04:42
	16:13	11 09:30 (WEA ZB07_wpd)	17:08		18:00	19:55	20:46	21:26
12	08:11	09:21 (WEA ZB07_wpd)	07:28		06:28	06:16	05:15	04:42
	16:15	8 09:29 (WEA ZB07_wpd)	17:10		18:02	19:57	20:48	21:27
13	08:10	09:24 (WEA ZB07_wpd)	07:26		06:26	06:14	05:13	04:42
	16:16	2 09:26 (WEA ZB07_wpd)	17:12		18:04	19:58	20:50	21:27
14	08:10		07:25		06:24	06:11	05:12	04:42
	16:18		17:14		18:06	20:00	20:51	21:28
15	08:09		07:23		06:21	06:09	05:10	04:41
	16:19		17:16		18:07	20:02	20:53	21:29
16	08:08		07:21	7 07:45 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41
	16:21		17:18	7 07:52 (WEA ZB04_wpd)	18:09	20:03	20:54	21:29
17	08:07		07:19	7 07:43 (WEA ZB04_wpd)	06:17	06:05	05:07	04:41
	16:23		17:20	11 07:54 (WEA ZB04_wpd)	18:11	20:05	20:56	21:30
18	08:06		07:17	7 07:41 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41
	16:24		17:22	14 07:55 (WEA ZB04_wpd)	18:13	20:07	20:57	21:30
19	08:05	9 08:34 (WEA ZB06_wpd)	07:15	7 07:39 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41
	16:26	08:43 (WEA ZB06_wpd)	17:23	17 07:56 (WEA ZB04_wpd)	18:15	20:09	20:59	21:30
20	08:04	08:32 (WEA ZB06_wpd)	07:12	7 07:38 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41
	16:28	12 08:44 (WEA ZB06_wpd)	17:25	19 07:57 (WEA ZB04_wpd)	18:16	20:10	21:00	21:31
21	08:03	08:31 (WEA ZB06_wpd)	07:10	7 07:38 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41
	16:29	15 08:46 (WEA ZB06_wpd)	17:27	19 07:57 (WEA ZB04_wpd)	18:18	20:12	21:02	21:31
22	08:02	08:31 (WEA ZB06_wpd)	07:08	7 07:37 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41
	16:31	17 08:48 (WEA ZB06_wpd)	17:29	19 07:56 (WEA ZB04_wpd)	18:20	20:14	21:03	21:31
23	08:00	08:30 (WEA ZB06_wpd)	07:06	7 07:37 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42
	16:33	18 08:48 (WEA ZB06_wpd)	17:31	19 07:56 (WEA ZB04_wpd)	18:22	20:16	21:05	21:31
24	07:59	08:30 (WEA ZB06_wpd)	07:04	7 07:38 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42
	16:35	20 08:50 (WEA ZB06_wpd)	17:33	18 07:56 (WEA ZB04_wpd)	18:23	20:17	21:06	21:31
25	07:58	08:30 (WEA ZB06_wpd)	07:02	7 07:39 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42
	16:36	21 08:51 (WEA ZB06_wpd)	17:35	16 07:55 (WEA ZB04_wpd)	18:25	20:19	21:08	21:32
26	07:56	08:29 (WEA ZB06_wpd)	07:00	7 07:40 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43
	16:38	22 08:51 (WEA ZB06_wpd)	17:37	14 07:54 (WEA ZB04_wpd)	18:27	20:21	21:09	21:32
27	07:55	08:30 (WEA ZB06_wpd)	06:58	7 07:41 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43
	16:40	22 08:52 (WEA ZB06_wpd)	17:38	10 07:51 (WEA ZB04_wpd)	18:29	20:23	21:10	21:31
28	07:54	08:30 (WEA ZB06_wpd)	06:55	7 07:44 (WEA ZB04_wpd)	05:51	05:41	04:53	04:44
	16:42	22 08:52 (WEA ZB06_wpd)	17:40	4 07:48 (WEA ZB04_wpd)	18:30	20:24	21:12	21:31
29	07:52	08:29 (WEA ZB06_wpd)			06:48	05:39	04:52	04:44
	16:44	23 08:52 (WEA ZB06_wpd)			19:32	20:26	21:13	21:31
30	07:51	08:30 (WEA ZB06_wpd)			06:46	05:37	04:51	04:45
	16:46	23 08:53 (WEA ZB06_wpd)			19:34	20:28	21:14	21:31
31	07:49	08:30 (WEA ZB06_wpd)			06:44		04:50	
	16:47	22 08:52 (WEA ZB06_wpd)			19:36		21:15	
Sonnenscheinstunden	256		276		367	417	488	502
astr.max.mögl.Beschattung	444		302					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-54 - SR-54, Hasenweg 2a, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	11 09:12 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	09:01 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	13 09:14 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	09:00 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	15 09:15 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	09:00 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	8 09:16 (WEA ZB07_wpd)
5	04:49	05:29	06:21	07:11	07:06	09:00 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	13 09:17 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	08:04 (WEA ZB06_wpd)
	21:28	20:49	19:43	18:32	16:27	16 07:58
7	04:50	05:32	06:24	07:14	07:10	15:52
	21:28	20:47	19:41	18:30	16:26	18 08:03 (WEA ZB06_wpd)
8	04:51	05:34	06:26	07:16	07:12	18 08:02 (WEA ZB06_wpd)
	21:27	20:45	19:38	18:28	16:24	20 08:22 (WEA ZB06_wpd)
9	04:52	05:36	06:27	07:18	07:14	08:01 (WEA ZB06_wpd)
	21:27	20:44	19:36	18:25	16:22	21 08:22 (WEA ZB06_wpd)
10	04:53	05:37	06:29	07:20	07:16	08:01 (WEA ZB06_wpd)
	21:26	20:42	19:34	18:23	16:21	22 08:23 (WEA ZB06_wpd)
11	04:54	05:39	06:31	07:21	07:17	22 08:01 (WEA ZB06_wpd)
	21:25	20:40	19:31	18:21	16:19	22 08:23 (WEA ZB06_wpd)
12	04:55	05:41	06:32	07:23	07:19	08:01 (WEA ZB06_wpd)
	21:24	20:38	19:29	18:19	16:17	23 08:24 (WEA ZB06_wpd)
13	04:57	05:42	06:34	07:25	07:21	08:01 (WEA ZB06_wpd)
	21:23	20:36	19:27	18:16	16:16	23 08:24 (WEA ZB06_wpd)
14	04:58	05:44	06:35	07:27	07:23	08:01 (WEA ZB06_wpd)
	21:22	20:34	19:24	18:14	16:14	23 08:24 (WEA ZB06_wpd)
15	04:59	05:46	06:37	07:28	07:25	23 08:02 (WEA ZB06_wpd)
	21:21	20:32	19:22	18:12	16:13	22 08:24 (WEA ZB06_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:02 (WEA ZB06_wpd)
	21:20	20:30	19:20	18:10	16:11	22 08:24 (WEA ZB06_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:03 (WEA ZB06_wpd)
	21:19	20:28	19:17	18:07	16:10	21 08:24 (WEA ZB06_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:04 (WEA ZB06_wpd)
	21:18	20:26	19:15	18:05	16:09	19 08:23 (WEA ZB06_wpd)
19	05:04	05:52	06:44	07:35	07:32	19 08:05 (WEA ZB06_wpd)
	21:17	20:23	19:12	18:03	16:07	18 08:23 (WEA ZB06_wpd)
20	05:05	05:54	06:45	07:37	07:33	18 08:06 (WEA ZB06_wpd)
	21:16	20:21	19:10	18:01	16:06	17 08:23 (WEA ZB06_wpd)
21	05:07	05:56	06:47	07:39	07:35	17 08:07 (WEA ZB06_wpd)
	21:14	20:19	19:08	17:59	16:05	15 08:22 (WEA ZB06_wpd)
22	05:08	05:57	06:49	07:41	07:37	15 08:09 (WEA ZB06_wpd)
	21:13	20:17	19:05	17:57	16:04	12 08:21 (WEA ZB06_wpd)
23	05:09	05:59	06:51	07:43	07:39	12 08:10 (WEA ZB06_wpd)
	21:12	20:15	19:03	17:55	16:03	9 08:19 (WEA ZB06_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:14 (WEA ZB06_wpd)
	21:10	20:13	19:01	17:53	16:01	2 08:16 (WEA ZB06_wpd)
25	05:12	06:02	06:54	07:46	07:42	15:54
	21:09	20:10	18:58	16:50	16:00	08:14
26	05:14	06:04	06:56	07:48	07:43	22 09:28 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	08:15
27	05:15	06:06	06:57	07:50	07:45	22 09:29 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	22 09:08 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	21 09:08 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	22 09:30 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	21 09:09 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:56	15:55	21 09:30 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	21 09:10 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				188	374	616

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-55 - SR-55, Hasenweg 3A, 15374 Müncheberg  
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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	08:15	09:11 (WEA ZB07_wpd)	07:48	08:32 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49	
	16:01	19 09:30 (WEA ZB07_wpd)	16:49	21 08:53 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16	
2	08:15	09:12 (WEA ZB07_wpd)	07:46	08:34 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48	
	16:02	19 09:31 (WEA ZB07_wpd)	16:51	19 08:53 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18	
3	08:15	09:13 (WEA ZB07_wpd)	07:44	08:34 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47	
	16:03	18 09:31 (WEA ZB07_wpd)	16:53	18 08:52 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19	
4	08:15	09:13 (WEA ZB07_wpd)	07:43	08:36 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46	
	16:04	18 09:31 (WEA ZB07_wpd)	16:55	15 08:51 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20	
5	08:15	09:14 (WEA ZB07_wpd)	07:41	08:37 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46	
	16:05	17 09:31 (WEA ZB07_wpd)	16:57	12 08:49 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21	
6	08:14	09:16 (WEA ZB07_wpd)	07:39	08:40 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45	
	16:06	16 09:32 (WEA ZB07_wpd)	16:59	6 08:46 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22	
7	08:14	09:16 (WEA ZB07_wpd)	07:38		06:40	06:27	05:24	04:44	
	16:08	15 09:31 (WEA ZB07_wpd)	17:01		17:53	19:48	20:40	21:23	
8	08:13	09:17 (WEA ZB07_wpd)	07:36		06:37	06:25	05:22	04:44	
	16:09	14 09:31 (WEA ZB07_wpd)	17:03		17:55	19:50	20:41	21:24	
9	08:13	09:19 (WEA ZB07_wpd)	07:34		06:35	06:23	05:20	04:43	
	16:10	12 09:31 (WEA ZB07_wpd)	17:04		17:57	19:51	20:43	21:24	
10	08:12	09:20 (WEA ZB07_wpd)	07:32		06:33	06:20	05:18	04:43	
	16:12	10 09:30 (WEA ZB07_wpd)	17:06		17:58	19:53	20:45	21:25	
11	08:12	09:22 (WEA ZB07_wpd)	07:30		06:30	06:18	05:17	04:42	
	16:13	7 09:29 (WEA ZB07_wpd)	17:08		18:00	19:55	20:46	21:26	
12	08:11		07:28		06:28	06:16	05:15	04:42	
	16:15		17:10		18:02	19:57	20:48	21:27	
13	08:10		07:26		06:26	06:14	05:13	04:42	
	16:16		17:12		18:04	19:58	20:50	21:27	
14	08:10		07:25		06:24	06:11	05:12	04:42	
	16:18		17:14		18:06	20:00	20:51	21:28	
15	08:09		07:23		07:47 (WEA ZB04_wpd)	06:21	06:09	05:10	04:41
	16:19		17:16	6	07:53 (WEA ZB04_wpd)	18:07	20:02	20:53	21:29
16	08:08		07:21		07:45 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41
	16:21		17:18	10	07:55 (WEA ZB04_wpd)	18:09	20:03	20:54	21:29
17	08:07	08:37 (WEA ZB06_wpd)	07:19		07:43 (WEA ZB04_wpd)	06:17	06:05	05:07	04:41
	16:23	4 08:41 (WEA ZB06_wpd)	17:20	14	07:57 (WEA ZB04_wpd)	18:11	20:05	20:56	21:30
18	08:06	08:35 (WEA ZB06_wpd)	07:17		07:41 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41
	16:24	9 08:44 (WEA ZB06_wpd)	17:22	16	07:57 (WEA ZB04_wpd)	18:13	20:07	20:57	21:30
19	08:05	08:34 (WEA ZB06_wpd)	07:15		07:40 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41
	16:26	12 08:46 (WEA ZB06_wpd)	17:23	18	07:58 (WEA ZB04_wpd)	18:15	20:09	20:59	21:30
20	08:04	08:32 (WEA ZB06_wpd)	07:12		07:40 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41
	16:28	15 08:47 (WEA ZB06_wpd)	17:25	18	07:58 (WEA ZB04_wpd)	18:16	20:10	21:00	21:31
21	08:03	08:32 (WEA ZB06_wpd)	07:10		07:40 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41
	16:29	16 08:48 (WEA ZB06_wpd)	17:27	19	07:59 (WEA ZB04_wpd)	18:18	20:12	21:02	21:31
22	08:02	08:32 (WEA ZB06_wpd)	07:08		07:39 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41
	16:31	18 08:50 (WEA ZB06_wpd)	17:29	19	07:58 (WEA ZB04_wpd)	18:20	20:14	21:03	21:31
23	08:00	08:31 (WEA ZB06_wpd)	07:06		07:39 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42
	16:33	19 08:50 (WEA ZB06_wpd)	17:31	18	07:57 (WEA ZB04_wpd)	18:22	20:16	21:05	21:31
24	07:59	08:31 (WEA ZB06_wpd)	07:04		07:40 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42
	16:35	20 08:51 (WEA ZB06_wpd)	17:33	17	07:57 (WEA ZB04_wpd)	18:23	20:17	21:06	21:31
25	07:58	08:31 (WEA ZB06_wpd)	07:02		07:41 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42
	16:36	21 08:52 (WEA ZB06_wpd)	17:35	15	07:56 (WEA ZB04_wpd)	18:25	20:19	21:08	21:32
26	07:56	08:31 (WEA ZB06_wpd)	07:00		07:43 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43
	16:38	21 08:52 (WEA ZB06_wpd)	17:37	11	07:54 (WEA ZB04_wpd)	18:27	20:21	21:09	21:32
27	07:55	08:31 (WEA ZB06_wpd)	06:58		07:46 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43
	16:40	22 08:53 (WEA ZB06_wpd)	17:38	3	07:49 (WEA ZB04_wpd)	18:29	20:23	21:10	21:31
28	07:54	08:31 (WEA ZB06_wpd)	06:55			05:51	05:41	04:53	04:44
	16:42	22 08:53 (WEA ZB06_wpd)	17:40			18:30	20:24	21:12	21:31
29	07:52	08:31 (WEA ZB06_wpd)				06:48	05:39	04:52	04:44
	16:44	22 08:53 (WEA ZB06_wpd)				19:32	20:26	21:13	21:31
30	07:51	08:32 (WEA ZB06_wpd)				06:46	05:37	04:51	04:45
	16:46	22 08:54 (WEA ZB06_wpd)				19:34	20:28	21:14	21:31
31	07:49	08:32 (WEA ZB06_wpd)				06:44		04:50	
	16:47	21 08:53 (WEA ZB06_wpd)				19:36		21:15	
Sonnenscheinstunden	256		276		367	417	488	502	
astr.max.mögl.Beschattung	429		275						

**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)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-55 - SR-55, Hasenweg 3A, 15374 Müncheberg

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	7 09:11 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	09:03 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	10 09:13 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	09:02 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	12 09:14 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	09:02 (WEA ZB07_wpd)
5	04:48	05:29	06:21	07:11	07:06	09:01 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	15 09:16 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	09:01 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	16 09:17 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	09:01 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	17 09:18 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	09:01 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	18 09:19 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	09:01 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	18 09:19 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	09:02 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	19 09:21 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	09:02 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	19 09:21 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	09:02 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	20 09:22 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	09:02 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	20 09:22 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	09:03 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	20 09:23 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	09:03 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	21 09:24 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	09:04 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	20 09:24 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	09:03 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	21 09:24 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	09:04 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	21 09:25 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	09:05 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	21 09:26 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	09:05 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	21 09:26 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	09:05 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	22 09:27 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	09:05 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	22 09:27 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	09:06 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	22 09:28 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	09:07 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	21 09:28 (WEA ZB07_wpd)
25	05:12	06:02	06:54	07:46	07:42	09:07 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	21 09:28 (WEA ZB07_wpd)
26	05:14	06:04	06:56	07:48	07:43	09:08 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	21 09:29 (WEA ZB07_wpd)
27	05:15	06:06	06:57	07:50	07:45	09:08 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	21 09:29 (WEA ZB07_wpd)
28	05:17	06:07	06:59	07:52	07:47	09:09 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	21 09:30 (WEA ZB07_wpd)
29	05:18	06:09	07:01	07:54	07:48	09:09 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	21 09:30 (WEA ZB07_wpd)
30	05:20	06:11	07:02	07:55	07:50	09:10 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	20 09:30 (WEA ZB07_wpd)
31	05:21	06:12	07:03	07:57	07:51	09:11 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	20 09:31 (WEA ZB07_wpd)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				188	359	582

**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)

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-56 - SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:12 (WEA ZB07_wpd)	07:48	08:31 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49
	16:01	21 09:33 (WEA ZB07_wpd)	16:49	23 08:54 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16
2	08:15	09:13 (WEA ZB07_wpd)	07:46	08:33 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48
	16:02	21 09:34 (WEA ZB07_wpd)	16:51	21 08:54 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18
3	08:15	09:14 (WEA ZB07_wpd)	07:44	08:33 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47
	16:03	20 09:34 (WEA ZB07_wpd)	16:53	21 08:54 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19
4	08:15	09:14 (WEA ZB07_wpd)	07:43	08:34 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46
	16:04	20 09:34 (WEA ZB07_wpd)	16:55	19 08:53 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20
5	08:15	09:16 (WEA ZB07_wpd)	07:41	08:35 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46
	16:05	18 09:34 (WEA ZB07_wpd)	16:57	17 08:52 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21
6	08:14	09:17 (WEA ZB07_wpd)	07:39	08:36 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45
	16:06	18 09:35 (WEA ZB07_wpd)	16:59	14 08:50 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22
7	08:14	09:17 (WEA ZB07_wpd)	07:38	08:39 (WEA ZB06_wpd)	06:40	06:27	05:24	04:44
	16:08	17 09:34 (WEA ZB07_wpd)	17:01	9 08:48 (WEA ZB06_wpd)	17:53	19:48	20:40	21:23
8	08:13	09:18 (WEA ZB07_wpd)	07:36		06:37	06:25	05:22	04:44
	16:09	16 09:34 (WEA ZB07_wpd)	17:03		17:55	19:50	20:41	21:24
9	08:13	09:20 (WEA ZB07_wpd)	07:34		06:35	06:23	05:20	04:43
	16:10	14 09:34 (WEA ZB07_wpd)	17:04		17:57	19:51	20:43	21:24
10	08:12	09:21 (WEA ZB07_wpd)	07:32		06:33	06:20	05:18	04:43
	16:12	12 09:33 (WEA ZB07_wpd)	17:06		17:58	19:53	20:45	21:25
11	08:12	09:22 (WEA ZB07_wpd)	07:30		06:30	06:18	05:17	04:42
	16:13	10 09:32 (WEA ZB07_wpd)	17:08		18:00	19:55	20:46	21:26
12	08:11	09:24 (WEA ZB07_wpd)	07:28		06:28	06:16	05:15	04:42
	16:15	7 09:31 (WEA ZB07_wpd)	17:10		18:02	19:57	20:48	21:27
13	08:10		07:26		06:26	06:14	05:13	04:42
	16:16		17:12		18:04	19:58	20:50	21:27
14	08:10		07:25		06:24	06:11	05:12	04:42
	16:18		17:14		18:06	20:00	20:51	21:28
15	08:09		07:23		06:21	06:09	05:10	04:41
	16:19		17:16		18:07	20:02	20:53	21:29
16	08:08		07:21	07:45 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41
	16:21		17:18	5 07:50 (WEA ZB04_wpd)	18:09	20:03	20:54	21:29
17	08:07		07:19	07:43 (WEA ZB04_wpd)	06:17	06:05	05:07	04:41
	16:23		17:20	10 07:53 (WEA ZB04_wpd)	18:11	20:05	20:56	21:30
18	08:06	08:37 (WEA ZB06_wpd)	07:17	07:41 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41
	16:24	5 08:42 (WEA ZB06_wpd)	17:22	13 07:54 (WEA ZB04_wpd)	18:13	20:07	20:57	21:30
19	08:05	08:35 (WEA ZB06_wpd)	07:15	07:39 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41
	16:26	10 08:45 (WEA ZB06_wpd)	17:23	17 07:56 (WEA ZB04_wpd)	18:15	20:09	20:59	21:30
20	08:04	08:33 (WEA ZB06_wpd)	07:12	07:38 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41
	16:28	13 08:46 (WEA ZB06_wpd)	17:25	18 07:56 (WEA ZB04_wpd)	18:16	20:10	21:00	21:31
21	08:03	08:32 (WEA ZB06_wpd)	07:10	07:38 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41
	16:29	16 08:48 (WEA ZB06_wpd)	17:27	19 07:57 (WEA ZB04_wpd)	18:18	20:12	21:02	21:31
22	08:02	08:32 (WEA ZB06_wpd)	07:08	07:37 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41
	16:31	18 08:50 (WEA ZB06_wpd)	17:29	19 07:56 (WEA ZB04_wpd)	18:20	20:14	21:03	21:31
23	08:00	08:31 (WEA ZB06_wpd)	07:06	07:37 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42
	16:33	19 08:50 (WEA ZB06_wpd)	17:31	19 07:56 (WEA ZB04_wpd)	18:22	20:16	21:05	21:31
24	07:59	08:31 (WEA ZB06_wpd)	07:04	07:37 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42
	16:35	20 08:51 (WEA ZB06_wpd)	17:33	19 07:56 (WEA ZB04_wpd)	18:23	20:17	21:06	21:31
25	07:58	08:31 (WEA ZB06_wpd)	07:02	07:38 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42
	16:36	22 08:53 (WEA ZB06_wpd)	17:35	18 07:56 (WEA ZB04_wpd)	18:25	20:19	21:08	21:32
26	07:56	08:31 (WEA ZB06_wpd)	07:00	07:39 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43
	16:38	22 08:53 (WEA ZB06_wpd)	17:37	16 07:55 (WEA ZB04_wpd)	18:27	20:21	21:09	21:32
27	07:55	08:30 (WEA ZB06_wpd)	06:58	07:39 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43
	16:40	23 08:53 (WEA ZB06_wpd)	17:38	14 07:53 (WEA ZB04_wpd)	18:29	20:23	21:10	21:31
28	07:54	08:31 (WEA ZB06_wpd)	06:55	07:41 (WEA ZB04_wpd)	05:51	05:41	04:53	04:44
	16:42	23 08:54 (WEA ZB06_wpd)	17:40	10 07:51 (WEA ZB04_wpd)	18:30	20:24	21:12	21:31
29	07:52	08:30 (WEA ZB06_wpd)			06:48	05:39	04:52	04:44
	16:44	24 08:54 (WEA ZB06_wpd)			19:32	20:26	21:13	21:31
30	07:51	08:31 (WEA ZB06_wpd)			06:46	05:37	04:51	04:45
	16:46	23 08:54 (WEA ZB06_wpd)			19:34	20:28	21:14	21:31
31	07:49	08:31 (WEA ZB06_wpd)			06:44		04:50	
	16:47	23 08:54 (WEA ZB06_wpd)			19:36		21:15	
Sonnenscheinstunden	256		276		367	417	488	502
astr.max.mögl.Beschattung	455		321					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-56 - SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	04:45	05:23	06:14	07:04	06:59	07:51	09:04 (WEA ZB07_wpd)
	21:31	20:58	19:55	18:44	16:37	15:55	10 09:14 (WEA ZB07_wpd)
2	04:46	05:24	06:16	07:06	07:01	07:53	09:04 (WEA ZB07_wpd)
	21:30	20:56	19:52	18:42	16:35	15:54	12 09:16 (WEA ZB07_wpd)
3	04:47	05:26	06:17	07:07	07:03	07:54	09:03 (WEA ZB07_wpd)
	21:30	20:55	19:50	18:39	16:33	15:54	14 09:17 (WEA ZB07_wpd)
4	04:48	05:28	06:19	07:09	07:05	07:55	16 09:03 (WEA ZB07_wpd)
	21:30	20:53	19:48	18:37	16:31	15:53	10 09:19 (WEA ZB07_wpd)
5	04:48	05:29	06:21	07:11	07:06	07:57	12 09:03 (WEA ZB07_wpd)
	21:29	20:51	19:45	18:35	16:29	15:53	14 09:19 (WEA ZB07_wpd)
6	04:49	05:31	06:22	07:13	07:08	07:58	16 09:02 (WEA ZB07_wpd)
	21:28	20:49	19:43	18:32	16:27	15:52	18 09:20 (WEA ZB07_wpd)
7	04:50	05:32	06:24	07:14	07:10	07:59	10 09:03 (WEA ZB07_wpd)
	21:28	20:47	19:41	18:30	16:26	15:52	12 09:21 (WEA ZB07_wpd)
8	04:51	05:34	06:26	07:16	07:12	08:01	14 09:03 (WEA ZB07_wpd)
	21:27	20:45	19:38	18:28	16:24	15:51	16 09:22 (WEA ZB07_wpd)
9	04:52	05:36	06:27	07:18	07:14	08:02	18 09:02 (WEA ZB07_wpd)
	21:27	20:44	19:36	18:25	16:22	15:51	20 09:22 (WEA ZB07_wpd)
10	04:53	05:37	06:29	07:20	07:16	08:03	22 09:03 (WEA ZB07_wpd)
	21:26	20:42	19:34	18:23	16:21	15:51	24 09:24 (WEA ZB07_wpd)
11	04:54	05:39	06:31	07:21	07:17	08:04	26 09:04 (WEA ZB07_wpd)
	21:25	20:40	19:31	18:21	16:19	15:51	28 09:24 (WEA ZB07_wpd)
12	04:55	05:41	06:32	07:23	07:19	08:05	30 09:04 (WEA ZB07_wpd)
	21:24	20:38	19:29	18:19	16:17	15:51	32 09:25 (WEA ZB07_wpd)
13	04:57	05:42	06:34	07:25	07:21	08:06	34 09:04 (WEA ZB07_wpd)
	21:23	20:36	19:27	18:16	16:16	15:50	36 09:25 (WEA ZB07_wpd)
14	04:58	05:44	06:35	07:27	07:23	08:07	38 09:04 (WEA ZB07_wpd)
	21:22	20:34	19:24	18:14	16:14	15:50	40 09:26 (WEA ZB07_wpd)
15	04:59	05:46	06:37	07:28	07:25	08:08	42 09:05 (WEA ZB07_wpd)
	21:21	20:32	19:22	18:12	16:13	15:51	44 09:27 (WEA ZB07_wpd)
16	05:00	05:47	06:39	07:30	07:26	08:09	46 09:05 (WEA ZB07_wpd)
	21:20	20:30	19:20	18:10	16:11	15:51	48 09:27 (WEA ZB07_wpd)
17	05:01	05:49	06:40	07:32	07:28	08:10	50 09:05 (WEA ZB07_wpd)
	21:19	20:28	19:17	18:07	16:10	15:51	52 09:27 (WEA ZB07_wpd)
18	05:03	05:51	06:42	07:34	07:30	08:11	54 09:06 (WEA ZB07_wpd)
	21:18	20:26	19:15	18:05	16:09	15:51	56 09:28 (WEA ZB07_wpd)
19	05:04	05:52	06:44	07:35	07:32	08:11	58 09:06 (WEA ZB07_wpd)
	21:17	20:23	19:12	18:03	16:07	15:51	60 09:29 (WEA ZB07_wpd)
20	05:05	05:54	06:45	07:37	07:33	08:12	62 09:06 (WEA ZB07_wpd)
	21:16	20:21	19:10	18:01	16:06	15:52	64 09:28 (WEA ZB07_wpd)
21	05:07	05:56	06:47	07:39	07:35	08:12	66 09:07 (WEA ZB07_wpd)
	21:14	20:19	19:08	17:59	16:05	15:52	68 09:29 (WEA ZB07_wpd)
22	05:08	05:57	06:49	07:41	07:37	08:13	70 09:07 (WEA ZB07_wpd)
	21:13	20:17	19:05	17:57	16:04	15:53	72 09:29 (WEA ZB07_wpd)
23	05:09	05:59	06:51	07:43	07:39	08:14	74 09:08 (WEA ZB07_wpd)
	21:12	20:15	19:03	17:55	16:03	15:53	76 09:30 (WEA ZB07_wpd)
24	05:11	06:01	06:52	07:44	07:40	08:14	78 09:08 (WEA ZB07_wpd)
	21:10	20:13	19:01	17:53	16:01	15:54	80 09:30 (WEA ZB07_wpd)
25	05:12	06:02	06:54	06:46	07:42	08:14	82 09:08 (WEA ZB07_wpd)
	21:09	20:10	18:58	16:50	16:00	15:54	84 09:31 (WEA ZB07_wpd)
26	05:14	06:04	06:56	06:48	07:43	08:15	86 09:10 (WEA ZB07_wpd)
	21:07	20:08	18:56	16:48	15:59	15:55	88 09:32 (WEA ZB07_wpd)
27	05:15	06:06	06:57	06:50	07:45	08:15	90 09:10 (WEA ZB07_wpd)
	21:06	20:06	18:53	16:46	15:58	15:56	92 09:32 (WEA ZB07_wpd)
28	05:17	06:07	06:59	06:52	07:47	08:15	94 09:11 (WEA ZB07_wpd)
	21:04	20:04	18:51	16:44	15:58	15:57	96 09:32 (WEA ZB07_wpd)
29	05:18	06:09	07:01	06:54	07:48	08:15	98 09:11 (WEA ZB07_wpd)
	21:03	20:01	18:49	16:42	15:57	15:57	100 09:33 (WEA ZB07_wpd)
30	05:20	06:11	07:02	06:55	07:50	08:15	102 09:12 (WEA ZB07_wpd)
	21:01	19:59	18:46	16:40	15:56	15:58	104 09:33 (WEA ZB07_wpd)
31	05:21	06:12	07:03	06:57	07:51	08:15	106 09:12 (WEA ZB07_wpd)
	21:00	19:57	18:43	16:39	15:59	15:59	108 09:34 (WEA ZB07_wpd)
Sonneneinstrahlung	505	455	381	331	264	241	
astr.max.mögl.Beschattung				203		392	622

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-57 - SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:16 (WEA ZB07_wpd)	07:48	08:34 (WEA ZB06_wpd)	06:53	06:41	05:35	04:49
	16:01	19 09:35 (WEA ZB07_wpd)	16:49	22 08:56 (WEA ZB06_wpd)	17:42	19:37	20:29	21:16
2	08:15	09:17 (WEA ZB07_wpd)	07:46	08:36 (WEA ZB06_wpd)	06:51	06:39	05:33	04:48
	16:02	18 09:35 (WEA ZB07_wpd)	16:51	20 08:56 (WEA ZB06_wpd)	17:44	19:39	20:31	21:18
3	08:15	09:18 (WEA ZB07_wpd)	07:44	08:37 (WEA ZB06_wpd)	06:49	06:37	05:31	04:47
	16:03	18 09:36 (WEA ZB07_wpd)	16:53	18 08:55 (WEA ZB06_wpd)	17:46	19:41	20:33	21:19
4	08:15	09:18 (WEA ZB07_wpd)	07:43	08:38 (WEA ZB06_wpd)	06:46	06:34	05:29	04:46
	16:04	17 09:35 (WEA ZB07_wpd)	16:55	16 08:54 (WEA ZB06_wpd)	17:48	19:43	20:35	21:20
5	08:15	09:19 (WEA ZB07_wpd)	07:41	08:39 (WEA ZB06_wpd)	06:44	06:32	05:28	04:46
	16:05	17 09:36 (WEA ZB07_wpd)	16:57	13 08:52 (WEA ZB06_wpd)	17:49	19:44	20:36	21:21
6	08:14	09:21 (WEA ZB07_wpd)	07:39	08:42 (WEA ZB06_wpd)	06:42	06:30	05:26	04:45
	16:06	15 09:36 (WEA ZB07_wpd)	16:59	8 08:50 (WEA ZB06_wpd)	17:51	19:46	20:38	21:22
7	08:14	09:21 (WEA ZB07_wpd)	07:38		06:40	06:27	05:24	04:44
	16:08	14 09:35 (WEA ZB07_wpd)	17:01		17:53	19:48	20:40	21:23
8	08:13	09:22 (WEA ZB07_wpd)	07:36		06:37	06:25	05:22	04:44
	16:09	13 09:35 (WEA ZB07_wpd)	17:03		17:55	19:50	20:41	21:24
9	08:13	09:24 (WEA ZB07_wpd)	07:34		06:35	06:23	05:20	04:43
	16:10	11 09:35 (WEA ZB07_wpd)	17:04		17:57	19:51	20:43	21:24
10	08:12	09:26 (WEA ZB07_wpd)	07:32		06:33	06:20	05:18	04:43
	16:12	7 09:33 (WEA ZB07_wpd)	17:06		17:58	19:53	20:45	21:25
11	08:12		07:30		06:30	06:18	05:17	04:42
	16:13		17:08		18:00	19:55	20:46	21:26
12	08:11		07:28		06:28	06:16	05:15	04:42
	16:15		17:10		18:02	19:57	20:48	21:27
13	08:10		07:26		06:26	06:14	05:13	04:42
	16:16		17:12		18:04	19:58	20:50	21:27
14	08:10		07:25		06:24	06:11	05:12	04:42
	16:18		17:14		18:06	20:00	20:51	21:28
15	08:09		07:23	5 07:47 (WEA ZB04_wpd)	06:21	06:09	05:10	04:41
	16:19		17:16	5 07:52 (WEA ZB04_wpd)	18:07	20:02	20:53	21:29
16	08:08	08:39 (WEA ZB06_wpd)	07:21	10 07:45 (WEA ZB04_wpd)	06:19	06:07	05:09	04:41
	16:21	4 08:43 (WEA ZB06_wpd)	17:18	10 07:55 (WEA ZB04_wpd)	18:09	20:03	20:54	21:29
17	08:07	08:37 (WEA ZB06_wpd)	07:19	17 07:43 (WEA ZB04_wpd)	06:17	06:05	05:07	04:41
	16:23	9 08:46 (WEA ZB06_wpd)	17:20	13 07:56 (WEA ZB04_wpd)	18:11	20:05	20:56	21:30
18	08:06	08:36 (WEA ZB06_wpd)	07:17	16 07:41 (WEA ZB04_wpd)	06:14	06:02	05:06	04:41
	16:24	12 08:48 (WEA ZB06_wpd)	17:22	16 07:57 (WEA ZB04_wpd)	18:13	20:07	20:57	21:30
19	08:05	08:35 (WEA ZB06_wpd)	07:15	18 07:40 (WEA ZB04_wpd)	06:12	06:00	05:04	04:41
	16:26	15 08:50 (WEA ZB06_wpd)	17:23	18 07:58 (WEA ZB04_wpd)	18:15	20:09	20:59	21:30
20	08:04	08:34 (WEA ZB06_wpd)	07:12	17 07:40 (WEA ZB04_wpd)	06:09	05:58	05:03	04:41
	16:28	16 08:50 (WEA ZB06_wpd)	17:25	19 07:59 (WEA ZB04_wpd)	18:16	20:10	21:00	21:31
21	08:03	08:33 (WEA ZB06_wpd)	07:10	20 07:39 (WEA ZB04_wpd)	06:07	05:56	05:01	04:41
	16:29	19 08:52 (WEA ZB06_wpd)	17:27	20 07:59 (WEA ZB04_wpd)	18:18	20:12	21:02	21:31
22	08:02	08:33 (WEA ZB06_wpd)	07:08	19 07:39 (WEA ZB04_wpd)	06:05	05:54	05:00	04:41
	16:31	20 08:53 (WEA ZB06_wpd)	17:29	19 07:58 (WEA ZB04_wpd)	18:20	20:14	21:03	21:31
23	08:00	08:32 (WEA ZB06_wpd)	07:06	19 07:39 (WEA ZB04_wpd)	06:02	05:52	04:59	04:42
	16:33	21 08:53 (WEA ZB06_wpd)	17:31	19 07:58 (WEA ZB04_wpd)	18:22	20:16	21:05	21:31
24	07:59	08:33 (WEA ZB06_wpd)	07:04	19 07:39 (WEA ZB04_wpd)	06:00	05:50	04:57	04:42
	16:35	22 08:55 (WEA ZB06_wpd)	17:33	19 07:58 (WEA ZB04_wpd)	18:23	20:17	21:06	21:31
25	07:58	08:33 (WEA ZB06_wpd)	07:02	17 07:40 (WEA ZB04_wpd)	05:58	05:47	04:56	04:42
	16:36	23 08:56 (WEA ZB06_wpd)	17:35	17 07:57 (WEA ZB04_wpd)	18:25	20:19	21:08	21:32
26	07:56	08:33 (WEA ZB06_wpd)	07:00	14 07:42 (WEA ZB04_wpd)	05:55	05:45	04:55	04:43
	16:38	23 08:56 (WEA ZB06_wpd)	17:37	14 07:56 (WEA ZB04_wpd)	18:27	20:21	21:09	21:32
27	07:55	08:32 (WEA ZB06_wpd)	06:58	10 07:43 (WEA ZB04_wpd)	05:53	05:43	04:54	04:43
	16:40	24 08:56 (WEA ZB06_wpd)	17:38	10 07:53 (WEA ZB04_wpd)	18:29	20:23	21:10	21:31
28	07:54	08:33 (WEA ZB06_wpd)	06:55		05:51	05:41	04:53	04:44
	16:42	23 08:56 (WEA ZB06_wpd)	17:40		18:30	20:24	21:12	21:31
29	07:52	08:33 (WEA ZB06_wpd)			06:48	05:39	04:52	04:44
	16:44	23 08:56 (WEA ZB06_wpd)			19:32	20:26	21:13	21:31
30	07:51	08:34 (WEA ZB06_wpd)			06:46	05:37	04:51	04:45
	16:46	23 08:57 (WEA ZB06_wpd)			19:34	20:28	21:14	21:31
31	07:49	08:34 (WEA ZB06_wpd)			06:44		04:50	
	16:47	22 08:56 (WEA ZB06_wpd)			19:36		21:15	
Sonnenscheinstunden		256	276	367	417	488	502	
astr.max.mögl.Beschattung		448	296					

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

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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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:11
	21:18	20:26	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:56	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:04	07:58	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				203	399	563

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-58 - SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg  
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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:15	09:20 (WEA ZB07_wpd)	07:48	08:38 (WEA ZB06_wpd)	06:53	06:41
	16:01	17 09:37 (WEA ZB07_wpd)	16:49	20 08:58 (WEA ZB06_wpd)	17:42	19:37
2	08:15	09:21 (WEA ZB07_wpd)	07:46	08:40 (WEA ZB06_wpd)	06:51	06:39
	16:02	16 09:37 (WEA ZB07_wpd)	16:51	18 08:58 (WEA ZB06_wpd)	17:44	19:39
3	08:15	09:22 (WEA ZB07_wpd)	07:44	08:41 (WEA ZB06_wpd)	06:49	06:37
	16:03	16 09:38 (WEA ZB07_wpd)	16:53	16 08:57 (WEA ZB06_wpd)	17:46	19:41
4	08:15	09:23 (WEA ZB07_wpd)	07:43	08:43 (WEA ZB06_wpd)	06:46	06:34
	16:04	14 09:37 (WEA ZB07_wpd)	16:55	12 08:55 (WEA ZB06_wpd)	17:48	19:43
5	08:15	09:24 (WEA ZB07_wpd)	07:41	08:46 (WEA ZB06_wpd)	06:44	06:32
	16:05	13 09:37 (WEA ZB07_wpd)	16:57	6 08:52 (WEA ZB06_wpd)	17:49	19:44
6	08:14	09:26 (WEA ZB07_wpd)	07:39		06:42	06:30
	16:06	11 09:37 (WEA ZB07_wpd)	16:59		17:51	19:46
7	08:14	09:27 (WEA ZB07_wpd)	07:38		06:40	06:27
	16:08	9 09:36 (WEA ZB07_wpd)	17:01		17:53	19:48
8	08:13	09:29 (WEA ZB07_wpd)	07:36		06:37	06:25
	16:09	5 09:34 (WEA ZB07_wpd)	17:03		17:55	19:50
9	08:13		07:34		06:35	06:23
	16:10		17:04		17:57	19:51
10	08:12		07:32		06:33	06:20
	16:12		17:06		17:58	19:53
11	08:12		07:30		06:30	06:18
	16:13		17:08		18:00	19:55
12	08:11		07:28		06:28	06:16
	16:15		17:10		18:02	19:57
13	08:10		07:26		06:26	06:14
	16:16		17:12		18:04	19:58
14	08:10	08:40 (WEA ZB06_wpd)	07:25	07:49 (WEA ZB04_wpd)	06:24	06:11
	16:18	6 08:46 (WEA ZB06_wpd)	17:14	5 07:54 (WEA ZB04_wpd)	18:06	20:00
15	08:09	08:39 (WEA ZB06_wpd)	07:23	07:47 (WEA ZB04_wpd)	06:21	06:09
	16:19	9 08:48 (WEA ZB06_wpd)	17:16	10 07:57 (WEA ZB04_wpd)	18:07	20:02
16	08:08	08:38 (WEA ZB06_wpd)	07:21	07:45 (WEA ZB04_wpd)	06:19	06:07
	16:21	12 08:50 (WEA ZB06_wpd)	17:18	14 07:59 (WEA ZB04_wpd)	18:09	20:03
17	08:07	08:37 (WEA ZB06_wpd)	07:19	07:43 (WEA ZB04_wpd)	06:17	06:05
	16:23	15 08:52 (WEA ZB06_wpd)	17:20	17 08:00 (WEA ZB04_wpd)	18:11	20:05
18	08:06	08:36 (WEA ZB06_wpd)	07:17	07:42 (WEA ZB04_wpd)	06:14	06:02
	16:24	17 08:53 (WEA ZB06_wpd)	17:22	18 08:00 (WEA ZB04_wpd)	18:13	20:07
19	08:05	08:36 (WEA ZB06_wpd)	07:15	07:42 (WEA ZB04_wpd)	06:12	06:00
	16:26	19 08:55 (WEA ZB06_wpd)	17:23	19 08:01 (WEA ZB04_wpd)	18:15	20:09
20	08:04	08:35 (WEA ZB06_wpd)	07:12	07:41 (WEA ZB04_wpd)	06:09	05:58
	16:28	20 08:55 (WEA ZB06_wpd)	17:25	20 08:01 (WEA ZB04_wpd)	18:16	20:10
21	08:03	08:35 (WEA ZB06_wpd)	07:10	07:42 (WEA ZB04_wpd)	06:07	05:56
	16:29	21 08:56 (WEA ZB06_wpd)	17:27	19 08:01 (WEA ZB04_wpd)	18:18	20:12
22	08:02	08:35 (WEA ZB06_wpd)	07:08	07:41 (WEA ZB04_wpd)	06:05	05:54
	16:31	22 08:57 (WEA ZB06_wpd)	17:29	19 08:00 (WEA ZB04_wpd)	18:20	20:14
23	08:00	08:35 (WEA ZB06_wpd)	07:06	07:41 (WEA ZB04_wpd)	06:02	05:52
	16:33	22 08:57 (WEA ZB06_wpd)	17:31	19 08:00 (WEA ZB04_wpd)	18:22	20:16
24	07:59	08:35 (WEA ZB06_wpd)	07:04	07:42 (WEA ZB04_wpd)	06:00	05:50
	16:35	23 08:58 (WEA ZB06_wpd)	17:33	17 07:59 (WEA ZB04_wpd)	18:23	20:17
25	07:58	08:36 (WEA ZB06_wpd)	07:02	07:44 (WEA ZB04_wpd)	05:58	05:47
	16:36	23 08:59 (WEA ZB06_wpd)	17:35	14 07:58 (WEA ZB04_wpd)	18:25	20:19
26	07:56	08:35 (WEA ZB06_wpd)	07:00	07:46 (WEA ZB04_wpd)	05:55	05:45
	16:38	24 08:59 (WEA ZB06_wpd)	17:37	10 07:56 (WEA ZB04_wpd)	18:27	20:21
27	07:55	08:35 (WEA ZB06_wpd)	06:58	07:49 (WEA ZB04_wpd)	05:53	05:43
	16:40	24 08:59 (WEA ZB06_wpd)	17:38	2 07:51 (WEA ZB04_wpd)	18:29	20:23
28	07:54	08:36 (WEA ZB06_wpd)	06:55		05:51	05:41
	16:42	23 08:59 (WEA ZB06_wpd)	17:40		18:30	20:24
29	07:52	08:36 (WEA ZB06_wpd)			06:48	05:39
	16:44	23 08:59 (WEA ZB06_wpd)			19:32	20:26
30	07:51	08:37 (WEA ZB06_wpd)			06:46	05:37
	16:46	22 08:59 (WEA ZB06_wpd)			19:34	20:28
31	07:49	08:38 (WEA ZB06_wpd)			06:44	04:50
	16:47	21 08:59 (WEA ZB06_wpd)			19:36	21:15
	Sonnenscheinstunden	256	276		367	417
	astr.max.mögl.Beschattung	447	275			488

**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)



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-58 - SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23	06:14	07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24	06:16	07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26	06:17	07:07	07:03	07:54
	21:30	20:55	19:50	18:39	16:33	15:54
4	04:48	05:28	06:19	07:09	07:05	07:55
	21:30	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29	06:21	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31	06:22	07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:26	07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36	06:27	07:18	07:14	08:02
	21:27	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:29	07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:31	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:56	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:11	15:51
17	05:01	05:49	06:40	07:32	07:28	08:10
	21:19	20:28	19:17	18:07	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:11
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59	06:51	07:43	07:39	08:14
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01	06:52	07:44	07:40	08:14
	21:10	20:13	19:01	17:53	16:01	15:54
25	05:12	06:02	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04	06:56	07:48	07:43	08:15
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:06	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07	06:59	07:52	07:47	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18	06:09	07:01	07:54	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:11	07:02	07:55	07:50	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12	07:04	07:57	07:51	08:15
	21:00	19:57	18:43	16:39	15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung				210	420	484

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-59 - SR-59, Am Höllengrund 3, 15537 Kienbaum  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:01	07:48 16:49	06:53 17:42	06:41 19:37		05:35 20:29	4	06:01 (WEA ZB09_wpd) 04:49 06:05 (WEA ZB09_wpd) 21:16
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 19:39		05:33 20:31	10	05:58 (WEA ZB09_wpd) 04:48 06:08 (WEA ZB09_wpd) 21:17
3	08:15 16:03	07:44 16:53	06:49 17:46	06:37 19:41		05:31 20:33	13	05:56 (WEA ZB09_wpd) 04:47 06:09 (WEA ZB09_wpd) 21:19
4	08:15 16:04	07:43 16:55	06:46 17:48	06:34 19:43		05:30 20:35	16	05:55 (WEA ZB09_wpd) 04:47 06:11 (WEA ZB09_wpd) 21:20
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44		05:28 20:36	19	05:53 (WEA ZB09_wpd) 04:46 06:12 (WEA ZB09_wpd) 21:21
6	08:14 16:07	07:39 16:59	06:42 17:51	06:30 19:46	06:54 (WEA ZB14_EnBW)	05:26 20:38	20	05:52 (WEA ZB09_wpd) 04:45 06:12 (WEA ZB09_wpd) 21:22
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	3 06:57 (WEA ZB14_EnBW)	05:24 20:40	20	05:52 (WEA ZB09_wpd) 04:45 06:12 (WEA ZB09_wpd) 21:23
8	08:13 16:09	07:36 17:03	06:37 17:55	06:25 19:50	10 07:00 (WEA ZB14_EnBW)	05:22 20:41	20	05:52 (WEA ZB09_wpd) 04:44 06:13 (WEA ZB09_wpd) 21:24
9	08:13 16:11	07:34 17:05	06:35 17:57	06:23 19:51	14 07:02 (WEA ZB14_EnBW)	05:20 20:43	22	05:51 (WEA ZB09_wpd) 04:43 06:13 (WEA ZB09_wpd) 21:24
10	08:12 16:12	07:32 17:06	06:33 17:59	06:20 19:53	17 07:03 (WEA ZB14_EnBW)	05:19 20:45	22	05:51 (WEA ZB09_wpd) 04:43 06:13 (WEA ZB09_wpd) 21:24
11	08:12 16:13	07:30 17:08	06:30 18:00	06:18 19:55	19 07:04 (WEA ZB14_EnBW)	05:17 20:46	21	05:51 (WEA ZB09_wpd) 04:43 06:13 (WEA ZB09_wpd) 21:26
12	08:11 16:15	07:28 17:10	06:28 18:02	06:16 19:57	20 07:03 (WEA ZB14_EnBW)	05:15 20:48	22	05:51 (WEA ZB09_wpd) 04:42 06:12 (WEA ZB09_wpd) 21:27
13	08:10 16:16	07:26 17:12	06:26 18:04	06:14 19:58	21 07:04 (WEA ZB14_EnBW)	05:14 20:49	21	05:52 (WEA ZB09_wpd) 04:42 06:12 (WEA ZB09_wpd) 21:27
14	08:09 16:18	07:25 17:14	06:24 18:06	06:11 20:00	22 07:04 (WEA ZB14_EnBW)	05:12 20:51	20	05:52 (WEA ZB09_wpd) 04:42 06:11 (WEA ZB09_wpd) 21:28
15	08:09 16:19	07:23 17:16	06:21 18:07	06:09 20:02	22 07:04 (WEA ZB14_EnBW)	05:10 20:53	19	05:53 (WEA ZB09_wpd) 04:42 06:11 (WEA ZB09_wpd) 21:29
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:03	20 07:02 (WEA ZB14_EnBW)	05:09 20:54	18	05:53 (WEA ZB09_wpd) 04:41 06:10 (WEA ZB09_wpd) 21:29
17	08:07 16:23	07:19 17:20	06:17 18:11	06:05 20:05	20 07:02 (WEA ZB14_EnBW)	05:07 20:56	17	05:54 (WEA ZB09_wpd) 04:41 06:10 (WEA ZB09_wpd) 21:30
18	08:06 16:24	07:17 17:22	06:14 18:13	06:03 20:07	18 07:01 (WEA ZB14_EnBW)	05:06 20:57	16	05:55 (WEA ZB09_wpd) 04:41 06:09 (WEA ZB09_wpd) 21:30
19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	15 06:59 (WEA ZB14_EnBW)	05:04 20:59	14	05:56 (WEA ZB09_wpd) 04:41 06:07 (WEA ZB09_wpd) 21:30
20	08:04 16:28	07:12 17:25	06:10 18:16	05:58 20:10	13 06:58 (WEA ZB14_EnBW)	05:03 21:00	11	05:58 (WEA ZB09_wpd) 04:41 06:06 (WEA ZB09_wpd) 21:31
21	08:03 16:29	07:10 17:27	06:07 18:18	05:56 20:12	8 06:55 (WEA ZB14_EnBW)	05:01 21:02	8	06:06 (WEA ZB09_wpd) 04:41 21:02
22	08:01 16:31	07:08 17:29	06:05 18:20	05:54 20:14		05:00 21:03		04:42 21:31
23	08:00 16:33	07:06 17:31	06:02 18:22	05:52 20:16		04:59 21:05		04:42 21:31
24	07:59 16:35	07:04 17:33	06:00 18:23	05:50 20:17		04:58 21:06		04:42 21:31
25	07:58 16:37	07:02 17:35	05:58 18:25	05:48 20:19		04:56 21:07		04:43 21:31
26	07:56 16:38	07:00 17:37	05:55 18:27	05:45 20:21		04:55 21:09		04:43 21:31
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23		04:54 21:10		04:43 21:31
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:24		04:53 21:11		04:44 21:31
29	07:52 16:44		06:48 19:32	05:39 20:26		04:52 21:13		04:44 21:31
30	07:51 16:46		06:46 19:34	05:37 20:28		04:51 21:14		04:45 21:31
31	07:49 16:48		06:44 19:36			04:50 21:15		04:45 21:31
	Sonnenscheinstunden	256	276	367	417	487		502
	astr.max.mögl.Beschattung				242		332	

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-59 - SR-59, Am Höllengrund 3, 15537 Kienbaum  
**Annahmen für Schattenwurfberechnung**

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	04:46	05:23	06:01 (WEA ZB09_wpd) 06:14	06:42 (WEA ZB14_ErBW) 07:04	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:25	06:02 (WEA ZB09_wpd) 06:16	06:43 (WEA ZB14_ErBW) 07:06	07:01	07:53
	21:30	20:56	19:52	18:42	16:35	15:55
3	04:47	05:26	06:01 (WEA ZB09_wpd) 06:17	06:44 (WEA ZB14_ErBW) 07:07	07:03	07:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48	05:28	06:02 (WEA ZB09_wpd) 06:19	06:45 (WEA ZB14_ErBW) 07:09	07:05	07:55
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:49	05:29	06:01 (WEA ZB09_wpd) 06:21	06:47 (WEA ZB14_ErBW) 07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:50	05:31	06:02 (WEA ZB09_wpd) 06:22	06:48 (WEA ZB14_ErBW) 07:13	07:08	07:58
	21:28	20:49	19:43	18:32	16:28	15:52
7	04:50	05:33	06:02 (WEA ZB09_wpd) 06:24	06:49 (WEA ZB14_ErBW) 07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34	06:03 (WEA ZB09_wpd) 06:26	06:50 (WEA ZB14_ErBW) 07:16	07:12	08:01
	21:27	20:45	19:38	18:28	16:24	15:52
9	04:52	05:36	06:04 (WEA ZB09_wpd) 06:27	06:51 (WEA ZB14_ErBW) 07:18	07:14	08:02
	21:26	20:44	19:36	18:25	16:22	15:51
10	04:53	05:37	06:06 (WEA ZB09_wpd) 06:29	06:52 (WEA ZB14_ErBW) 07:20	07:16	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39	06:07 (WEA ZB09_wpd) 06:31	06:53 (WEA ZB14_ErBW) 07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:56	05:41	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:18	15:51
13	04:57	05:42	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:51
14	04:58	05:44	06:36	07:27	07:23	08:07
	21:22	20:34	19:24	18:14	16:15	15:51
15	04:59	05:46	06:37	07:28	07:25	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47	06:39	07:30	07:26	08:09
	21:20	20:30	19:20	18:10	16:12	15:51
17	05:01	05:49	06:41	07:32	07:28	08:10
	21:19	20:28	19:17	18:08	16:10	15:51
18	05:03	05:51	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:08	15:51
20	05:05	05:54	06:46	07:37	07:33	08:12
	21:16	20:21	19:10	18:01	16:06	15:52
21	05:07	05:56	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:10	05:59	06:51 (WEA ZB14_ErBW) 06:51	07:43 (WEA ZB14_ErBW) 07:38	07:38	08:13
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:01 (WEA ZB09_wpd) 06:01	06:59 (WEA ZB14_ErBW) 06:52	07:44 (WEA ZB14_ErBW) 07:40	07:40	08:14
	21:10	20:13	19:01	17:53	16:02	15:54
25	05:12	06:02 (WEA ZB09_wpd) 06:02	06:46 (WEA ZB14_ErBW) 06:54	07:45 (WEA ZB14_ErBW) 07:42	07:42	08:14
	21:09	20:10	18:58	17:51	16:01	15:54
26	05:14	06:04 (WEA ZB09_wpd) 06:04	06:45 (WEA ZB14_ErBW) 06:56	07:46 (WEA ZB14_ErBW) 07:43	07:43	08:15
	21:07	20:08	18:56	17:49	16:00	15:55
27	05:15	06:06 (WEA ZB09_wpd) 06:06	06:44 (WEA ZB14_ErBW) 06:57	07:47 (WEA ZB14_ErBW) 07:44	07:44	08:15
	21:06	20:06	18:53	17:46	15:59	15:56
28	05:17	06:07 (WEA ZB09_wpd) 06:07	06:43 (WEA ZB14_ErBW) 06:59	07:48 (WEA ZB14_ErBW) 07:47	07:47	08:15
	21:04	20:04	18:51	17:44	15:58	15:57
29	05:18	06:09 (WEA ZB09_wpd) 06:09	06:43 (WEA ZB14_ErBW) 07:01	07:49 (WEA ZB14_ErBW) 07:48	07:48	08:15
	21:03	20:01	18:49	17:43	15:57	15:58
30	05:20	06:11 (WEA ZB09_wpd) 06:11	06:42 (WEA ZB14_ErBW) 07:02	07:50 (WEA ZB14_ErBW) 07:50	07:50	08:15
	21:01	19:59	18:46	17:41	15:56	15:58
31	05:21	06:12 (WEA ZB09_wpd) 06:12	06:42 (WEA ZB14_ErBW) 07:04	07:51 (WEA ZB14_ErBW) 07:51	07:51	08:15
	21:00	19:57	18:44	17:40	15:55	15:58
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung	136	361	85			

**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:  
R-2-2023-0060

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-60 - SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	08:14 (WEA007)	06:53	07:24 (WEA004)	06:41	
2	08:15	16:49	18 08:32 (WEA007)	17:42	36 08:10 (WEA004)	19:37	
3	08:15	07:46	08:12 (WEA007)	06:51	07:16 (WEA005)	06:39	
4	16:02	16:51	20 08:21 (WEA007)	17:44	39 08:01 (WEA004)	19:39	
5	08:15	07:44	08:12 (WEA007)	06:48	07:12 (WEA005)	06:36	
6	16:03	15:27 (WEA)	16:53	21 08:31 (WEA007)	17:46	48 08:09 (WEA004)	19:41
7	16:04	15:28 (WEA)	16:55	23 08:35 (WEA007)	17:47	52 08:09 (WEA004)	19:42
8	08:14	15:25 (WEA)	16:51	24 08:31 (WEA007)	17:44	57 07:07 (WEA005)	06:32
9	16:05	15:30 (WEA)	16:57	24 08:35 (WEA007)	17:49	57 08:09 (WEA004)	19:44
10	08:14	15:24 (WEA)	16:59	24 08:31 (WEA007)	17:42	57 07:06 (WEA005)	06:29
11	16:06	15:31 (WEA)	16:59	24 08:35 (WEA007)	17:51	57 08:08 (WEA004)	19:46
12	08:14	15:24 (WEA)	16:57	24 08:31 (WEA007)	17:42	57 07:05 (WEA005)	06:27
13	16:09	15:37 (WEA)	17:00	24 08:35 (WEA007)	17:53	59 08:08 (WEA004)	19:48
14	08:13	15:24 (WEA)	16:57	24 08:31 (WEA007)	17:42	59 07:04 (WEA005)	06:25
15	16:09	15:34 (WEA)	17:02	24 08:31 (WEA007)	17:55	59 08:07 (WEA004)	19:49
16	08:13	15:24 (WEA)	16:57	24 08:31 (WEA007)	17:42	59 07:04 (WEA005)	06:23
17	16:10	15:35 (WEA)	17:04	24 08:35 (WEA007)	17:56	58 08:06 (WEA004)	19:51
18	08:12	15:23 (WEA)	16:52	24 08:31 (WEA007)	17:40	58 07:04 (WEA005)	06:20
19	16:12	15:37 (WEA)	17:06	24 08:31 (WEA007)	17:58	57 08:06 (WEA004)	19:53
20	08:11	15:24 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:03 (WEA005)	06:18
21	16:13	15:38 (WEA)	17:28	24 08:31 (WEA007)	18:00	55 08:04 (WEA004)	19:54
22	08:11	15:24 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:03 (WEA005)	06:16
23	16:15	15:41 (WEA)	17:30	24 08:31 (WEA007)	18:02	55 08:02 (WEA004)	19:56
24	08:10	15:24 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:04 (WEA005)	06:13
25	16:16	15:42 (WEA)	17:32	24 08:31 (WEA007)	18:04	54 08:01 (WEA004)	19:58
26	08:09	15:24 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:04 (WEA005)	06:11
27	16:18	15:44 (WEA)	17:34	24 08:31 (WEA007)	18:05	54 07:58 (WEA004)	20:00
28	08:08	15:24 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:06 (WEA005)	06:09
29	16:19	15:49 (WEA)	17:45	24 08:31 (WEA007)	18:07	52 07:35 (WEA004)	20:01
30	08:08	15:25 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:08 (WEA005)	06:07
31	16:21	15:45 (WEA)	17:48	24 08:31 (WEA007)	18:09	51 07:50 (WEA004)	20:03
1	08:07	15:25 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:10 (WEA005)	06:04
2	16:22	15:46 (WEA)	17:49	24 08:31 (WEA007)	18:11	50 07:16 (WEA004)	20:05
3	08:06	15:25 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	06:02
4	16:24	15:46 (WEA)	17:51	24 08:31 (WEA007)	18:13	49 07:58 (WEA004)	20:07
5	08:05	15:25 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	06:00
6	16:26	15:46 (WEA)	17:53	24 08:31 (WEA007)	18:14	48 07:58 (WEA004)	20:08
7	08:03	15:26 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:58
8	16:27	15:46 (WEA)	17:55	24 08:31 (WEA007)	18:16	47 07:58 (WEA004)	20:10
9	08:02	15:27 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:56
10	16:29	15:46 (WEA)	17:57	24 08:31 (WEA007)	18:18	46 07:58 (WEA004)	20:12
11	08:01	15:27 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:54
12	16:31	15:46 (WEA)	17:59	24 08:31 (WEA007)	18:20	45 07:58 (WEA004)	20:14
13	08:00	15:28 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:51
14	16:33	15:46 (WEA)	17:59	24 08:31 (WEA007)	18:21	44 07:58 (WEA004)	20:15
15	07:59	15:29 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:48
16	16:34	15:46 (WEA)	17:59	24 08:31 (WEA007)	18:22	43 07:58 (WEA004)	20:17
17	07:57	15:30 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:47
18	16:36	15:44 (WEA)	17:54	24 08:31 (WEA007)	18:25	42 07:58 (WEA004)	20:19
19	07:56	15:32 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:45
20	16:38	15:42 (WEA)	17:56	24 08:31 (WEA007)	18:27	41 07:58 (WEA004)	20:21
21	07:55	15:33 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:43
22	16:40	15:42 (WEA)	17:58	24 08:31 (WEA007)	18:28	40 07:58 (WEA004)	20:23
23	07:53	15:35 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:41
24	16:42	15:42 (WEA)	17:50	24 08:31 (WEA007)	18:30	39 08:09 (WEA004)	20:25
25	07:52	15:36 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:39
26	16:44	15:42 (WEA)	17:52	24 08:31 (WEA007)	18:32	38 07:58 (WEA004)	20:26
27	07:50	15:37 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:37
28	16:45	15:42 (WEA)	17:52	24 08:31 (WEA007)	18:34	37 07:58 (WEA004)	20:27
29	07:49	15:38 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:35
30	16:47	15:42 (WEA)	17:54	24 08:31 (WEA007)	18:35	36 08:09 (WEA004)	20:29
31	07:48	15:39 (WEA)	16:50	24 08:31 (WEA007)	17:30	57 07:16 (WEA005)	05:33
Sonnenscheinstunden							
astron.mögl.Beschattung	390	276	840	787	417	375	1427

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-60 - SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	06:26 (WEA2B1_EhW)	05:23	06:08 (WEA2B1_EhW)	05:14	06:57 (WEA2B1_EhW)
2	04:46	06:28 (WEA2B1_EhW)	05:24	06:07 (WEA2B1_EhW)	05:15	06:56 (WEA2B1_EhW)
3	04:47	06:26 (WEA2B1_EhW)	05:25	06:07 (WEA2B1_EhW)	05:16	06:56 (WEA2B1_EhW)
4	04:48	06:25 (WEA2B1_EhW)	05:27	06:07 (WEA2B1_EhW)	05:18	06:54 (WEA2B1_EhW)
5	04:49	06:24 (WEA2B1_EhW)	05:31	06:06 (WEA2B1_EhW)	05:22	06:53 (WEA2B1_EhW)
6	04:50	06:22 (WEA2B1_EhW)	05:36	06:05 (WEA2B1_EhW)	05:27	06:52 (WEA2B1_EhW)
7	04:52	06:20 (WEA2B1_EhW)	05:42	06:04 (WEA2B1_EhW)	05:33	06:51 (WEA2B1_EhW)
8	04:55	06:17 (WEA2B1_EhW)	05:49	06:03 (WEA2B1_EhW)	05:40	06:50 (WEA2B1_EhW)
9	04:59	06:14 (WEA2B1_EhW)	05:57	06:02 (WEA2B1_EhW)	05:48	06:49 (WEA2B1_EhW)
10	05:05	06:11 (WEA2B1_EhW)	06:06	06:01 (WEA2B1_EhW)	05:57	06:48 (WEA2B1_EhW)
11	05:13	06:08 (WEA2B1_EhW)	06:16	06:00 (WEA2B1_EhW)	06:07	06:47 (WEA2B1_EhW)
12	05:22	06:05 (WEA2B1_EhW)	06:27	05:59 (WEA2B1_EhW)	06:18	06:46 (WEA2B1_EhW)
13	05:33	06:03 (WEA2B1_EhW)	06:39	05:58 (WEA2B1_EhW)	06:30	06:45 (WEA2B1_EhW)
14	05:45	06:01 (WEA2B1_EhW)	06:52	05:57 (WEA2B1_EhW)	06:43	06:44 (WEA2B1_EhW)
15	05:59	06:00 (WEA2B1_EhW)	07:06	05:56 (WEA2B1_EhW)	06:57	06:43 (WEA2B1_EhW)
16	06:15	06:00 (WEA2B1_EhW)	07:21	05:55 (WEA2B1_EhW)	07:12	06:42 (WEA2B1_EhW)
17	06:32	06:00 (WEA2B1_EhW)	07:37	05:54 (WEA2B1_EhW)	07:25	06:41 (WEA2B1_EhW)
18	06:51	06:00 (WEA2B1_EhW)	07:54	05:53 (WEA2B1_EhW)	07:41	06:40 (WEA2B1_EhW)
19	07:12	06:00 (WEA2B1_EhW)	08:12	05:52 (WEA2B1_EhW)	07:50	06:39 (WEA2B1_EhW)
20	07:35	06:00 (WEA2B1_EhW)	08:31	05:51 (WEA2B1_EhW)	08:01	06:38 (WEA2B1_EhW)
21	08:00	06:00 (WEA2B1_EhW)	08:51	05:50 (WEA2B1_EhW)	08:14	06:37 (WEA2B1_EhW)
22	08:27	06:00 (WEA2B1_EhW)	09:12	05:49 (WEA2B1_EhW)	08:29	06:36 (WEA2B1_EhW)
23	09:07	06:00 (WEA2B1_EhW)	09:34	05:48 (WEA2B1_EhW)	08:46	06:35 (WEA2B1_EhW)
24	09:59	06:00 (WEA2B1_EhW)	10:00	05:47 (WEA2B1_EhW)	09:06	06:34 (WEA2B1_EhW)
25	11:00	06:00 (WEA2B1_EhW)	10:30	05:46 (WEA2B1_EhW)	09:30	06:33 (WEA2B1_EhW)
26	12:10	06:00 (WEA2B1_EhW)	11:05	05:45 (WEA2B1_EhW)	10:00	06:32 (WEA2B1_EhW)
27	13:20	06:00 (WEA2B1_EhW)	11:45	05:44 (WEA2B1_EhW)	10:36	06:31 (WEA2B1_EhW)
28	14:20	06:00 (WEA2B1_EhW)	12:30	05:43 (WEA2B1_EhW)	11:19	06:30 (WEA2B1_EhW)
29	15:00	06:00 (WEA2B1_EhW)	13:15	05:42 (WEA2B1_EhW)	12:00	06:29 (WEA2B1_EhW)
30	15:50	06:00 (WEA2B1_EhW)	14:00	05:41 (WEA2B1_EhW)	12:39	06:28 (WEA2B1_EhW)
31	16:40	06:00 (WEA2B1_EhW)	14:45	05:40 (WEA2B1_EhW)	13:16	06:27 (WEA2B1_EhW)
Sommerschneinstunden	505					
astronomisch Beschattung	1104	465	854	381	366	1248

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-61 - SR-61, Neue Mühle 2, 15518 Jänickendorf  
**Annahmen für Schattenwurfberechnung**

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	08:15	07:48	06:53	07:19 (WEA ZB08_wpd)06:41	05:35	04:49
2	16:01	16:49	17:42	7 07:26 (WEA ZB08_wpd)09:37	20:29	21:16
3	16:03	16:51	17:44	12 07:29 (WEA ZB08_wpd)09:39	20:31	21:18
4	16:04	16:55	17:48	18 07:31 (WEA ZB08_wpd)09:43	20:33	21:20
5	16:05	16:57	17:49	16 07:30 (WEA ZB08_wpd)09:41	20:32	21:19
6	16:06	16:58	17:50	10 07:17 (WEA ZB06_wpd)05:29	05:33	04:48
7	08:47 (WEA ZB14_EnBW)16:59	19 08:33 (WEA ZB09_wpd)17:51	20 07:31 (WEA ZB08_wpd)09:46	22 07:23 (WEA ZB06_wpd)05:28	04:46	
8	08:47 (WEA ZB14_EnBW)17:01	21 08:34 (WEA ZB09_wpd)17:53	20 07:31 (WEA ZB08_wpd)09:46	22 07:23 (WEA ZB06_wpd)05:28	04:46	
9	08:47 (WEA ZB14_EnBW)17:03	23 08:35 (WEA ZB09_wpd)17:55	20 07:31 (WEA ZB08_wpd)09:46	22 07:23 (WEA ZB06_wpd)05:28	04:46	
10	08:47 (WEA ZB14_EnBW)17:04	25 08:36 (WEA ZB09_wpd)17:57	19 07:30 (WEA ZB08_wpd)09:45	25 07:23 (WEA ZB06_wpd)05:27	04:45	
11	08:47 (WEA ZB14_EnBW)17:05	26 08:37 (WEA ZB09_wpd)17:58	19 07:29 (WEA ZB08_wpd)09:44	26 07:22 (WEA ZB06_wpd)05:26	04:44	
12	08:47 (WEA ZB14_EnBW)17:06	27 08:38 (WEA ZB09_wpd)18:00	19 07:28 (WEA ZB08_wpd)09:43	26 07:21 (WEA ZB06_wpd)05:25	04:43	
13	08:47 (WEA ZB14_EnBW)17:07	28 08:39 (WEA ZB09_wpd)18:01	23 07:26 (WEA ZB08_wpd)09:41	25 07:20 (WEA ZB06_wpd)05:24	04:42	
14	08:47 (WEA ZB14_EnBW)17:08	29 08:40 (WEA ZB09_wpd)18:02	24 07:24 (WEA ZB08_wpd)09:40	31 07:22 (WEA ZB06_wpd)05:23	04:41	
15	08:47 (WEA ZB14_EnBW)17:09	30 08:41 (WEA ZB09_wpd)18:03	20 07:19 (WEA ZB07_wpd)08:00	34 07:21 (WEA ZB06_wpd)05:22	04:40	
16	08:47 (WEA ZB14_EnBW)17:10	31 08:42 (WEA ZB09_wpd)18:04	24 07:20 (WEA ZB07_wpd)08:02	06:33 (WEA ZB04_wpd)05:21	04:39	
17	08:47 (WEA ZB14_EnBW)17:11	01 08:43 (WEA ZB09_wpd)18:05	26 07:21 (WEA ZB07_wpd)08:03	07:18 (WEA ZB06_wpd)05:20	04:38	
18	08:47 (WEA ZB14_EnBW)17:12	02 08:44 (WEA ZB09_wpd)18:06	28 07:21 (WEA ZB07_wpd)08:05	06:31 (WEA ZB04_wpd)05:19	04:37	
19	08:47 (WEA ZB14_EnBW)17:13	03 08:45 (WEA ZB09_wpd)18:07	28 07:21 (WEA ZB07_wpd)08:05	36 07:17 (WEA ZB06_wpd)05:18	04:36	
20	08:47 (WEA ZB14_EnBW)17:14	04 08:46 (WEA ZB09_wpd)18:08	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
21	08:47 (WEA ZB14_EnBW)17:15	05 08:47 (WEA ZB09_wpd)18:09	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
22	08:47 (WEA ZB14_EnBW)17:16	06 08:48 (WEA ZB09_wpd)18:10	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
23	08:47 (WEA ZB14_EnBW)17:17	07 08:49 (WEA ZB09_wpd)18:11	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
24	08:47 (WEA ZB14_EnBW)17:18	08 08:50 (WEA ZB09_wpd)18:12	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
25	08:47 (WEA ZB14_EnBW)17:19	09 08:51 (WEA ZB09_wpd)18:13	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
26	08:47 (WEA ZB14_EnBW)17:20	10 08:52 (WEA ZB09_wpd)18:14	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
27	08:47 (WEA ZB14_EnBW)17:21	11 08:53 (WEA ZB09_wpd)18:15	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
28	08:47 (WEA ZB14_EnBW)17:22	12 08:54 (WEA ZB09_wpd)18:16	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
29	08:47 (WEA ZB14_EnBW)17:23	13 08:55 (WEA ZB09_wpd)18:17	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
30	08:47 (WEA ZB14_EnBW)17:24	14 08:56 (WEA ZB09_wpd)18:18	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
31	08:47 (WEA ZB14_EnBW)17:25	15 08:57 (WEA ZB09_wpd)18:19	28 07:21 (WEA ZB07_wpd)08:05	33 07:17 (WEA ZB06_wpd)05:18	04:36	
Sonneneinstrahlung	256	276	367	417	488	502
astr. max.mögl.Beschattung	444	405	647	557		

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-61 - SR-61, Neue Mühle 2, 15518 Jänickendorf**  
**Annahmen für Schattenwurfberechnung**

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	09:46   18:23	08:52   19:08	08:04   19:55	07:20   20:42	06:44   21:30	06:10   22:18	05:44   23:06	05:18   23:54	04:54   24:42	04:30   25:30	04:06   26:18
2	09:46   18:24	08:52   19:09	08:04   19:56	07:20   20:43	06:44   21:31	06:10   22:19	05:44   23:07	05:18   23:55	04:54   24:43	04:30   25:31	04:06   26:19
3	09:47   18:25	08:53   19:10	08:05   19:57	07:21   20:44	06:45   21:32	06:11   22:20	05:45   23:08	05:19   23:56	04:55   24:44	04:31   25:32	04:07   26:20
4	09:48   18:26	08:53   19:11	08:05   19:58	07:21   20:45	06:45   21:33	06:11   22:21	05:45   23:09	05:19   23:57	04:55   24:45	04:31   25:33	04:07   26:21
5	09:49   18:27	08:54   19:12	08:06   19:59	07:22   20:46	06:46   21:34	06:12   22:22	05:46   23:10	05:20   23:58	04:56   24:46	04:32   25:34	04:08   26:22
6	09:49   18:28	08:54   19:13	08:06   20:00	07:22   20:47	06:46   21:35	06:12   22:23	05:46   23:11	05:20   23:59	04:56   24:47	04:32   25:35	04:08   26:23
7	09:50   18:29	08:55   19:14	08:07   20:01	07:23   20:48	06:47   21:36	06:13   22:24	05:47   23:12	05:21   24:00	04:57   24:48	04:33   25:36	04:09   26:24
8	09:51   18:30	08:55   19:15	08:07   20:02	07:23   20:49	06:47   21:37	06:13   22:25	05:47   23:13	05:21   24:01	04:57   24:49	04:33   25:37	04:09   26:25
9	09:52   18:31	08:56   19:16	08:08   20:03	07:24   20:50	06:48   21:38	06:14   22:26	05:48   23:14	05:22   24:02	04:58   24:50	04:34   25:38	04:10   26:26
10	09:52   18:32	08:56   19:17	08:08   20:04	07:24   20:51	06:48   21:39	06:14   22:27	05:48   23:15	05:22   24:03	04:58   24:51	04:34   25:39	04:10   26:27
11	09:53   18:33	08:57   19:18	08:09   20:05	07:25   20:52	06:49   21:40	06:15   22:28	05:49   23:16	05:23   24:04	04:59   24:52	04:35   25:40	04:11   26:28
12	09:53   18:34	08:57   19:19	08:09   20:06	07:25   20:53	06:49   21:41	06:15   22:29	05:49   23:17	05:23   24:05	04:59   24:53	04:35   25:41	04:11   26:29
13	09:54   18:35	08:58   19:20	08:10   20:07	07:26   20:54	06:50   21:42	06:16   22:30	05:50   23:18	05:24   24:06	05:00   24:54	04:36   25:42	04:12   26:30
14	09:54   18:36	08:58   19:21	08:10   20:08	07:26   20:55	06:50   21:43	06:16   22:31	05:50   23:19	05:24   24:07	05:00   24:55	04:36   25:43	04:12   26:31
15	09:55   18:37	08:59   19:22	08:11   20:09	07:27   20:56	06:51   21:44	06:17   22:32	05:51   23:20	05:25   24:08	05:01   24:56	04:37   25:44	04:13   26:32
16	09:55   18:38	08:59   19:23	08:11   20:10	07:27   20:57	06:51   21:45	06:17   22:33	05:51   23:21	05:25   24:09	05:01   24:57	04:37   25:45	04:13   26:33
17	09:56   18:39	08:59   19:24	08:12   20:11	07:28   20:58	06:52   21:46	06:18   22:34	05:52   23:22	05:26   24:10	05:02   24:58	04:38   25:46	04:14   26:34
18	09:56   18:40	08:59   19:25	08:12   20:12	07:28   20:59	06:52   21:47	06:18   22:35	05:52   23:23	05:26   24:11	05:02   24:59	04:38   25:47	04:14   26:35
19	09:57   18:41	09:00   19:26	08:13   20:13	07:29   21:00	06:53   21:48	06:19   22:36	05:53   23:24	05:27   24:12	05:03   25:00	04:39   25:48	04:15   26:36
20	09:57   18:42	09:00   19:27	08:13   20:14	07:29   21:01	06:53   21:49	06:19   22:37	05:53   23:25	05:27   24:13	05:03   25:01	04:39   25:49	04:15   26:37
21	09:58   18:43	09:01   19:28	08:14   20:15	07:30   21:02	06:54   21:50	06:20   22:38	05:54   23:26	05:28   24:14	05:04   25:02	04:40   25:50	04:16   26:38
22	09:58   18:44	09:01   19:29	08:14   20:16	07:30   21:03	06:54   21:51	06:20   22:39	05:54   23:27	05:28   24:15	05:04   25:03	04:40   25:51	04:16   26:39
23	09:59   18:45	09:02   19:30	08:15   20:17	07:31   21:04	06:55   21:52	06:21   22:40	05:55   23:28	05:29   24:16	05:05   25:04	04:41   25:52	04:17   26:40
24	09:59   18:46	09:02   19:31	08:15   20:18	07:31   21:05	06:55   21:53	06:21   22:41	05:55   23:29	05:29   24:17	05:05   25:05	04:41   25:53	04:17   26:41
25	09:59   18:47	09:03   19:32	08:16   20:19	07:32   21:06	06:56   21:54	06:22   22:42	05:56   23:30	05:30   24:18	05:06   25:06	04:42   25:54	04:18   26:42
26	09:59   18:48	09:03   19:33	08:16   20:20	07:32   21:07	06:56   21:55	06:22   22:43	05:56   23:31	05:30   24:19	05:06   25:07	04:42   25:55	04:18   26:43
27	09:59   18:49	09:04   19:34	08:17   20:21	07:33   21:08	06:57   21:56	06:23   22:44	05:57   23:32	05:31   24:20	05:07   25:08	04:43   25:56	04:19   26:44
28	09:59   18:50	09:04   19:35	08:17   20:22	07:33   21:09	06:57   21:57	06:23   22:45	05:57   23:33	05:31   24:21	05:07   25:09	04:43   25:57	04:19   26:45
29	09:59   18:51	09:05   19:36	08:18   20:23	07:34   21:10	06:58   21:58	06:24   22:46	05:58   23:34	05:32   24:22	05:08   25:10	04:44   25:58	04:20   26:46
30	09:59   18:52	09:05   19:37	08:18   20:24	07:34   21:11	06:58   21:59	06:24   22:47	05:58   23:35	05:32   24:23	05:08   25:11	04:44   25:59	04:20   26:47
31	09:59   18:53	09:06   19:38	08:19   20:25	07:35   21:12	06:59   22:00	06:25   22:48	05:59   23:36	05:33   24:24	05:09   25:12	04:45   26:00	04:21   26:48
Sonneneinstrahlung		1 505		1 455		1 381		1 311		1 264	
astron.mögl. Beschattung		365		365		365		365		365	

**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 (SS:MM)	Schattenende (SS:MM)	Schattenanfang (SS:MM)	Schattenende (SS:MM)
--------------	-----------------------	-------------------------	----------------------	-------------------	------------------------	----------------------	------------------------	----------------------



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-62 - SR-62, Hoppegartener Straße 23, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	08:37 (WEA V01)   08:53	08:41	19:04 (WEA Z05)   05:35	19:30 (WEA Z01)   04:49
1	16:00	16:49	20 08:57 (WEA V01)   17:42	19:37	7 19:11 (WEA Z05)   20:29	18 19:48 (WEA Z01)   21:16
2	08:15	07:46	08:38 (WEA V01)   08:51	08:39	19:03 (WEA Z05)   05:33	19:31 (WEA Z01)   04:48
1	16:01	16:51	18 08:58 (WEA V01)   17:46	19:39	10 19:13 (WEA Z05)   20:31	15 19:46 (WEA Z01)   21:17
3	08:15	07:44	08:39 (WEA V01)   08:48	08:36	19:01 (WEA Z05)   05:31	19:32 (WEA Z01)   04:47
1	16:03	16:53	16 08:55 (WEA V01)   17:46	19:41	13 19:14 (WEA Z05)   20:33	13 19:45 (WEA Z01)   21:18
4	08:15	07:42	08:54 (WEA V01)   08:46	08:34	19:01 (WEA Z05)   05:29	19:33 (WEA Z01)   04:46
1	16:04	16:55	18 08:54 (WEA V01)   17:47	19:42	15 19:16 (WEA Z05)   20:34	9 19:42 (WEA Z01)   21:19
5	08:14	07:41	08:55 (WEA V01)   08:44	08:32	19:01 (WEA Z05)   05:27	04:45
1	16:05	16:57	6 08:51 (WEA V01)   17:49	19:44	18 19:18 (WEA Z05)   20:36	21:20
6	08:14	07:39	08:42	08:29	18:59 (WEA Z05)   05:25	04:45
1	16:06	16:59	17:51	19:46	19 19:18 (WEA Z05)   20:38	21:21
7	08:14	07:37	08:29	08:27	18:59 (WEA Z05)   05:24	04:44
1	16:07	17:00	17:53	19:48	19 19:18 (WEA Z05)   20:39	21:22
8	08:13	07:36	08:27	08:25	19:00 (WEA Z05)   05:22	04:44
1	16:09	17:02	17:55	19:49	18 19:18 (WEA Z05)   20:41	21:23
9	08:13	07:34	08:25	08:22	19:01 (WEA Z05)   05:20	04:43
1	16:10	17:04	17:56	19:51	16 19:16 (WEA Z05)   20:43	21:24
10	08:12	07:32	08:23	08:20	19:01 (WEA Z05)   05:18	04:43
1	16:12	17:06	17:58	19:53	14 19:15 (WEA Z05)   20:44	21:25
11	08:11	07:30	08:20	08:18	19:02 (WEA Z05)   05:17	04:42
1	16:13	17:08	18:00	19:55	11 19:13 (WEA Z05)   20:46	21:26
12	08:11	07:28	08:28	08:16	19:06 (WEA Z05)   05:15	04:42
1	16:15	4 08:41 (WEA V01)   17:10	18:02	19:56	3 19:09 (WEA Z05)   05:13	04:42
13	08:10	07:26	08:26	08:13	19:09 (WEA Z05)   05:13	04:42
14	08:09	07:24	08:24	08:09	19:10 (WEA Z05)   05:12	04:42
1	16:18	7 08:47 (WEA V01)   17:12	18:04	19:58	20:49	21:27
15	08:08	07:22	08:22	08:05	19:11 (WEA Z05)   05:11	04:41
16	08:08	07:20	08:20	08:01	19:12 (WEA Z05)   05:10	04:41
1	16:19	12 08:50 (WEA V01)   17:16	18:07	20:01	20:52	21:28
17	08:08	07:18	08:19	07:59	19:13 (WEA Z05)   05:09	04:41
1	16:21	15 08:52 (WEA V01)   17:18	18:09	20:03	20:54	21:29
18	08:07	07:18	08:18	07:58	19:14 (WEA Z05)   05:08	04:41
1	16:22	17 08:53 (WEA V01)   17:19	18:11	20:05	20:56	4 20:21 (WEA Z01)   21:29
19	08:06	07:16	08:16	07:54	19:15 (WEA Z05)   05:07	04:41
1	16:24	19 08:54 (WEA V01)   17:21	18:12	20:07	20:57	8 20:26 (WEA Z01)   21:30
19	08:05	07:14	08:12	07:50	19:16 (WEA Z05)   05:06	04:41
1	16:26	21 08:54 (WEA V01)   17:23	18:14	20:08	4 19:37 (WEA Z01)   20:59	10 20:27 (WEA Z01)   21:30
20	08:04	07:12	08:09	07:47	19:17 (WEA Z05)   05:05	04:41
1	16:27	22 08:55 (WEA V01)   17:25	18:16	20:10	9 19:47 (WEA Z01)   21:00	12 20:28 (WEA Z01)   21:30
21	08:02	07:10	08:07	07:45	19:18 (WEA Z05)   05:04	04:41
1	16:29	23 08:56 (WEA V01)   17:27	18:18	20:12	12 19:44 (WEA Z01)   21:02	15 20:31 (WEA Z01)   21:31
22	08:01	07:08	08:05	07:43	19:19 (WEA Z05)   05:03	04:41
1	16:31	24 08:57 (WEA V01)   17:29	18:20	20:14	15 19:46 (WEA Z01)   21:03	16 20:31 (WEA Z01)   21:31
23	08:00	07:06	08:00	07:38	19:20 (WEA Z05)   05:02	04:41
1	16:33	24 08:57 (WEA V01)   17:31	18:21	20:15	17 19:47 (WEA Z01)   21:04	18 20:31 (WEA Z01)   21:31
24	07:59	07:04	08:00	07:36	19:21 (WEA Z05)   05:01	04:41
1	16:34	25 08:58 (WEA V01)   17:33	18:23	20:17	20 19:48 (WEA Z01)   21:06	20 20:34 (WEA Z01)   21:31
25	07:57	07:02	08:01	07:35	19:22 (WEA Z05)   05:00	04:41
1	16:36	25 08:59 (WEA V01)   17:34	18:25	20:19	22 19:50 (WEA Z01)   21:07	21 20:35 (WEA Z01)   21:31
26	07:56	06:59	08:02	07:34	19:23 (WEA Z05)   05:00	04:41
1	16:38	25 08:59 (WEA V01)   17:36	18:27	20:21	22 19:51 (WEA Z01)   21:09	22 20:36 (WEA Z01)   21:31
27	07:55	06:57	08:03	07:32	19:24 (WEA Z05)   04:59	04:41
1	16:40	24 08:58 (WEA V01)   17:38	18:28	20:22	21 19:49 (WEA Z01)   21:10	22 20:36 (WEA Z01)   21:31
28	07:53	06:55	08:04	07:30	19:25 (WEA Z05)   04:58	04:41
1	16:42	24 08:59 (WEA V01)   17:40	18:30	20:24	21 19:49 (WEA Z01)   21:11	22 20:36 (WEA Z01)   21:31
29	07:52	06:54	08:05	07:29	19:26 (WEA Z05)   04:57	04:41
1	16:43	24 08:59 (WEA V01)   17:42	18:31	20:26	20 19:48 (WEA Z01)   21:13	22 20:36 (WEA Z01)   21:31
30	07:50	06:53	08:06	07:27	19:27 (WEA Z05)   04:56	04:41
1	16:45	23 08:59 (WEA V01)   17:44	18:32	20:27	20 19:49 (WEA Z01)   21:14	23 20:37 (WEA Z01)   21:31
31	07:49	06:52	08:07	07:26	19:28 (WEA Z05)   04:55	04:41
1	16:47	22 08:58 (WEA V01)   17:46	18:34	20:29	21 19:49 (WEA Z01)   21:15	22 20:36 (WEA Z01)   21:31
	Sonnenscheinstunden					
	astronomisch Beschattung	266	236	207	187	162
		390	72	2	417	312

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-62 - SR-62, Hoppegartener Straße 23, 15518 Schönfelde

**Annahmen für Schattenwurfberechnung**

- 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	04:45	20:22 (WEA ZB01_wpd)05:23	06:14	19:01 (WEA ZB05_wpd)07:04	06:59	07:51
2	04:46	20:22 (WEA ZB01_wpd)05:24	06:15	19:00 (WEA ZB05_wpd)07:05	07:01	07:52
3	04:47	20:22 (WEA ZB01_wpd)05:26	06:17	18:58 (WEA ZB05_wpd)07:07	07:02	07:54
4	04:47	20:22 (WEA ZB01_wpd)05:27	06:19	18:57 (WEA ZB05_wpd)07:09	07:04	07:55
5	04:48	20:22 (WEA ZB01_wpd)05:29	06:20	18:55 (WEA ZB05_wpd)07:11	07:06	07:56
6	04:49	20:22 (WEA ZB01_wpd)05:31	06:22	18:55 (WEA ZB05_wpd)07:12	07:08	07:58
7	04:50	20:22 (WEA ZB01_wpd)05:32	06:24	18:55 (WEA ZB05_wpd)07:14	07:10	08:00
8	04:51	20:22 (WEA ZB01_wpd)05:34	19:45 (WEA ZB03_wpd)06:25	19:13 (WEA ZB05_wpd)07:16	07:12	08:01 (WEA Vb01) 08:02
9	04:52	20:22 (WEA ZB01_wpd)05:35	19:42 (WEA ZB03_wpd)06:27	19:11 (WEA ZB05_wpd)07:18	07:13	08:02 (WEA Vb01) 08:03
10	04:53	20:22 (WEA ZB01_wpd)05:37	19:40 (WEA ZB03_wpd)06:29	19:09 (WEA ZB05_wpd)07:20	07:15	08:03 (WEA Vb01) 08:04
11	04:54	20:22 (WEA ZB01_wpd)05:39	19:39 (WEA ZB03_wpd)06:30	19:06 (WEA ZB05_wpd)07:22	07:16	08:04 (WEA Vb01) 08:05
12	04:55	20:22 (WEA ZB01_wpd)05:40	19:38 (WEA ZB03_wpd)06:32	19:04 (WEA ZB05_wpd)07:24	07:18	08:05 (WEA Vb01) 08:06
13	04:56	20:22 (WEA ZB01_wpd)05:42	19:37 (WEA ZB03_wpd)06:34	19:02 (WEA ZB05_wpd)07:26	07:19	08:06 (WEA Vb01) 08:07
14	04:57	20:22 (WEA ZB01_wpd)05:44	19:36 (WEA ZB03_wpd)06:35	18:59 (WEA ZB05_wpd)07:28	07:21	08:07 (WEA Vb01) 08:08
15	04:59	20:22 (WEA ZB01_wpd)05:45	19:35 (WEA ZB03_wpd)06:37	18:57 (WEA ZB05_wpd)07:30	07:22	08:08 (WEA Vb01) 08:09
16	05:00	20:22 (WEA ZB01_wpd)05:47	19:34 (WEA ZB03_wpd)06:39	18:55 (WEA ZB05_wpd)07:32	07:23	08:09 (WEA Vb01) 08:10
17	05:01	20:24 (WEA ZB01_wpd)05:49	19:33 (WEA ZB03_wpd)06:40	18:53 (WEA ZB05_wpd)07:34	07:24	08:10 (WEA Vb01) 08:11
18	05:02	20:24 (WEA ZB01_wpd)05:50	19:32 (WEA ZB03_wpd)06:42	18:51 (WEA ZB05_wpd)07:36	07:25	08:11 (WEA Vb01) 08:12
19	05:04	20:24 (WEA ZB01_wpd)05:52	19:31 (WEA ZB03_wpd)06:44	18:49 (WEA ZB05_wpd)07:38	07:26	08:12 (WEA Vb01) 08:13
20	05:05	20:24 (WEA ZB01_wpd)05:54	19:30 (WEA ZB03_wpd)06:45	18:47 (WEA ZB05_wpd)07:40	07:27	08:13 (WEA Vb01) 08:14
21	05:06	20:25 (WEA ZB01_wpd)05:55	19:29 (WEA ZB03_wpd)06:47	18:45 (WEA ZB05_wpd)07:42	07:28	08:14 (WEA Vb01) 08:15
22	05:08	20:25 (WEA ZB01_wpd)05:57	19:28 (WEA ZB03_wpd)06:49	18:43 (WEA ZB05_wpd)07:44	07:29	08:15 (WEA Vb01) 08:16
23	05:09	20:26 (WEA ZB01_wpd)05:59	19:27 (WEA ZB03_wpd)06:50	18:41 (WEA ZB05_wpd)07:46	07:30	08:16 (WEA Vb01) 08:17
24	05:11	20:26 (WEA ZB01_wpd)06:00	19:26 (WEA ZB03_wpd)06:52	18:39 (WEA ZB05_wpd)07:48	07:31	08:17 (WEA Vb01) 08:18
25	05:12	20:28 (WEA ZB01_wpd)06:02	19:25 (WEA ZB03_wpd)06:54	18:37 (WEA ZB05_wpd)07:50	07:32	08:18 (WEA Vb01) 08:19
26	05:14	20:28 (WEA ZB01_wpd)06:04	19:24 (WEA ZB03_wpd)06:56	18:35 (WEA ZB05_wpd)07:52	07:33	08:19 (WEA Vb01) 08:20
27	05:15	20:33 (WEA ZB01_wpd)06:05	19:23 (WEA ZB03_wpd)06:57	18:33 (WEA ZB05_wpd)07:54	07:34	08:20 (WEA Vb01) 08:21
28	05:17	20:33 (WEA ZB01_wpd)06:06	19:22 (WEA ZB03_wpd)06:59	18:31 (WEA ZB05_wpd)07:56	07:35	08:21 (WEA Vb01) 08:22
29	05:18	20:33 (WEA ZB01_wpd)06:07	19:21 (WEA ZB03_wpd)07:00	18:29 (WEA ZB05_wpd)07:58	07:36	08:22 (WEA Vb01) 08:23
30	05:20	20:33 (WEA ZB01_wpd)06:08	19:20 (WEA ZB03_wpd)07:02	18:27 (WEA ZB05_wpd)08:00	07:37	08:23 (WEA Vb01) 08:24
31	05:21	20:33 (WEA ZB01_wpd)06:09	19:19 (WEA ZB03_wpd)07:04	18:25 (WEA ZB05_wpd)08:02	07:38	08:24 (WEA Vb01) 08:25
Sonnenstunden	505	455	381	321	264	241
astr. max. mögl. Beschattung	504	266	166	466		

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-63 - SR-63, Hopppegartener Straße 24, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
2	08:15	07:47	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
3	08:15	07:47	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
4	08:15	07:47	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
5	08:14	07:41	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
6	08:14	07:39	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
7	08:14	07:37	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
8	08:13	07:36	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
9	08:13	07:34	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
10	08:12	07:32	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
11	08:11	07:30	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
12	08:11	07:28	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
13	08:10	07:26	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
14	08:09	07:24	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
15	08:08	07:22	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
16	08:07	07:20	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
17	08:06	07:18	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
18	08:05	07:16	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
19	08:04	07:14	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
20	08:03	07:12	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
21	08:02	07:10	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
22	08:01	07:08	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
23	08:00	07:06	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
24	07:59	07:04	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
25	07:58	07:02	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
26	07:57	07:00	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
27	07:56	06:58	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
28	07:55	06:56	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
29	07:54	06:54	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
30	07:53	06:52	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
31	07:52	06:50	08:44 (WEA V01)	06:41	19:02 (WEA Z05_wpd)	05:35
Sonnenscheinstunden	480					
astronom. mögl. Beschattung	480					

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6366

### SHADOW - Kalender

Berechnung: WEA\_GB Schattenrezeptor:SR-63 - SR-63, Hoppegartener Straße 24, 15518 Schönfelde  
Annahmen für Schattenwurfberechnung

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

	Juli	August	September	Oktober	November	Dezember
1	04:45	20:22 (WEA ZB01_wpd)05:23	06:14	19:04 (WEA ZB05_wpd)07:04	06:59	07:51
2	04:46	20:21 (WEA ZB01_wpd)05:24	06:15	19:00 (WEA ZB05_wpd)07:05	07:01	07:52
3	04:47	20:20 (WEA ZB01_wpd)05:25	06:16	18:56 (WEA ZB05_wpd)07:06	07:02	07:53
4	04:47	20:21 (WEA ZB01_wpd)05:26	06:17	18:52 (WEA ZB05_wpd)07:07	07:03	07:54
5	04:48	20:20 (WEA ZB01_wpd)05:27	06:18	18:48 (WEA ZB05_wpd)07:08	07:04	07:55
6	04:49	20:19 (WEA ZB01_wpd)05:28	06:19	18:44 (WEA ZB05_wpd)07:09	07:05	07:56
7	04:50	20:18 (WEA ZB01_wpd)05:29	06:20	18:40 (WEA ZB05_wpd)07:10	07:06	07:57
8	04:51	20:17 (WEA ZB01_wpd)05:30	06:21	18:36 (WEA ZB05_wpd)07:11	07:07	07:58
9	04:52	20:16 (WEA ZB01_wpd)05:31	06:22	18:32 (WEA ZB05_wpd)07:12	07:08	07:59
10	04:53	20:15 (WEA ZB01_wpd)05:32	06:23	18:28 (WEA ZB05_wpd)07:13	07:09	08:00
11	04:54	20:14 (WEA ZB01_wpd)05:33	06:24	18:24 (WEA ZB05_wpd)07:14	07:10	08:01
12	04:55	20:13 (WEA ZB01_wpd)05:34	06:25	18:20 (WEA ZB05_wpd)07:15	07:11	08:02
13	04:56	20:12 (WEA ZB01_wpd)05:35	06:26	18:16 (WEA ZB05_wpd)07:16	07:12	08:03
14	04:57	20:11 (WEA ZB01_wpd)05:36	06:27	18:12 (WEA ZB05_wpd)07:17	07:13	08:04
15	04:58	20:10 (WEA ZB01_wpd)05:37	06:28	18:08 (WEA ZB05_wpd)07:18	07:14	08:05
16	04:59	20:09 (WEA ZB01_wpd)05:38	06:29	18:04 (WEA ZB05_wpd)07:19	07:15	08:06
17	05:00	20:08 (WEA ZB01_wpd)05:39	06:30	18:00 (WEA ZB05_wpd)07:20	07:16	08:07
18	05:01	20:07 (WEA ZB01_wpd)05:40	06:31	17:56 (WEA ZB05_wpd)07:21	07:17	08:08
19	05:02	20:06 (WEA ZB01_wpd)05:41	06:32	17:52 (WEA ZB05_wpd)07:22	07:18	08:09
20	05:03	20:05 (WEA ZB01_wpd)05:42	06:33	17:48 (WEA ZB05_wpd)07:23	07:19	08:10
21	05:04	20:04 (WEA ZB01_wpd)05:43	06:34	17:44 (WEA ZB05_wpd)07:24	07:20	08:11
22	05:05	20:03 (WEA ZB01_wpd)05:44	06:35	17:40 (WEA ZB05_wpd)07:25	07:21	08:12
23	05:06	20:02 (WEA ZB01_wpd)05:45	06:36	17:36 (WEA ZB05_wpd)07:26	07:22	08:13
24	05:07	20:01 (WEA ZB01_wpd)05:46	06:37	17:32 (WEA ZB05_wpd)07:27	07:23	08:14
25	05:08	20:00 (WEA ZB01_wpd)05:47	06:38	17:28 (WEA ZB05_wpd)07:28	07:24	08:15
26	05:09	19:59 (WEA ZB01_wpd)05:48	06:39	17:24 (WEA ZB05_wpd)07:29	07:25	08:16
27	05:10	19:58 (WEA ZB01_wpd)05:49	06:40	17:20 (WEA ZB05_wpd)07:30	07:26	08:17
28	05:11	19:57 (WEA ZB01_wpd)05:50	06:41	17:16 (WEA ZB05_wpd)07:31	07:27	08:18
29	05:12	19:56 (WEA ZB01_wpd)05:51	06:42	17:12 (WEA ZB05_wpd)07:32	07:28	08:19
30	05:13	19:55 (WEA ZB01_wpd)05:52	06:43	17:08 (WEA ZB05_wpd)07:33	07:29	08:20
31	05:14	19:54 (WEA ZB01_wpd)05:53	06:44	17:04 (WEA ZB05_wpd)07:34	07:30	08:21
1	05:15	19:53 (WEA ZB01_wpd)05:54	06:45	17:00 (WEA ZB05_wpd)07:35	07:31	08:22
2	05:16	19:52 (WEA ZB01_wpd)05:55	06:46	16:56 (WEA ZB05_wpd)07:36	07:32	08:23
3	05:17	19:51 (WEA ZB01_wpd)05:56	06:47	16:52 (WEA ZB05_wpd)07:37	07:33	08:24
4	05:18	19:50 (WEA ZB01_wpd)05:57	06:48	16:48 (WEA ZB05_wpd)07:38	07:34	08:25
5	05:19	19:49 (WEA ZB01_wpd)05:58	06:49	16:44 (WEA ZB05_wpd)07:39	07:35	08:26
6	05:20	19:48 (WEA ZB01_wpd)05:59	06:50	16:40 (WEA ZB05_wpd)07:40	07:36	08:27
7	05:21	19:47 (WEA ZB01_wpd)06:00	06:51	16:36 (WEA ZB05_wpd)07:41	07:37	08:28
8	05:22	19:46 (WEA ZB01_wpd)06:01	06:52	16:32 (WEA ZB05_wpd)07:42	07:38	08:29
9	05:23	19:45 (WEA ZB01_wpd)06:02	06:53	16:28 (WEA ZB05_wpd)07:43	07:39	08:30
10	05:24	19:44 (WEA ZB01_wpd)06:03	06:54	16:24 (WEA ZB05_wpd)07:44	07:40	08:31
11	05:25	19:43 (WEA ZB01_wpd)06:04	06:55	16:20 (WEA ZB05_wpd)07:45	07:41	08:32
12	05:26	19:42 (WEA ZB01_wpd)06:05	06:56	16:16 (WEA ZB05_wpd)07:46	07:42	08:33
13	05:27	19:41 (WEA ZB01_wpd)06:06	06:57	16:12 (WEA ZB05_wpd)07:47	07:43	08:34
14	05:28	19:40 (WEA ZB01_wpd)06:07	06:58	16:08 (WEA ZB05_wpd)07:48	07:44	08:35
15	05:29	19:39 (WEA ZB01_wpd)06:08	06:59	16:04 (WEA ZB05_wpd)07:49	07:45	08:36
16	05:30	19:38 (WEA ZB01_wpd)06:09	07:00	16:00 (WEA ZB05_wpd)07:50	07:46	08:37
17	05:31	19:37 (WEA ZB01_wpd)06:10	07:01	15:56 (WEA ZB05_wpd)07:51	07:47	08:38
18	05:32	19:36 (WEA ZB01_wpd)06:11	07:02	15:52 (WEA ZB05_wpd)07:52	07:48	08:39
19	05:33	19:35 (WEA ZB01_wpd)06:12	07:03	15:48 (WEA ZB05_wpd)07:53	07:49	08:40
20	05:34	19:34 (WEA ZB01_wpd)06:13	07:04	15:44 (WEA ZB05_wpd)07:54	07:50	08:41
21	05:35	19:33 (WEA ZB01_wpd)06:14	07:05	15:40 (WEA ZB05_wpd)07:55	07:51	08:42
22	05:36	19:32 (WEA ZB01_wpd)06:15	07:06	15:36 (WEA ZB05_wpd)07:56	07:52	08:43
23	05:37	19:31 (WEA ZB01_wpd)06:16	07:07	15:32 (WEA ZB05_wpd)07:57	07:53	08:44
24	05:38	19:30 (WEA ZB01_wpd)06:17	07:08	15:28 (WEA ZB05_wpd)07:58	07:54	08:45
25	05:39	19:29 (WEA ZB01_wpd)06:18	07:09	15:24 (WEA ZB05_wpd)07:59	07:55	08:46
26	05:40	19:28 (WEA ZB01_wpd)06:19	07:10	15:20 (WEA ZB05_wpd)08:00	07:56	08:47
27	05:41	19:27 (WEA ZB01_wpd)06:20	07:11	15:16 (WEA ZB05_wpd)08:01	07:57	08:48
28	05:42	19:26 (WEA ZB01_wpd)06:21	07:12	15:12 (WEA ZB05_wpd)08:02	07:58	08:49
29	05:43	19:25 (WEA ZB01_wpd)06:22	07:13	15:08 (WEA ZB05_wpd)08:03	07:59	08:50
30	05:44	19:24 (WEA ZB01_wpd)06:23	07:14	15:04 (WEA ZB05_wpd)08:04	08:00	08:51
31	05:45	19:23 (WEA ZB01_wpd)06:24	07:15	15:00 (WEA ZB05_wpd)08:05	08:01	08:52
Sonnenscheinstunden	505	455	381	331	264	488
astr.max.mögl.Beschattung	513	243	157	31	264	35

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)			Schattenanfang (WEA mit letztem Schatten)	
	Minuten mit Schatten		Zeitpunkt (SS:MM)	Schattenanfang (WEA mit letztem Schatten)	

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-64 - SR-64, Hopppegartener Straße 23a, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:53	06:41	05:35	04:49
2	16:00	16:49	17:42	19:37	20:29	21:16
3	08:15	07:46	06:53	06:39	05:31	04:46
4	16:00	16:51	17:44	19:39	20:31	21:17
5	08:15	07:44	06:48	17:14 (WEA ZBL_ErBw)	06:36	05:31
6	16:00	16:53	17:46	19:41	20:33	21:18
7	08:15	07:42	06:46	17:12 (WEA ZBL_ErBw)	06:34	05:29
8	16:00	16:55	17:47	19:42	20:34	21:19
9	08:14	07:41	06:44	17:11 (WEA ZBL_ErBw)	06:32	05:27
10	16:00	16:57	17:49	19:44	20:36	21:20
11	08:14	07:39	06:42	17:10 (WEA ZBL_ErBw)	06:29	05:25
12	16:00	16:59	17:51	19:46	20:38	21:21
13	08:13	07:36	06:39	17:09 (WEA ZBL_ErBw)	06:25	05:22
14	16:00	17:02	17:55	19:49	20:41	21:22
15	08:13	07:34	06:35	17:09 (WEA ZBL_ErBw)	06:22	05:20
16	16:00	17:04	17:56	19:51	20:43	21:24
17	08:13	07:32	06:33	17:10 (WEA ZBL_ErBw)	06:20	05:18
18	16:00	17:06	17:58	19:53	20:44	21:25
19	08:13	07:30	06:30	17:10 (WEA ZBL_ErBw)	06:18	05:17
20	16:00	17:08	18:00	19:55	20:46	21:26
21	08:13	07:28	06:28	17:12 (WEA ZBL_ErBw)	06:16	05:15
22	16:00	17:10	18:02	19:56	20:48	21:26
23	08:10	07:26	06:26	17:14 (WEA ZBL_ErBw)	06:13	05:13
24	16:00	17:12	18:04	19:58	20:49	21:27
25	08:09	07:24	06:23	17:14 (WEA ZBL_ErBw)	06:11	05:12
26	16:00	17:14	18:05	19:59	20:51	21:28
27	08:08	07:22	06:21	17:15 (WEA ZBL_ErBw)	06:09	05:10
28	16:00	17:16	18:07	20:01	20:52	21:28
29	08:08	07:20	06:19	17:16	06:07	05:08
30	16:00	17:18	18:09	20:03	20:54	21:29
31	08:07	07:18	06:16	17:18	06:04	05:07
1	16:00	17:19	18:11	20:05	20:56	21:29
2	08:06	07:16	06:14	17:19	06:02	05:05
3	16:00	17:21	18:12	20:07	20:57	21:30
4	08:05	07:14	06:12	17:20	06:00	05:04
5	16:00	17:23	18:14	20:09	20:59	21:30
6	08:04	07:12	06:09	17:21 (WEA ZBL_ErBw)	05:58	05:02
7	16:00	17:25	18:16	20:10	21:00	21:30
8	08:03	07:10	06:07	17:22	05:56	05:01
9	16:00	17:27	18:18	20:12	21:02	21:31
10	08:02	07:08	06:05	17:23	05:54	05:00
11	16:00	17:29	18:20	20:14	21:03	21:31
12	08:01	07:06	06:02	17:24	05:51	05:00
13	16:00	17:31	18:21	20:15	21:04	21:31
14	07:59	07:04	06:00	17:25	05:49	04:57
15	16:00	17:33	18:23	20:17	21:06	21:31
16	07:57	07:02	05:57	17:26	05:47	04:56
17	16:00	17:34	18:25	20:19	21:07	21:31
18	07:56	06:59	05:55	17:27	05:45	04:55
19	16:00	17:36	18:27	20:21	21:09	21:31
20	07:55	06:57	05:53	17:28	05:43	04:54
21	16:00	17:38	18:28	20:22	21:10	21:31
22	07:53	06:55	05:50	17:29	05:41	04:54
23	16:00	17:40	18:30	20:24	21:11	21:31
24	07:52	06:53	05:48	17:30	05:39	04:53
25	16:00	17:42	18:32	20:26	21:13	21:31
26	07:50	06:51	05:46	17:31	05:37	04:53
27	16:00	17:44	18:35	20:27	21:14	21:31
28	07:49	06:49	05:43	17:32	05:35	04:52
29	16:00	17:46	18:37	20:29	21:15	21:31
30	07:48	06:47	05:39	17:33	05:33	04:51
31	16:00	17:48	18:39	20:31	21:17	21:31
Sonnenscheinstunden	256	276	307	417	488	502
astr.max.mögl.Beschattung	287	151	145	316	279	670

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-64 - SR-64, Hoppegartener Straße 23a, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45 21:30	05:22 20:49	06:14 19:54	07:04 19:20	07:59 18:52	07:51 18:36
2	04:46 21:30	05:24 20:49	06:15 19:52	07:05 19:20	07:59 18:54	07:52 18:34
3	04:47 21:30	05:26 20:49	06:17 19:50	07:07 19:20	07:59 18:54	07:54 18:34
4	04:47 21:29	05:27 20:51	19:51 (WEA2003_wpd) 06:19	19:00 (WEA2005_wpd) 07:09	17:47 (WEA2001_ErBN) 07:04	08:07 (WEA001) 07:55
5	04:48 21:29	05:29 20:51	19:54 (WEA2003_wpd) 06:20	19:00 (WEA2005_wpd) 07:11	17:46 (WEA2001_ErBN) 07:06	08:07 (WEA001) 07:56
6	04:49 21:28	05:31 20:49	19:56 (WEA2003_wpd) 06:22	19:00 (WEA2005_wpd) 07:12	17:46 (WEA2001_ErBN) 07:08	08:07 (WEA001) 07:58
7	04:50 21:28	05:33 20:47	19:59 (WEA2003_wpd) 06:24	19:00 (WEA2005_wpd) 07:14	17:46 (WEA2001_ErBN) 07:10	08:07 (WEA001) 07:59
8	04:51 21:27	05:34 20:45	19:43 (WEA2003_wpd) 06:25	19:01 (WEA2005_wpd) 07:16	17:46 (WEA2001_ErBN) 07:12	08:07 (WEA001) 08:00
9	04:52 21:26	05:35 20:43	19:43 (WEA2003_wpd) 06:27	19:03 (WEA2005_wpd) 07:18	17:46 (WEA2001_ErBN) 07:13	08:07 (WEA001) 08:02
10	04:53 21:25	05:37 20:42	19:43 (WEA2003_wpd) 06:29	19:03 (WEA2005_wpd) 07:20	17:47 (WEA2001_ErBN) 07:15	08:07 (WEA001) 08:03
11	04:54 21:25	05:39 20:41	19:43 (WEA2003_wpd) 06:30	19:03 (WEA2005_wpd) 07:21	17:47 (WEA2001_ErBN) 07:17	08:07 (WEA001) 08:04
12	04:55 21:24	05:40 20:40	19:43 (WEA2003_wpd) 06:32	19:04 (WEA2005_wpd) 07:23	17:47 (WEA2001_ErBN) 07:19	08:07 (WEA001) 08:05
13	04:56 21:23	05:42 20:39	19:41 (WEA2003_wpd) 06:34	19:04 (WEA2005_wpd) 07:25	17:47 (WEA2001_ErBN) 07:21	08:06 (WEA001) 08:06
14	04:57 21:22	05:44 20:38	19:41 (WEA2003_wpd) 06:35	19:04 (WEA2005_wpd) 07:26	17:47 (WEA2001_ErBN) 07:23	08:06 (WEA001) 08:07
15	04:59 21:21	05:45 20:37	19:41 (WEA2003_wpd) 06:37	19:04 (WEA2005_wpd) 07:28	17:47 (WEA2001_ErBN) 07:24	08:06 (WEA001) 08:08
16	05:00 21:20	05:47 20:36	19:41 (WEA2003_wpd) 06:38	19:04 (WEA2005_wpd) 07:29	17:47 (WEA2001_ErBN) 07:26	08:06 (WEA001) 08:09
17	05:01 21:19	05:49 20:35	19:41 (WEA2003_wpd) 06:40	19:04 (WEA2005_wpd) 07:31	17:47 (WEA2001_ErBN) 07:28	08:06 (WEA001) 08:10
18	05:02 21:18	05:51 20:34	19:41 (WEA2003_wpd) 06:42	19:04 (WEA2005_wpd) 07:33	17:47 (WEA2001_ErBN) 07:30	08:06 (WEA001) 08:11
19	05:04 21:17	05:52 20:33	19:44 (WEA2003_wpd) 06:44	19:04 (WEA2005_wpd) 07:35	17:47 (WEA2001_ErBN) 07:32	08:06 (WEA001) 08:12
20	05:05 21:16	05:54 20:32	19:44 (WEA2003_wpd) 06:46	19:04 (WEA2005_wpd) 07:37	17:47 (WEA2001_ErBN) 07:34	08:06 (WEA001) 08:13
21	05:06 21:14	05:55 20:31	19:53 (WEA2003_wpd) 06:47	19:04 (WEA2005_wpd) 07:39	17:47 (WEA2001_ErBN) 07:36	08:06 (WEA001) 08:14
22	05:08 21:13	05:57 20:30	19:51 (WEA2003_wpd) 06:49	19:04 (WEA2005_wpd) 07:41	17:47 (WEA2001_ErBN) 07:38	08:06 (WEA001) 08:15
23	05:09 21:11	05:59 20:29	19:03 06:50	17:56 07:42	16:03 08:21	08:22 (WEA001) 08:14
24	05:11 21:10	06:00 20:28	19:03 06:50	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
25	05:12 21:09	06:02 20:26	19:03 06:50	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
26	05:14 21:07	06:04 20:25	19:03 06:50	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
27	05:15 21:06	06:05 20:24	19:03 06:50	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
28	05:17 21:04	06:07 20:23	19:03 06:50	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
29	05:18 21:03	06:09 20:21	19:03 (WEA2005_wpd) 07:00	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
30	05:20 21:01	06:10 20:19	19:05 (WEA2005_wpd) 07:02	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
31	05:21 20:59	06:12 20:17	19:04 (WEA2005_wpd) 07:04	17:54 07:42	16:03 08:21	08:21 (WEA001) 08:14
	20:59	19:57	18:50	18:38	18:26	18:15
	19:56	18:50	17:31	17:01	16:54	16:46
Sonnenscheinstunden						
astr.max.mögl.Beschattung	407	319	137	144	437	213

**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)	Schattendenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-65 - SR-65, Hopppegartener Straße 25, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:47 (WEA VB03)	07:47	08:27 (WEA VB01)	06:53	06:41
2	16:05	16:05 (WEA VB02)	16:49	25 08:52 (WEA VB01)	17:42	19:37
3	08:15	08:47 (WEA VB03)	07:46	08:27 (WEA VB01)	06:51	06:40
4	16:05	16:05 (WEA VB02)	16:51	25 08:52 (WEA VB01)	17:44	19:39
5	08:15	08:47 (WEA VB03)	07:44	08:27 (WEA VB01)	06:48	06:36
6	16:05	16:05 (WEA VB02)	16:53	24 08:51 (WEA VB01)	17:46	19:41
7	08:15	08:46 (WEA VB03)	07:42	08:28 (WEA VB01)	06:46	17:20 (WEA ZB11_ErWB)
8	16:05	16:05 (WEA VB02)	16:55	24 08:52 (WEA VB01)	17:47	19:42
9	08:15	08:46 (WEA VB03)	07:41	08:29 (WEA VB01)	06:44	17:16 (WEA ZB11_ErWB)
10	16:05	16:05 (WEA VB02)	16:57	22 08:51 (WEA VB01)	17:49	19:44
11	08:14	08:46 (WEA VB03)	07:39	08:30 (WEA VB01)	06:42	17:15 (WEA ZB11_ErWB)
12	16:06	16:06 (WEA VB02)	16:59	21 08:50 (WEA VB01)	17:51	19:46
13	08:14	08:47 (WEA VB03)	07:37	08:30 (WEA VB01)	06:39	17:14 (WEA ZB11_ErWB)
14	16:07	16:07 (WEA VB02)	17:00	19 08:49 (WEA VB01)	17:53	19:48
15	08:13	08:47 (WEA VB03)	07:36	08:32 (WEA VB01)	06:37	17:13 (WEA ZB11_ErWB)
16	16:09	16:09 (WEA VB02)	17:02	16 08:48 (WEA VB01)	17:55	15 17:28 (WEA ZB11_ErWB)
17	08:13	08:47 (WEA VB03)	07:34	08:34 (WEA VB01)	06:35	17:13 (WEA ZB11_ErWB)
18	16:10	16:10 (WEA VB02)	17:04	08:46 (WEA VB01)	17:56	17:30 (WEA ZB11_ErWB)
19	08:12	08:48 (WEA VB03)	07:32	08:37 (WEA VB01)	06:33	17:13 (WEA ZB11_ErWB)
20	16:12	16:12 (WEA VB02)	17:06	5 08:42 (WEA VB01)	17:58	18 17:31 (WEA ZB11_ErWB)
21	08:11	08:48 (WEA VB03)	07:30	08:30	06:30	17:12 (WEA ZB11_ErWB)
22	16:13	16:13 (WEA VB02)	17:08	18 17:30 (WEA ZB11_ErWB)	19:55	19 19:25 (WEA ZB05_wpt)
23	08:11	08:49 (WEA VB03)	07:28	08:28	06:28	17:13 (WEA ZB11_ErWB)
24	16:15	16:15 (WEA VB02)	17:10	18:02	19:56	18 19:24 (WEA ZB05_wpt)
25	08:10	08:49 (WEA VB03)	07:26	08:26	06:26	17:14 (WEA ZB11_ErWB)
26	16:16	16:16 (WEA VB02)	17:12	18:04	19:58	17 19:24 (WEA ZB05_wpt)
27	08:09	08:50 (WEA VB03)	07:24	08:23	06:23	17:15 (WEA ZB11_ErWB)
28	16:18	16:18 (WEA VB02)	17:14	18:05	19:59	17 17:26 (WEA ZB11_ErWB)
29	08:08	08:50 (WEA VB03)	07:22	08:21	06:21	17:19 (WEA ZB11_ErWB)
30	16:19	16:19 (WEA VB02)	17:16	18:07	19:59	3 17:22 (WEA ZB11_ErWB)
31	08:08	08:51 (WEA VB03)	07:20	18:09	19:57	20:01
1	16:21	16:21 (WEA VB02)	17:18	18:09	20:03	8 19:18 (WEA ZB05_wpt)
2	08:07	08:51 (WEA VB03)	07:18	18:04	19:54	06:07
3	16:22	16:22 (WEA VB02)	17:19	18:11	20:05	20:56
4	08:06	08:53 (WEA VB03)	07:16	18:12	19:57	05:55
5	16:24	16:24 (WEA VB02)	17:21	18:12	20:07	21:30
6	08:05	08:54 (WEA VB03)	07:14	18:12	19:57	20:57
7	16:26	16:26 (WEA VB02)	17:23	18:14	20:09	21:30
8	08:04	08:54 (WEA VB03)	07:12	18:14	19:58	20:59
9	16:27	16:27 (WEA VB02)	17:25	18:16	20:10	21:30
10	08:03	08:54 (WEA VB03)	07:10	18:16	19:57	20:57
11	16:29	16:29 (WEA VB02)	17:27	18:18	20:12	21:30
12	08:01	08:54 (WEA VB03)	07:08	18:18	19:54	20:54
13	16:31	16:31 (WEA VB02)	17:29	18:20	20:14	21:30
14	08:00	08:54 (WEA VB03)	07:06	18:20	19:51	20:54
15	16:33	16:33 (WEA VB02)	17:31	18:21	20:15	21:30
16	07:59	08:28 (WEA VB01)	07:04	18:23	19:49	20:57 (WEA ZB01_wpt)
17	16:34	16:34 (WEA VB02)	17:33	18:23	20:17	5 20:34 (WEA ZB01_wpt)
18	07:57	08:27 (WEA VB01)	07:02	18:25	19:47	5 20:38 (WEA ZB01_wpt)
19	16:36	16:36 (WEA VB02)	17:34	18:25	20:19	7 20:35 (WEA ZB01_wpt)
20	07:56	08:27 (WEA VB01)	06:59	18:25	19:39	20:27 (WEA ZB01_wpt)
21	16:38	16:38 (WEA VB02)	17:36	18:27	20:21	9 20:36 (WEA ZB01_wpt)
22	07:55	08:26 (WEA VB01)	06:57	18:28	19:38	20:26 (WEA ZB01_wpt)
23	16:40	16:40 (WEA VB02)	17:38	18:28	20:22	16 19:54 (WEA ZB01_wpt)
24	07:53	08:27 (WEA VB01)	06:55	18:29	19:37	20:25 (WEA ZB01_wpt)
25	16:42	16:42 (WEA VB02)	17:40	18:30	20:24	18 19:55 (WEA ZB01_wpt)
26	07:52	08:26 (WEA VB01)	06:54	18:30	19:36	20:25 (WEA ZB01_wpt)
27	16:43	16:43 (WEA VB02)	17:41	18:31	20:26	15 20:40 (WEA ZB01_wpt)
28	07:50	08:26 (WEA VB01)	06:54	18:32	19:37	20:24 (WEA ZB01_wpt)
29	16:45	16:45 (WEA VB02)	17:42	18:32	20:27	17 20:41 (WEA ZB01_wpt)
30	07:49	08:27 (WEA VB01)	06:53	18:33	19:37	20:24 (WEA ZB01_wpt)
31	16:47	16:47 (WEA VB02)	17:44	18:34	20:28	18 20:42 (WEA ZB01_wpt)
Sonnenscheinstunden	256	256	276	417	417	502
astr.mögl.Beschattung	674	193	143	278	273	659

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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-65 - SR-65, Hoppegartener Straße 25, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember			
1	04:45	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
2	04:46	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
3	04:47	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
4	04:47	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
5	04:48	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
6	04:49	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
7	04:50	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
8	04:51	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
9	04:52	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
10	04:53	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
11	04:54	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
12	04:55	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
13	04:56	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
14	04:57	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
15	04:59	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
16	05:00	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
17	05:01	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
18	05:02	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
19	05:04	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
20	05:05	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
21	05:06	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
22	05:08	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
23	05:09	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
24	05:11	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
25	05:12	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
26	05:14	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
27	05:17	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
28	05:17	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
29	05:18	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
30	05:20	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
31	05:21	20:29 (WEA Z801_wpd)	05:32	19:54	17:52 (WEA Z811_EhW)	06:59	08:06 (WEA V801)	07:51	08:30 (WEA B803)
Sonnenscheinstunden	269	195	181	168	159	151	146	141	139
astr.max.mögl.Beschattung	345	347	347	347	347	347	347	347	347

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-66 - SR-66, Hopppegartener Straße 16/17, 15518 Schönfelde  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:41 (WEA V02)	07:47			
2	08:15	10:00 (WEA V02)	16:49	25	08:47 (WEA V01)	17:42
3	08:15	09:42 (WEA V02)	07:46			
4	08:14	09:46 (WEA V02)	07:41			
5	08:14	10:00 (WEA V02)	16:57	24	08:47 (WEA V01)	17:49
6	08:14	09:46 (WEA V02)	07:39			
7	08:14	09:59 (WEA V02)	16:59	23	08:47 (WEA V01)	17:51
8	08:13	09:51 (WEA V02)	17:00	22	08:46 (WEA V01)	17:53
9	08:13	09:51 (WEA V02)	17:02	20	08:45 (WEA V01)	17:55
10	08:12	07:32	06:33			
11	08:12	07:34	06:35			
12	08:11	07:34	06:35			
13	08:10	07:26	06:26			
14	08:09	07:24	06:23			
15	08:08	07:22	06:21			
16	08:08	07:16	06:07			
17	08:07	07:18	06:09			
18	08:06	07:19	06:11			
19	08:05	07:16	06:08			
20	08:04	07:12	06:04			
21	08:02	07:25	06:16			
22	08:01	07:29	06:20			
23	08:00	07:30	06:21			
24	07:59	07:31	06:21			
25	07:57	07:30	06:20			
26	07:56	07:28	06:18			
27	07:55	07:26	06:16			
28	07:53	07:22	06:12			
29	07:52	07:19	06:09			
30	07:50	07:15	06:05			
31	07:49	07:11	06:01			
Sonnenscheinstunden	256	276	307	417	488	502
astr.mögl. Beschattung	294	231	153	257	272	633

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-66 - SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember					
1	04:45	20:32 (WEA Z801_wpd)	05:22	19:53 (WEA Z802_wpd)	06:14	19:06 (WEA Z805_wpd)	07:04	17:51 (WEA Z811_EhW)	06:59	07:57 (WEA V801)	07:51
2	04:46	20:32 (WEA Z801_wpd)	05:22	19:53 (WEA Z802_wpd)	06:14	19:06 (WEA Z805_wpd)	07:04	17:51 (WEA Z811_EhW)	06:59	07:57 (WEA V801)	07:51
3	04:47	20:33 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	19:08 (WEA Z805_wpd)	07:07	17:53 (WEA Z811_EhW)	07:01	07:58 (WEA V801)	07:52
4	04:47	20:33 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	19:08 (WEA Z805_wpd)	07:07	17:53 (WEA Z811_EhW)	07:01	07:58 (WEA V801)	07:52
5	04:48	20:34 (WEA Z801_wpd)	05:29	19:56 (WEA Z803_wpd)	06:20	19:10 (WEA Z805_wpd)	07:11	17:54 (WEA Z811_EhW)	07:05	07:59 (WEA V801)	07:56
6	04:49	20:34 (WEA Z801_wpd)	05:31	19:56 (WEA Z803_wpd)	06:22	19:10 (WEA Z805_wpd)	07:12	17:54 (WEA Z811_EhW)	07:06	07:59 (WEA V801)	07:56
7	04:50	20:35 (WEA Z801_wpd)	05:34	19:57 (WEA Z803_wpd)	06:25	19:11 (WEA Z805_wpd)	07:15	17:55 (WEA Z811_EhW)	07:09	08:00 (WEA V801)	07:59
8	04:51	20:35 (WEA Z801_wpd)	05:34	19:57 (WEA Z803_wpd)	06:25	19:11 (WEA Z805_wpd)	07:15	17:55 (WEA Z811_EhW)	07:09	08:00 (WEA V801)	07:59
9	04:52	20:36 (WEA Z801_wpd)	05:38	19:59 (WEA Z803_wpd)	06:29	19:13 (WEA Z805_wpd)	07:19	17:57 (WEA Z811_EhW)	07:13	08:02 (WEA V801)	08:03
10	04:53	20:36 (WEA Z801_wpd)	05:37	19:57 (WEA Z803_wpd)	06:29	19:13 (WEA Z805_wpd)	07:19	17:57 (WEA Z811_EhW)	07:13	08:02 (WEA V801)	08:03
11	04:54	20:37 (WEA Z801_wpd)	05:41	19:59 (WEA Z803_wpd)	06:33	19:15 (WEA Z805_wpd)	07:23	17:59 (WEA Z811_EhW)	07:17	08:04 (WEA V801)	08:07
12	04:55	20:37 (WEA Z801_wpd)	05:40	19:57 (WEA Z803_wpd)	06:32	19:15 (WEA Z805_wpd)	07:23	17:59 (WEA Z811_EhW)	07:17	08:04 (WEA V801)	08:07
13	04:56	20:38 (WEA Z801_wpd)	05:42	19:57 (WEA Z803_wpd)	06:34	19:15 (WEA Z805_wpd)	07:25	17:59 (WEA Z811_EhW)	07:19	08:04 (WEA V801)	08:09
14	04:57	20:39 (WEA Z801_wpd)	05:44	19:58 (WEA Z803_wpd)	06:35	19:16 (WEA Z805_wpd)	07:26	17:59 (WEA Z811_EhW)	07:20	08:05 (WEA V801)	08:10
15	04:59	20:40 (WEA Z801_wpd)	05:45	19:58 (WEA Z803_wpd)	06:37	19:16 (WEA Z805_wpd)	07:28	17:59 (WEA Z811_EhW)	07:22	08:05 (WEA V801)	08:12
16	05:00	20:41 (WEA Z801_wpd)	05:47	19:59 (WEA Z803_wpd)	06:39	19:17 (WEA Z805_wpd)	07:30	18:00 (WEA Z811_EhW)	07:24	08:06 (WEA V801)	08:13
17	05:01	20:41 (WEA Z801_wpd)	05:49	19:59 (WEA Z803_wpd)	06:40	19:17 (WEA Z805_wpd)	07:32	18:00 (WEA Z811_EhW)	07:26	08:06 (WEA V801)	08:15
18	05:02	20:42 (WEA Z801_wpd)	05:51	19:59 (WEA Z803_wpd)	06:41	19:18 (WEA Z805_wpd)	07:33	18:01 (WEA Z811_EhW)	07:27	08:07 (WEA V801)	08:16
19	05:03	20:43 (WEA Z801_wpd)	05:52	19:59 (WEA Z803_wpd)	06:42	19:18 (WEA Z805_wpd)	07:35	18:01 (WEA Z811_EhW)	07:29	08:07 (WEA V801)	08:18
20	05:05	20:44 (WEA Z801_wpd)	05:54	19:59 (WEA Z803_wpd)	06:44	19:19 (WEA Z805_wpd)	07:37	18:02 (WEA Z811_EhW)	07:31	08:08 (WEA V801)	08:19
21	05:06	20:44 (WEA Z801_wpd)	05:55	19:59 (WEA Z803_wpd)	06:45	19:19 (WEA Z805_wpd)	07:39	18:02 (WEA Z811_EhW)	07:33	08:08 (WEA V801)	08:21
22	05:08	20:45 (WEA Z801_wpd)	05:57	19:59 (WEA Z803_wpd)	06:46	19:20 (WEA Z805_wpd)	07:41	18:03 (WEA Z811_EhW)	07:35	08:09 (WEA V801)	08:22
23	05:09	20:45 (WEA Z801_wpd)	05:58	19:59 (WEA Z803_wpd)	06:47	19:20 (WEA Z805_wpd)	07:43	18:03 (WEA Z811_EhW)	07:37	08:09 (WEA V801)	08:24
24	05:11	20:46 (WEA Z801_wpd)	05:59	19:59 (WEA Z803_wpd)	06:48	19:21 (WEA Z805_wpd)	07:45	18:04 (WEA Z811_EhW)	07:39	08:10 (WEA V801)	08:25
25	05:12	20:46 (WEA Z801_wpd)	06:00	19:59 (WEA Z803_wpd)	06:49	19:21 (WEA Z805_wpd)	07:47	18:04 (WEA Z811_EhW)	07:41	08:10 (WEA V801)	08:27
26	05:14	20:47 (WEA Z801_wpd)	06:02	19:59 (WEA Z803_wpd)	06:50	19:22 (WEA Z805_wpd)	07:49	18:05 (WEA Z811_EhW)	07:43	08:11 (WEA V801)	08:28
27	05:15	20:48 (WEA Z801_wpd)	06:04	19:59 (WEA Z803_wpd)	06:51	19:22 (WEA Z805_wpd)	07:51	18:05 (WEA Z811_EhW)	07:45	08:11 (WEA V801)	08:30
28	05:17	20:49 (WEA Z801_wpd)	06:06	19:59 (WEA Z803_wpd)	06:52	19:23 (WEA Z805_wpd)	07:53	18:06 (WEA Z811_EhW)	07:47	08:12 (WEA V801)	08:31
29	05:18	20:50 (WEA Z801_wpd)	06:07	19:59 (WEA Z803_wpd)	06:53	19:23 (WEA Z805_wpd)	07:55	18:06 (WEA Z811_EhW)	07:49	08:12 (WEA V801)	08:33
30	05:20	20:51 (WEA Z801_wpd)	06:09	19:59 (WEA Z803_wpd)	06:54	19:24 (WEA Z805_wpd)	07:57	18:07 (WEA Z811_EhW)	07:51	08:13 (WEA V801)	08:34
31	05:21	20:52 (WEA Z801_wpd)	06:11	19:59 (WEA Z803_wpd)	06:55	19:24 (WEA Z805_wpd)	07:59	18:07 (WEA Z811_EhW)	07:53	08:13 (WEA V801)	08:36
Sonnenscheinstunden	269	269	269	269	269	269	269	269	269	269	269
astr.mög.Beschattung	267	267	267	267	267	267	267	267	267	267	267

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-67 - SR-67, Grünstraße 26, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:00 08:15 16:01	08:47 (WEA V03) 10:06 (WEA V02) 08:47 (WEA V03) 10:06 (WEA V02)	07:47 16:49 08:21 (WEA V01) 17:42	06:53 19:37 08:21 (WEA V01) 19:37	06:41 19:37 08:21 (WEA V01) 19:37	06:49 20:29 08:21 (WEA V01) 20:29
2	08:15 16:01	08:47 (WEA V03) 10:06 (WEA V02)	07:47 16:49	06:53 19:37	06:41 19:37	06:49 20:29
3	08:15 16:03	08:47 (WEA V03) 10:06 (WEA V02)	07:47 16:51	06:53 19:39	06:41 19:39	06:49 20:31
4	08:15 16:04	08:46 (WEA V03) 10:06 (WEA V02)	07:42 16:52	06:46 19:41	06:34 19:41	06:42 20:33
5	08:14 16:05	08:46 (WEA V03) 10:06 (WEA V02)	07:41 16:57	06:44 19:44	06:32 19:44	06:40 20:35
6	08:14 16:06	08:45 (WEA V03) 10:06 (WEA V02)	07:39 16:59	06:42 19:46	06:30 19:46	06:38 20:37
7	08:14 16:07	08:45 (WEA V03) 10:06 (WEA V02)	07:37 17:00	06:39 19:48	06:27 19:48	06:35 20:39
8	08:13 16:09	08:45 (WEA V03) 10:06 (WEA V02)	07:36 17:02	06:37 19:50	06:25 19:50	06:33 20:41
9	08:13 16:10	08:44 (WEA V03) 10:06 (WEA V02)	07:34 17:04	06:35 19:51	06:23 19:51	06:31 20:43
10	08:12 16:12	08:44 (WEA V03) 10:06 (WEA V02)	07:32 17:06	06:33 19:53	06:21 19:53	06:29 20:45
11	08:11 16:13	08:44 (WEA V03) 10:06 (WEA V02)	07:30 17:08	06:31 19:54	06:19 19:54	06:27 20:47
12	08:11 16:15	08:43 (WEA V03) 10:06 (WEA V02)	07:28 17:10	06:29 19:56	06:17 19:56	06:25 20:49
13	08:10 16:16	08:43 (WEA V03) 10:06 (WEA V02)	07:26 17:12	06:27 19:58	06:15 19:58	06:23 20:51
14	08:09 16:18	08:43 (WEA V03) 10:06 (WEA V02)	07:24 17:14	06:25 20:00	06:13 20:00	06:21 20:53
15	08:08 16:19	08:42 (WEA V03) 10:06 (WEA V02)	07:22 17:16	06:23 20:01	06:11 20:01	06:19 20:55
16	08:08 16:21	08:42 (WEA V03) 10:06 (WEA V02)	07:21 17:18	06:21 20:02	06:09 20:02	06:17 20:57
17	08:07 16:22	08:41 (WEA V03) 10:06 (WEA V02)	07:19 17:20	06:19 20:03	06:07 20:03	06:15 20:59
18	08:06 16:24	08:41 (WEA V03) 10:06 (WEA V02)	07:18 17:21	06:17 20:04	06:05 20:04	06:13 21:01
19	08:05 16:26	08:41 (WEA V03) 10:06 (WEA V02)	07:17 17:23	06:15 20:06	06:03 20:06	06:11 21:03
20	08:04 16:27	08:40 (WEA V03) 10:06 (WEA V02)	07:16 17:25	06:13 20:07	06:01 20:07	06:09 21:05
21	08:02 16:29	08:40 (WEA V03) 10:06 (WEA V02)	07:15 17:27	06:11 20:08	05:59 20:08	06:07 21:07
22	08:01 16:31	08:39 (WEA V03) 10:06 (WEA V02)	07:14 17:29	06:09 20:10	05:57 20:10	06:05 21:09
23	08:00 16:33	08:39 (WEA V03) 10:06 (WEA V02)	07:13 17:31	06:07 20:11	05:55 20:11	06:03 21:11
24	07:59 16:34	08:38 (WEA V03) 10:06 (WEA V02)	07:12 17:33	06:05 20:12	05:53 20:12	06:01 21:13
25	07:57 16:36	08:38 (WEA V03) 10:06 (WEA V02)	07:11 17:35	06:03 20:13	05:51 20:13	05:59 21:15
26	07:56 16:38	08:37 (WEA V03) 10:06 (WEA V02)	07:10 17:37	06:01 20:14	05:49 20:14	05:57 21:17
27	07:55 16:40	08:37 (WEA V03) 10:06 (WEA V02)	07:09 17:38	05:59 20:15	05:47 20:15	05:55 21:19
28	07:53 16:42	08:37 (WEA V03) 10:06 (WEA V02)	07:08 17:40	05:57 20:16	05:45 20:16	05:53 21:21
29	07:52 16:43	08:36 (WEA V03) 10:06 (WEA V02)	07:07 17:42	05:55 20:17	05:43 20:17	05:51 21:23
30	07:50 16:45	08:36 (WEA V03) 10:06 (WEA V02)	07:06 17:44	05:53 20:18	05:41 20:18	05:49 21:25
31	07:49 16:47	08:35 (WEA V03) 10:06 (WEA V02)	07:05 17:46	05:51 20:19	05:39 20:19	05:47 21:27
Sonnenscheinstunden astron.mögl. Beschattung	256 750	256 750	287 750	307 750	327 750	347 750

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-67 - SR-67, Grünstraße 26, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:36 (WEA Z801_wpd)	05:22	19:54 (WEA Z805_wpd)	06:14	19:10 (WEA Z805_wpd)
2	11:30	20:56 (WEA Z801_wpd)	20:58	20:10 (WEA Z803_wpd)	19:54	17:57 (WEA Z805_wpd)
3	04:47	20:56 (WEA Z801_wpd)	05:26	19:51 (WEA Z803_wpd)	06:15	19:11 (WEA Z805_wpd)
4	04:47	20:56 (WEA Z801_wpd)	05:26	19:51 (WEA Z803_wpd)	06:17	19:11 (WEA Z805_wpd)
5	04:48	20:57 (WEA Z801_wpd)	05:29	19:52 (WEA Z803_wpd)	06:20	19:11 (WEA Z805_wpd)
6	04:49	20:57 (WEA Z801_wpd)	05:31	19:51 (WEA Z803_wpd)	06:22	19:11 (WEA Z805_wpd)
7	04:50	20:57 (WEA Z801_wpd)	05:32	19:51 (WEA Z803_wpd)	06:24	19:11 (WEA Z805_wpd)
8	04:51	20:58 (WEA Z801_wpd)	05:34	19:51 (WEA Z803_wpd)	06:25	19:11 (WEA Z805_wpd)
9	04:52	20:58 (WEA Z801_wpd)	05:35	19:51 (WEA Z803_wpd)	06:27	19:11 (WEA Z805_wpd)
10	04:53	20:59 (WEA Z801_wpd)	05:37	19:52 (WEA Z803_wpd)	06:29	19:11 (WEA Z805_wpd)
11	04:54	20:59 (WEA Z801_wpd)	05:39	19:52 (WEA Z803_wpd)	06:31	19:11 (WEA Z805_wpd)
12	04:55	20:59 (WEA Z801_wpd)	05:40	19:52 (WEA Z803_wpd)	06:32	19:11 (WEA Z805_wpd)
13	04:56	20:59 (WEA Z801_wpd)	05:42	19:52 (WEA Z803_wpd)	06:34	19:11 (WEA Z805_wpd)
14	04:57	20:59 (WEA Z801_wpd)	05:44	19:54 (WEA Z803_wpd)	06:35	19:11 (WEA Z805_wpd)
15	04:59	20:46 (WEA Z801_wpd)	05:45	19:55 (WEA Z803_wpd)	06:37	19:11 (WEA Z805_wpd)
16	05:00	20:48 (WEA Z801_wpd)	05:47	19:55 (WEA Z803_wpd)	06:39	19:11 (WEA Z805_wpd)
17	05:01	20:49	05:49	19:57 (WEA Z803_wpd)	06:41	19:11 (WEA Z805_wpd)
18	05:02	20:49	05:50	19:58	06:42	19:11 (WEA Z805_wpd)
19	05:04	20:49	05:52	19:59	06:44	19:11 (WEA Z805_wpd)
20	05:05	20:49	05:53	19:59	06:45	19:11 (WEA Z805_wpd)
21	05:06	20:49	05:54	19:59	06:46	19:11 (WEA Z805_wpd)
22	05:08	20:49	05:57	19:59	06:49	19:11 (WEA Z805_wpd)
23	05:09	20:49	05:59	19:59	06:50	19:11 (WEA Z805_wpd)
24	05:11	20:49	06:00	19:59	06:52	19:11 (WEA Z805_wpd)
25	05:12	20:49	06:02	19:59	06:54	19:11 (WEA Z805_wpd)
26	05:14	20:49	06:04	19:59	06:55	19:11 (WEA Z805_wpd)
27	05:15	20:49	06:06	19:59	06:57	19:11 (WEA Z805_wpd)
28	05:17	20:49	06:07	19:59	06:59	19:11 (WEA Z805_wpd)
29	05:18	20:49	06:09	19:59	07:00	19:11 (WEA Z805_wpd)
30	05:20	20:49	06:10	19:59	07:02	19:11 (WEA Z805_wpd)
31	05:21	20:49	06:12	19:59	07:04	19:11 (WEA Z805_wpd)
Sonnenscheinstunden	195	195	195	195	195	195
astron.mög.Beschattung	239	392	122	122	638	999

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-68 - SR-68, Grünstraße 27, 15518 Steinhöfel

**Annahmen für Schattenwurfberechnung**

- 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	08:15	08:47 (WEA VB03) 07:47	08:25 (WEA VB01) 06:53	06:41	05:35	19:42 (WEA ZB03_wpd)04:49
16:00	36	10:11 (WEA VB02) 16:40	26 08:51 (WEA VB01) 17:42	19:37	20:29	19 20:01 (WEA ZB03_wpd)11:16
2	08:15	08:47 (WEA VB03) 07:46	08:25 (WEA VB01) 06:51	06:39	05:33	19:41 (WEA ZB03_wpd)04:48
16:01	35	10:11 (WEA VB02) 16:51	26 08:51 (WEA VB01) 17:44	19:39	20:31	20 20:01 (WEA ZB03_wpd)11:17
3	08:15	08:47 (WEA VB03) 07:44	08:24 (WEA VB01) 06:48	06:36	05:31	19:41 (WEA ZB03_wpd)04:47
16:03	35	10:11 (WEA VB02) 16:53	27 08:51 (WEA VB01) 17:46	19:41	20:33	20 20:01 (WEA ZB03_wpd)11:18
4	08:15	08:46 (WEA VB03) 07:42	08:26 (WEA VB01) 06:46	06:34	05:29	19:40 (WEA ZB03_wpd)04:46
16:04	35	10:10 (WEA VB02) 16:55	26 08:52 (WEA VB01) 17:47	19:42	20:34	21 20:01 (WEA ZB03_wpd)11:19
5	08:14	08:46 (WEA VB03) 07:41	08:26 (WEA VB01) 06:44	06:32	05:27	19:40 (WEA ZB03_wpd)04:45
16:05	34	10:10 (WEA VB02) 16:57	26 08:52 (WEA VB01) 17:49	19:44	20:36	20 20:00 (WEA ZB03_wpd)11:20
6	08:14	08:46 (WEA VB03) 07:39	08:26 (WEA VB01) 06:42	06:29	05:25	19:41 (WEA ZB03_wpd)04:45
16:06	32	10:09 (WEA VB02) 16:59	25 08:51 (WEA VB01) 17:51	19:46	20:38	20 20:01 (WEA ZB03_wpd)11:21
7	08:14	08:47 (WEA VB03) 07:37	08:27 (WEA VB01) 06:39	06:27	19:16 (WEA ZB05_wpd)05:24	19:41 (WEA ZB03_wpd)04:44
16:07	28	10:08 (WEA VB02) 17:00	24 08:51 (WEA VB01) 17:53	19:48	5 19:21 (WEA ZB05_wpd)20:39	19 20:00 (WEA ZB03_wpd)11:22
8	08:13	08:46 (WEA VB03) 07:36	08:27 (WEA VB01) 06:37	06:25	19:14 (WEA ZB05_wpd)05:22	19:41 (WEA ZB03_wpd)04:44
16:09	21	09:07 (WEA VB03) 17:02	23 08:50 (WEA VB01) 17:55	19:49	9 19:23 (WEA ZB05_wpd)20:41	18 19:59 (WEA ZB03_wpd)11:23
9	08:13	08:46 (WEA VB03) 07:34	08:28 (WEA VB01) 06:35	06:22	19:12 (WEA ZB05_wpd)05:20	19:42 (WEA ZB03_wpd)04:43
16:10	22	09:08 (WEA VB03) 17:04	21 08:49 (WEA VB01) 17:56	19:51	12 19:24 (WEA ZB05_wpd)20:43	17 19:59 (WEA ZB03_wpd)11:24
10	08:12	08:48 (WEA VB03) 07:32	08:30 (WEA VB01) 06:33	06:20	19:11 (WEA ZB05_wpd)05:18	19:43 (WEA ZB03_wpd)04:43
16:12	21	09:09 (WEA VB03) 17:06	17 08:47 (WEA VB01) 17:58	19:53	15 19:26 (WEA ZB05_wpd)20:44	15 19:58 (WEA ZB03_wpd)11:25
11	08:11	08:48 (WEA VB03) 07:30	08:31 (WEA VB01) 06:30	06:18	19:11 (WEA ZB05_wpd)05:17	19:44 (WEA ZB03_wpd)04:42
16:13	21	09:09 (WEA VB03) 17:08	15 08:46 (WEA VB01) 18:00	19:54	17 19:28 (WEA ZB05_wpd)20:46	12 19:56 (WEA ZB03_wpd)11:26
12	08:11	08:48 (WEA VB03) 07:28	08:34 (WEA VB01) 06:28	06:16	19:11 (WEA ZB05_wpd)05:15	19:46 (WEA ZB03_wpd)04:42
16:15	21	09:09 (WEA VB03) 17:10	9 08:43 (WEA VB01) 18:02	19:56	18 19:29 (WEA ZB05_wpd)20:48	9 19:55 (WEA ZB03_wpd)11:26
13	08:10	08:48 (WEA VB03) 07:26	06:26	06:13	19:11 (WEA ZB05_wpd)05:13	19:49 (WEA ZB03_wpd)04:42
16:16	22	09:10 (WEA VB03) 17:12	18:04	19:58	18 19:29 (WEA ZB05_wpd)20:49	2 19:51 (WEA ZB03_wpd)11:27
14	08:09	08:49 (WEA VB03) 07:24	06:23	06:11	19:10 (WEA ZB05_wpd)05:12	04:41
16:18	21	09:10 (WEA VB03) 17:14	18:05	20:00	18 19:28 (WEA ZB05_wpd)20:51	21:28
15	08:08	08:49 (WEA VB03) 07:22	06:21	06:09	19:10 (WEA ZB05_wpd)05:10	04:41
16:19	21	09:10 (WEA VB03) 17:16	18:07	20:01	17 19:27 (WEA ZB05_wpd)20:52	21:28
16	08:08	08:50 (WEA VB03) 07:20	06:19	06:07	19:11 (WEA ZB05_wpd)05:08	04:41
16:21	20	09:10 (WEA VB03) 17:18	18:09	20:03	15 19:26 (WEA ZB05_wpd)20:54	21:29
17	08:07	08:51 (WEA VB03) 07:18	06:16	06:04	19:12 (WEA ZB05_wpd)05:07	04:41
16:22	19	09:10 (WEA VB03) 17:19	18:11	20:05	13 19:25 (WEA ZB05_wpd)20:56	21:29
18	08:06	08:52 (WEA VB03) 07:16	06:14	06:02	19:14 (WEA ZB05_wpd)05:05	04:41
16:24	18	09:10 (WEA VB03) 17:21	18:12	20:07	9 19:23 (WEA ZB05_wpd)20:57	21:30
19	08:05	08:52 (WEA VB03) 07:14	06:12	06:00	05:04	04:41
16:26	17	09:09 (WEA VB03) 17:23	18:14	20:08	20:59	21:30
20	08:04	08:53 (WEA VB03) 07:12	06:09	05:58	05:02	04:41
16:27	16	09:09 (WEA VB03) 17:25	18:16	20:10	21:00	21:30
21	08:02	08:54 (WEA VB03) 07:10	06:07	05:56	05:01	04:41
16:29	15	09:09 (WEA VB03) 17:27	18:18	20:12	21:02	21:31
22	08:01	08:31 (WEA VB01) 07:08	06:05	05:54	05:00	04:41
16:31	22	09:08 (WEA VB03) 17:29	18:20	20:14	21:03	21:31
23	08:00	08:29 (WEA VB01) 07:06	06:02	05:51	04:58	04:42
16:33	22	08:27 (WEA VB01) 07:02	18:21	20:15	19:49	21:31
24	07:59	08:28 (WEA VB01) 07:04	06:00	05:49	04:57	04:42
16:34	17	08:45 (WEA VB01) 17:33	18:23	20:17	21:06	21:31
25	07:57	08:27 (WEA VB01) 07:02	05:57	05:47	04:56	04:42
16:36	19	08:46 (WEA VB01) 17:34	18:25	20:19	21:07	21:31
26	07:56	08:27 (WEA VB01) 06:59	05:55	05:45	19:49 (WEA ZB03_wpd)04:55	20:34 (WEA ZB01_wpd)04:43
16:38	20	08:47 (WEA VB01) 17:36	18:27	20:21	3 19:52 (WEA ZB03_wpd)21:09	2 20:36 (WEA ZB01_wpd)11:31
27	07:55	08:26 (WEA VB01) 06:57	05:53	05:43	19:46 (WEA ZB03_wpd)04:54	20:32 (WEA ZB01_wpd)04:43
16:40	22	08:48 (WEA VB01) 17:38	18:28	20:22	8 19:54 (WEA ZB03_wpd)21:10	6 20:38 (WEA ZB01_wpd)11:31
28	07:53	08:26 (WEA VB01) 06:55	05:50	05:41	19:44 (WEA ZB03_wpd)04:53	20:31 (WEA ZB01_wpd)04:44
16:42	23	08:49 (WEA VB01) 17:40	18:30	20:24	11 19:55 (WEA ZB03_wpd)21:11	8 20:39 (WEA ZB01_wpd)11:31
29	07:52	08:25 (WEA VB01) 06:53	05:48	05:39	19:43 (WEA ZB03_wpd)04:51	20:30 (WEA ZB01_wpd)04:44
16:43	25	08:50 (WEA VB01) 17:42	18:32	20:26	14 19:57 (WEA ZB03_wpd)21:13	10 20:40 (WEA ZB01_wpd)11:31
30	07:50	08:24 (WEA VB01) 06:51	05:46	05:37	19:43 (WEA ZB03_wpd)04:50	20:29 (WEA ZB01_wpd)04:45
16:45	26	08:50 (WEA VB01) 17:44	18:34	20:27	16 19:59 (WEA ZB03_wpd)21:14	12 20:41 (WEA ZB01_wpd)11:31
31	07:49	08:25 (WEA VB01) 06:49	05:43	05:34	04:49	20:28 (WEA ZB01_wpd)
16:47	26	08:51 (WEA VB01) 17:46	18:35	20:28	14 20:42 (WEA ZB01_wpd)	22 20:54 (WEA ZB01_wpd)
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	732	265	218	264	615	

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-68 - SR-68, Grünstraße 27, 15518 Steinhöfel

#### Annahmen für Schattenwurfberechnung

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- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli		August		September		Oktober		November		Dezember	
1	04:45	20:32 (WEA Z801_wpd)	05:23	19:55 (WEA Z803_wpd)	06:14	19:10 (WEA Z805_wpd)	07:04	18:59 (WEA V801)	07:51	18:30 (WEA V803)		
2	04:46	20:32 (WEA Z801_wpd)	05:24	19:55 (WEA Z803_wpd)	06:15	19:10 (WEA Z805_wpd)	07:05	18:59 (WEA V801)	07:52	18:30 (WEA V803)		
3	04:47	20:33 (WEA Z801_wpd)	05:26	19:53 (WEA Z803_wpd)	06:17	19:10 (WEA Z805_wpd)	07:07	18:59 (WEA V801)	07:54	18:31 (WEA V803)		
4	04:47	20:34 (WEA Z801_wpd)	05:27	19:51 (WEA Z803_wpd)	06:19	19:11 (WEA Z805_wpd)	07:09	18:59 (WEA V801)	07:55	18:31 (WEA V803)		
5	04:48	20:34 (WEA Z801_wpd)	05:29	19:51 (WEA Z803_wpd)	06:20	19:12 (WEA Z805_wpd)	07:11	18:59 (WEA V801)	07:56	18:32 (WEA V803)		
6	04:49	20:34 (WEA Z801_wpd)	05:31	19:50 (WEA Z803_wpd)	06:22	19:12 (WEA Z805_wpd)	07:12	18:59 (WEA V801)	07:58	18:32 (WEA V803)		
7	04:50	20:34 (WEA Z801_wpd)	05:32	19:50 (WEA Z803_wpd)	06:24	19:12 (WEA Z805_wpd)	07:14	18:59 (WEA V801)	07:59	18:32 (WEA V803)		
8	04:51	20:34 (WEA Z801_wpd)	05:34	19:49 (WEA Z803_wpd)	06:25	19:13 (WEA Z805_wpd)	07:16	18:59 (WEA V801)	08:00	18:33 (WEA V803)		
9	04:52	20:35 (WEA Z801_wpd)	05:35	19:50 (WEA Z803_wpd)	06:27	19:13 (WEA Z805_wpd)	07:18	18:59 (WEA V801)	08:02	18:33 (WEA V803)		
10	04:53	20:35 (WEA Z801_wpd)	05:37	19:50 (WEA Z803_wpd)	06:29	19:13 (WEA Z805_wpd)	07:19	18:59 (WEA V801)	08:03	18:33 (WEA V803)		
11	04:54	20:36 (WEA Z801_wpd)	05:39	19:50 (WEA Z803_wpd)	06:30	19:14 (WEA Z805_wpd)	07:21	18:59 (WEA V801)	08:04	18:33 (WEA V803)		
12	04:55	20:36 (WEA Z801_wpd)	05:40	19:50 (WEA Z803_wpd)	06:32	19:14 (WEA Z805_wpd)	07:23	18:59 (WEA V801)	08:05	18:33 (WEA V803)		
13	04:56	20:37 (WEA Z801_wpd)	05:42	19:50 (WEA Z803_wpd)	06:34	19:15 (WEA Z805_wpd)	07:25	18:59 (WEA V801)	08:06	18:33 (WEA V803)		
14	04:57	20:38 (WEA Z801_wpd)	05:44	19:51 (WEA Z803_wpd)	06:35	19:16 (WEA Z805_wpd)	07:26	18:59 (WEA V801)	08:07	18:33 (WEA V803)		
15	04:59	20:39 (WEA Z801_wpd)	05:45	19:52 (WEA Z803_wpd)	06:37	19:16 (WEA Z805_wpd)	07:28	18:59 (WEA V801)	08:08	18:34 (WEA V803)		
16	05:00	20:40 (WEA Z801_wpd)	05:47	19:54 (WEA Z803_wpd)	06:39	19:17 (WEA Z805_wpd)	07:30	18:59 (WEA V801)	08:09	18:34 (WEA V803)		
17	05:01	20:42 (WEA Z801_wpd)	05:49	19:57 (WEA Z803_wpd)	06:40	19:18 (WEA Z805_wpd)	07:32	18:59 (WEA V801)	08:09	18:34 (WEA V803)		
18	05:02	20:47 (WEA Z801_wpd)	05:50	19:58 (WEA Z803_wpd)	06:42	19:19 (WEA Z805_wpd)	07:33	18:59 (WEA V801)	08:10	18:34 (WEA V803)		
19	05:04	20:25	06:25	19:15	18:05	16:09	17:31	18:59 (WEA V801)	15:51	18:30 (WEA V803)		
20	05:05	20:23	06:23	19:12	18:03	16:07	17:29	18:59 (WEA V801)	15:51	18:30 (WEA V803)		
21	05:06	20:21	06:21	19:10	18:01	16:06	17:27	18:59 (WEA V801)	15:51	18:30 (WEA V803)		
22	05:08	20:19	06:19	19:07	17:59	16:05	17:25	18:59 (WEA V801)	15:51	18:30 (WEA V803)		
23	05:10	20:17	06:17	19:05	17:56	16:03	17:23	18:59 (WEA V801)	15:52	18:30 (WEA V803)		
24	05:11	20:15	06:15	19:03	17:54	16:02	17:21	18:59 (WEA V801)	15:53	18:30 (WEA V803)		
25	05:12	20:13	06:13	19:02	17:52	16:01	17:19	18:59 (WEA V801)	15:53	18:30 (WEA V803)		
26	05:14	20:10	06:10	19:17 (WEA Z805_wpd)	18:54	16:00	17:17	18:59 (WEA V801)	15:54	18:30 (WEA V803)		
27	05:15	20:08	06:08	19:28 (WEA Z805_wpd)	18:56	16:00	17:15	18:59 (WEA V801)	15:55	18:30 (WEA V803)		
28	05:17	20:06	06:06	19:43 (WEA Z805_wpd)	18:57	16:00	17:13	18:59 (WEA V801)	15:56	18:30 (WEA V803)		
29	05:18	20:03	06:03	19:59 (WEA Z805_wpd)	18:51	16:00	17:11	18:59 (WEA V801)	15:57	18:30 (WEA V803)		
30	05:20	20:01	06:01	19:11 (WEA Z805_wpd)	18:48	16:00	17:09	18:59 (WEA V801)	15:57	18:30 (WEA V803)		
31	05:21	19:57 (WEA Z803_wpd)	06:10	19:29 (WEA Z805_wpd)	18:46	16:00	17:07	18:59 (WEA V801)	15:58	18:30 (WEA V803)		
Sonnenscheinstunden	505		455		381		331		254		241	
astronom. mög. Beschattung	280		375		58		25		657		1021	

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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-69 - SR-69, Grünstraße 28, 15518 Steinhöfel

**Annahmen für Schattenwurfberechnung**

- 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	08:15	08:47 (WEA VB03) 07:47	08:27 (WEA VB01) 06:53	06:41	05:35	19:41 (WEA ZB03_wpd)04:49
16:00	35	10:13 (WEA VB02) 16:40	27 08:34 (WEA VB01) 17:42	19:37	20	20:01 (WEA ZB03_wpd)1:16
2	08:15	08:47 (WEA VB03) 07:46	08:26 (WEA VB01) 06:51	06:39	05:33	19:40 (WEA ZB03_wpd)04:48
16:01	35	10:13 (WEA VB02) 16:51	27 08:53 (WEA VB01) 17:44	19:39	20:31	21 20:01 (WEA ZB03_wpd)1:17
3	08:15	08:47 (WEA VB03) 07:44	08:26 (WEA VB01) 06:48	06:36	05:31	19:40 (WEA ZB03_wpd)04:47
16:03	34	10:13 (WEA VB02) 16:53	27 08:53 (WEA VB01) 17:46	19:41	20:33	20 20:00 (WEA ZB03_wpd)1:18
4	08:15	08:47 (WEA VB03) 07:42	08:28 (WEA VB01) 06:46	06:34	05:29	19:40 (WEA ZB03_wpd)04:46
16:04	32	10:12 (WEA VB02) 16:55	26 08:54 (WEA VB01) 17:47	19:42	20:34	20 20:00 (WEA ZB03_wpd)1:19
5	08:14	08:47 (WEA VB03) 07:41	08:28 (WEA VB01) 06:44	06:32	05:27	19:39 (WEA ZB03_wpd)04:45
16:05	31	10:12 (WEA VB02) 16:57	26 08:54 (WEA VB01) 17:49	19:44	20:36	20 19:59 (WEA ZB03_wpd)1:20
6	08:14	08:47 (WEA VB03) 07:39	08:28 (WEA VB01) 06:42	06:29	05:25	19:40 (WEA ZB03_wpd)04:45
16:06	27	10:10 (WEA VB02) 16:59	25 08:53 (WEA VB01) 17:51	19:46	20:38	20 20:00 (WEA ZB03_wpd)1:21
7	08:14	08:48 (WEA VB03) 07:37	08:29 (WEA VB01) 06:39	06:27	19:15 (WEA ZB05_wpd)05:24	19:41 (WEA ZB03_wpd)04:44
16:07	21	09:09 (WEA VB03) 17:00	23 08:52 (WEA VB01) 17:53	19:48	6 19:21 (WEA ZB05_wpd)05:20	18 19:59 (WEA ZB03_wpd)1:22
8	08:13	08:48 (WEA VB03) 07:36	08:30 (WEA VB01) 06:37	06:25	19:14 (WEA ZB05_wpd)05:22	19:41 (WEA ZB03_wpd)04:44
16:09	22	09:10 (WEA VB03) 17:02	21 08:51 (WEA VB01) 17:55	19:49	9 19:23 (WEA ZB05_wpd)05:20	17 19:58 (WEA ZB03_wpd)1:23
9	08:13	08:48 (WEA VB03) 07:34	08:31 (WEA VB01) 06:35	06:22	19:12 (WEA ZB05_wpd)05:20	19:42 (WEA ZB03_wpd)04:43
16:10	22	09:10 (WEA VB03) 17:04	19 08:50 (WEA VB01) 17:56	19:51	12 19:24 (WEA ZB05_wpd)05:17	16 19:58 (WEA ZB03_wpd)1:24
10	08:12	08:49 (WEA VB03) 07:32	08:32 (WEA VB01) 06:33	06:20	19:11 (WEA ZB05_wpd)05:18	19:43 (WEA ZB03_wpd)04:43
16:12	22	09:11 (WEA VB03) 17:06	17 08:49 (WEA VB01) 17:58	19:53	15 19:26 (WEA ZB05_wpd)05:17	13 19:56 (WEA ZB03_wpd)1:25
11	08:11	08:49 (WEA VB03) 07:30	08:35 (WEA VB01) 06:30	06:18	19:11 (WEA ZB05_wpd)05:17	19:44 (WEA ZB03_wpd)04:42
16:13	22	09:11 (WEA VB03) 17:08	11 08:46 (WEA VB01) 18:00	19:54	17 19:28 (WEA ZB05_wpd)05:16	10 19:54 (WEA ZB03_wpd)1:26
12	08:11	08:50 (WEA VB03) 07:28	06:28	06:16	19:10 (WEA ZB05_wpd)05:15	19:48 (WEA ZB03_wpd)04:42
16:15	21	09:11 (WEA VB03) 17:10	18:02	19:56	19 19:29 (WEA ZB05_wpd)05:14	3 19:51 (WEA ZB03_wpd)1:26
13	08:10	08:50 (WEA VB03) 07:26	06:26	06:13	19:10 (WEA ZB05_wpd)05:13	04:42
16:16	22	09:12 (WEA VB03) 17:12	18:04	19:58	19 19:29 (WEA ZB05_wpd)05:12	21:27
14	08:09	08:51 (WEA VB03) 07:24	06:23	06:11	19:10 (WEA ZB05_wpd)05:12	04:41
16:18	21	09:12 (WEA VB03) 17:14	18:05	20:00	17 19:27 (WEA ZB05_wpd)05:11	21:28
15	08:08	08:51 (WEA VB03) 07:22	06:21	06:09	19:10 (WEA ZB05_wpd)05:10	04:41
16:19	21	09:12 (WEA VB03) 17:16	18:07	20:01	17 19:27 (WEA ZB05_wpd)05:10	21:28
16	08:08	08:52 (WEA VB03) 07:20	06:19	06:07	19:11 (WEA ZB05_wpd)05:08	04:41
16:21	20	09:12 (WEA VB03) 17:18	18:09	20:03	15 19:26 (WEA ZB05_wpd)05:07	21:29
17	08:07	08:53 (WEA VB03) 07:18	06:16	06:04	19:12 (WEA ZB05_wpd)05:07	04:41
16:22	19	09:12 (WEA VB03) 17:19	18:11	20:05	11 19:24 (WEA ZB05_wpd)05:06	21:29
18	08:06	08:54 (WEA VB03) 07:16	06:14	06:02	19:15 (WEA ZB05_wpd)05:05	04:41
16:24	18	09:12 (WEA VB03) 17:21	18:12	20:07	6 19:21 (WEA ZB05_wpd)05:04	21:30
19	08:05	08:54 (WEA VB03) 07:14	06:12	06:00	05:04	04:41
16:26	17	09:11 (WEA VB03) 17:23	18:14	20:08	20:59	21:30
20	08:04	08:56 (WEA VB03) 07:12	06:09	05:58	05:02	04:41
16:27	17	09:11 (WEA VB03) 17:25	18:16	20:10	21:00	21:30
21	08:02	08:33 (WEA VB01) 07:10	06:07	05:56	05:01	04:41
16:29	23	09:10 (WEA VB03) 17:27	18:18	20:12	21:02	21:31
22	08:01	08:31 (WEA VB01) 07:08	06:05	05:54	05:00	04:41
16:31	24	09:09 (WEA VB03) 17:29	18:20	20:14	21:03	21:31
23	08:00	08:30 (WEA VB01) 07:06	06:02	05:51	04:58	04:42
16:33	20	09:06 (WEA VB03) 17:31	18:22	20:15	21:04	21:31
24	07:59	08:29 (WEA VB01) 07:04	06:00	05:49	04:57	04:42
16:34	19	08:48 (WEA VB01) 17:33	18:23	20:17	21:06	21:31
25	07:57	08:28 (WEA VB01) 07:02	05:57	05:47	04:56	04:42
16:36	21	08:49 (WEA VB01) 17:34	18:25	20:19	21:07	21:31
26	07:56	08:28 (WEA VB01) 06:59	05:55	05:45	19:46 (WEA ZB03_wpd)04:55	20:30 (WEA ZB01_wpd)04:43
16:38	22	08:50 (WEA VB01) 17:36	18:27	20:21	6 19:32 (WEA ZB03_wpd)04:54	6 20:30 (WEA ZB01_wpd)04:43
27	07:55	08:27 (WEA VB01) 06:57	05:53	05:43	19:44 (WEA ZB03_wpd)04:54	20:29 (WEA ZB01_wpd)04:43
16:40	24	08:51 (WEA VB01) 17:38	18:28	20:22	10 19:54 (WEA ZB03_wpd)04:53	9 20:28 (WEA ZB01_wpd)04:43
28	07:53	08:27 (WEA VB01) 06:55	05:50	05:41	19:43 (WEA ZB03_wpd)04:53	20:28 (WEA ZB01_wpd)04:44
16:42	25	08:52 (WEA VB01) 17:40	18:30	20:24	12 19:55 (WEA ZB03_wpd)04:51	11 20:39 (WEA ZB01_wpd)04:44
29	07:52	08:27 (WEA VB01) 06:53	06:48	06:39	19:41 (WEA ZB03_wpd)04:51	20:27 (WEA ZB01_wpd)04:44
16:43	25	08:52 (WEA VB01) 17:42	19:32	20:26	16 19:57 (WEA ZB03_wpd)04:51	13 20:40 (WEA ZB01_wpd)04:44
30	07:50	08:26 (WEA VB01) 06:51	06:46	06:37	19:42 (WEA ZB03_wpd)04:50	20:27 (WEA ZB01_wpd)04:45
16:45	26	08:52 (WEA VB01) 17:44	19:34	20:27	17 19:59 (WEA ZB03_wpd)04:50	14 20:41 (WEA ZB01_wpd)04:45
31	07:49	08:27 (WEA VB01) 06:50	06:43	06:34	04:49	20:26 (WEA ZB01_wpd)
16:47	27	08:54 (WEA VB01) 17:46	19:35	20:28	21:15	16 20:42 (WEA ZB01_wpd)
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	735	249	224	271	626	

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-70 - SR-70, Grünstraße 30/31, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	08:53 (WEA VB03) 07:47 09:15 (WEA VB03) 16:40	08:36 (WEA VB01) 06:53 09:03 (WEA VB01) 17:42	06:41 19:37	05:35 20:29	19:37 (WEA ZB03_wpd)04:49 20:20 (WEA ZB01_wpd)
2	08:15 16:01	08:54 (WEA VB03) 07:46 09:16 (WEA VB03) 16:51	08:37 (WEA VB01) 06:51 09:02 (WEA VB01) 17:44	06:39 19:39	05:33 20:31	19:37 (WEA ZB03_wpd)04:48 20:20 (WEA ZB01_wpd)
3	08:15 16:03	08:54 (WEA VB03) 07:44 09:17 (WEA VB03) 16:53	08:37 (WEA VB01) 06:48 09:02 (WEA VB01) 17:45	06:36 19:41	05:31 20:33	19:37 (WEA ZB03_wpd)04:47 20:20 (WEA ZB01_wpd)
4	08:15 16:04	08:54 (WEA VB03) 07:42 09:16 (WEA VB03) 16:55	08:39 (WEA VB01) 06:46 09:02 (WEA VB01) 17:47	06:34 19:42	05:29 20:34	19:37 (WEA ZB03_wpd)04:46 20:20 (WEA ZB01_wpd)
5	08:14 16:05	08:55 (WEA VB03) 07:41 09:17 (WEA VB03) 16:57	08:40 (WEA VB01) 06:44 09:01 (WEA VB01) 17:49	06:32 19:44	05:27 20:36	19:38 (WEA ZB03_wpd)04:45 20:20 (WEA ZB01_wpd)
6	08:14 16:06	08:55 (WEA VB03) 07:39 09:17 (WEA VB03) 16:59	08:41 (WEA VB01) 06:42 09:00 (WEA VB01) 17:51	06:29 19:46	05:25 20:38	19:40 (WEA ZB03_wpd)04:45 20:21 (WEA ZB01_wpd)
7	08:14 16:07	08:56 (WEA VB03) 07:37 09:18 (WEA VB03) 17:00	08:42 (WEA VB01) 06:39 09:01 (WEA VB01) 17:53	06:27 19:48	05:24 20:39	19:41 (WEA ZB03_wpd)04:44 20:21 (WEA ZB01_wpd)
8	08:13 16:08	08:56 (WEA VB03) 07:36 09:18 (WEA VB03) 17:02	08:45 (WEA VB01) 06:37 09:02 (WEA VB01) 17:55	06:25 19:49	05:22 20:41	19:45 (WEA ZB03_wpd)04:44 20:22 (WEA ZB01_wpd)
9	08:13 16:10	08:57 (WEA VB03) 07:34 09:19 (WEA VB03) 17:04	08:46 (WEA VB01) 06:35 09:03 (WEA VB01) 17:57	06:22 19:51	05:20 20:43	19:46 (WEA ZB03_wpd)04:44 20:23 (WEA ZB01_wpd)
10	08:12 16:12	08:58 (WEA VB03) 07:32 09:19 (WEA VB03) 17:06	08:47 (WEA VB01) 06:33 09:04 (WEA VB01) 17:59	06:20 19:53	05:18 20:44	19:47 (WEA ZB03_wpd)04:44 20:24 (WEA ZB01_wpd)
11	08:11 16:13	08:58 (WEA VB03) 07:30 09:19 (WEA VB03) 17:08	08:48 (WEA VB01) 06:31 09:05 (WEA VB01) 18:00	06:18 19:54	05:17 20:46	19:48 (WEA ZB03_wpd)04:44 20:25 (WEA ZB01_wpd)
12	08:11 16:15	08:59 (WEA VB03) 07:28 09:19 (WEA VB03) 17:10	08:49 (WEA VB01) 06:29 09:06 (WEA VB01) 18:02	06:16 19:56	05:15 20:48	19:49 (WEA ZB03_wpd)04:44 20:26 (WEA ZB01_wpd)
13	08:10 16:16	09:00 (WEA VB03) 07:26 09:19 (WEA VB03) 17:12	08:50 (WEA VB01) 06:27 09:07 (WEA VB01) 18:04	06:13 19:58	05:13 20:49	19:50 (WEA ZB03_wpd)04:44 20:27 (WEA ZB01_wpd)
14	08:09 16:18	09:01 (WEA VB03) 07:24 09:18 (WEA VB03) 17:14	08:51 (WEA VB01) 06:25 09:08 (WEA VB01) 18:05	06:11 20:00	05:12 20:51	19:51 (WEA ZB03_wpd)04:44 20:28 (WEA ZB01_wpd)
15	08:08 16:19	09:02 (WEA VB03) 07:22 09:18 (WEA VB03) 17:16	08:52 (WEA VB01) 06:23 09:09 (WEA VB01) 18:07	06:09 20:01	05:10 20:52	19:52 (WEA ZB03_wpd)04:44 20:29 (WEA ZB01_wpd)
16	08:08 16:21	09:03 (WEA VB03) 07:20 09:18 (WEA VB03) 17:18	08:53 (WEA VB01) 06:21 09:10 (WEA VB01) 18:09	06:07 20:03	05:08 20:54	19:53 (WEA ZB03_wpd)04:44 20:30 (WEA ZB01_wpd)
17	08:07 16:22	09:04 (WEA VB03) 07:18 09:17 (WEA VB03) 17:19	08:54 (WEA VB01) 06:19 09:11 (WEA VB01) 18:11	06:05 20:05	05:07 20:56	19:54 (WEA ZB03_wpd)04:44 20:31 (WEA ZB01_wpd)
18	08:06 16:24	09:05 (WEA VB03) 07:16 09:18 (WEA VB03) 17:21	08:55 (WEA VB01) 06:17 09:12 (WEA VB01) 18:13	06:02 20:06	05:05 20:57	19:55 (WEA ZB03_wpd)04:44 20:32 (WEA ZB01_wpd)
19	08:05 16:26	09:06 (WEA VB03) 07:14 09:13 (WEA VB03) 17:23	08:56 (WEA VB01) 06:15 09:13 (WEA VB01) 18:14	06:00 20:08	05:04 20:59	19:56 (WEA ZB03_wpd)04:44 20:33 (WEA ZB01_wpd)
20	08:04 16:27	09:07 (WEA VB03) 07:12 09:13 (WEA VB03) 17:25	08:57 (WEA VB01) 06:13 09:14 (WEA VB01) 18:16	05:58 20:10	05:02 21:00	19:57 (WEA ZB03_wpd)04:44 20:34 (WEA ZB01_wpd)
21	08:02 16:29	09:08 (WEA VB03) 07:10 09:13 (WEA VB03) 17:27	08:58 (WEA VB01) 06:11 09:15 (WEA VB01) 18:18	05:56 20:12	05:01 21:02	19:58 (WEA ZB03_wpd)04:44 20:35 (WEA ZB01_wpd)
22	08:01 16:31	09:09 (WEA VB03) 07:08 09:13 (WEA VB03) 17:29	08:59 (WEA VB01) 06:09 09:16 (WEA VB01) 18:20	05:54 20:14	05:00 21:03	19:59 (WEA ZB03_wpd)04:44 20:36 (WEA ZB01_wpd)
23	08:00 16:33	09:10 (WEA VB03) 07:06 09:13 (WEA VB03) 17:31	09:00 (WEA VB01) 06:07 09:17 (WEA VB01) 18:23	05:51 20:17	04:58 21:04	19:43 (WEA ZB03_wpd)04:58 20:21 (WEA ZB01_wpd)
24	07:59 16:34	09:11 (WEA VB03) 07:04 09:13 (WEA VB03) 17:33	09:01 (WEA VB01) 06:05 09:18 (WEA VB01) 18:25	05:49 20:19	4 19:47 (WEA ZB03_wpd)04:57 8 19:49 (WEA ZB03_wpd)04:56	19:41 (WEA ZB03_wpd)04:57 20:20 (WEA ZB01_wpd)04:42
25	07:57 16:36	09:12 (WEA VB03) 07:02 09:14 (WEA VB03) 17:34	09:02 (WEA VB01) 06:03 09:19 (WEA VB01) 18:27	05:47 20:21	14 19:52 (WEA ZB03_wpd)04:56 12 19:51 (WEA ZB03_wpd)04:55	20:20 (WEA ZB01_wpd)04:42 20:20 (WEA ZB01_wpd)04:42
26	07:56 16:38	09:13 (WEA VB03) 07:00 09:15 (WEA VB03) 17:36	09:03 (WEA VB01) 06:01 09:20 (WEA VB01) 18:30	05:45 20:22	18 19:38 (WEA ZB03_wpd)04:55 16 20:35 (WEA ZB01_wpd)04:44	20:20 (WEA ZB01_wpd)04:42 20:20 (WEA ZB01_wpd)04:44
27	07:55 16:40	09:14 (WEA VB03) 06:58 09:16 (WEA VB03) 17:38	09:04 (WEA VB01) 05:59 09:21 (WEA VB01) 18:33	05:43 20:23	17 19:54 (WEA ZB03_wpd)04:54 15 20:38 (WEA ZB01_wpd)04:44	20:20 (WEA ZB01_wpd)04:44 20:20 (WEA ZB01_wpd)04:44
28	07:53 16:42	09:15 (WEA VB03) 06:55 09:18 (WEA VB03) 17:40	09:05 (WEA VB01) 05:57 09:22 (WEA VB01) 18:36	05:41 20:24	14 19:52 (WEA ZB03_wpd)04:53 12 19:51 (WEA ZB03_wpd)04:52	20:19 (WEA ZB01_wpd)04:44 20:19 (WEA ZB01_wpd)04:44
29	07:52 16:43	09:16 (WEA VB03) 06:53 09:19 (WEA VB03) 17:42	09:06 (WEA VB01) 05:55 09:23 (WEA VB01) 18:39	05:39 20:25	18 19:55 (WEA ZB03_wpd)04:51 16 20:39 (WEA ZB01_wpd)04:44	20:19 (WEA ZB01_wpd)04:44 20:19 (WEA ZB01_wpd)04:44
30	07:50 16:45	09:17 (WEA VB03) 06:51 09:20 (WEA VB03) 17:44	09:07 (WEA VB01) 05:53 09:24 (WEA VB01) 18:42	05:37 20:26	17 19:54 (WEA ZB03_wpd)04:50 15 20:39 (WEA ZB01_wpd)04:44	20:19 (WEA ZB01_wpd)04:44 20:19 (WEA ZB01_wpd)04:44
31	07:49 16:47	09:18 (WEA VB03) 06:49 09:21 (WEA VB03) 17:46	09:08 (WEA VB01) 05:51 09:25 (WEA VB01) 18:45	05:35 20:27	20 19:57 (WEA ZB03_wpd)04:49 18 20:40 (WEA ZB01_wpd)	20:19 (WEA ZB01_wpd)04:44 20:19 (WEA ZB01_wpd)04:44
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	750	166	113	288	575	

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-70 - SR-70, Grünstraße 30/31, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

Juli		August		September		Oktober		November		Dezember	
1	04:45	20:27 (WEA ZB01_wpd)05:23		06:14	07:04	06:59				07:51	08:41 (WEA VB03)
1	21:30	20:46 (WEA ZB01_wpd)20:58		19:54	18:44	16:36				15:55	09:01 (WEA VB03)
2	04:46	20:26 (WEA ZB01_wpd)05:24		06:15	07:05	07:01				07:52	08:40 (WEA VB03)
1	21:30	20:45 (WEA ZB01_wpd)20:56		19:52	18:41	16:35				15:54	21 09:01 (WEA VB03)
3	04:47	20:27 (WEA ZB01_wpd)05:26		06:17	07:07	07:02			08:14 (WEA VB01)	07:54	08:41 (WEA VB03)
1	21:30	20:46 (WEA ZB01_wpd)20:54		19:50	18:39	16:33	12		08:26 (WEA VB01)	15:54	21 09:02 (WEA VB03)
4	04:47	20:27 (WEA ZB01_wpd)05:27		06:19	07:09	07:04			08:12 (WEA VB01)	07:55	08:41 (WEA VB03)
1	21:29	20:46 (WEA ZB01_wpd)20:52		19:47	18:37	16:31	16		08:28 (WEA VB01)	15:53	21 09:02 (WEA VB03)
5	04:48	20:27 (WEA ZB01_wpd)05:29		19:53 (WEA ZB03_wpd)06:20	07:11	07:06			08:10 (WEA VB01)	07:56	08:41 (WEA VB03)
1	21:29	20:47 (WEA ZB01_wpd)20:51	5	19:58 (WEA ZB03_wpd)19:45	18:34	16:29	19		08:29 (WEA VB01)	15:52	22 09:03 (WEA VB03)
6	04:49	20:26 (WEA ZB01_wpd)05:31		19:50 (WEA ZB03_wpd)06:22	07:12	07:08			08:09 (WEA VB01)	07:58	08:41 (WEA VB03)
1	21:28	20:46 (WEA ZB01_wpd)20:49		20:00 (WEA ZB03_wpd)19:45	18:32	16:27	22		08:31 (WEA VB01)	15:52	22 09:03 (WEA VB03)
7	04:50	20:27 (WEA ZB01_wpd)05:32		19:49 (WEA ZB03_wpd)06:24	07:14	07:10			08:08 (WEA VB01)	07:59	08:41 (WEA VB03)
1	21:28	20:47 (WEA ZB01_wpd)20:47		20:02 (WEA ZB03_wpd)19:41	18:30	16:25	24		08:32 (WEA VB01)	15:52	22 09:03 (WEA VB03)
8	04:51	20:27 (WEA ZB01_wpd)05:34		19:47 (WEA ZB03_wpd)06:25	07:16	07:12			08:08 (WEA VB01)	08:00	08:42 (WEA VB03)
1	21:27	20:47 (WEA ZB01_wpd)20:45		20:03 (WEA ZB03_wpd)19:38	18:27	16:24	25		08:33 (WEA VB01)	15:51	23 09:05 (WEA VB03)
9	04:52	20:27 (WEA ZB01_wpd)05:35		19:47 (WEA ZB03_wpd)06:27	07:18	07:13			08:07 (WEA VB01)	08:02	08:42 (WEA VB03)
1	21:26	20:47 (WEA ZB01_wpd)20:43		20:04 (WEA ZB03_wpd)19:36	18:25	16:22	26		08:33 (WEA VB01)	15:51	23 09:05 (WEA VB03)
10	04:53	20:27 (WEA ZB01_wpd)05:37		19:45 (WEA ZB03_wpd)06:29	07:19	07:15			08:07 (WEA VB01)	08:03	08:43 (WEA VB03)
1	21:25	20:48 (WEA ZB01_wpd)20:41		20:04 (WEA ZB03_wpd)19:33	18:23	16:20	27		08:34 (WEA VB01)	15:51	23 09:05 (WEA VB03)
11	04:54	20:27 (WEA ZB01_wpd)05:39		19:45 (WEA ZB03_wpd)06:30	07:21	07:17			08:07 (WEA VB01)	08:04	08:43 (WEA VB03)
1	21:25	20:48 (WEA ZB01_wpd)20:39		20:04 (WEA ZB03_wpd)19:31	18:21	16:19	27		08:34 (WEA VB01)	15:50	22 09:05 (WEA VB03)
12	04:55	20:27 (WEA ZB01_wpd)05:40		19:45 (WEA ZB03_wpd)06:32	07:23	07:19			08:07 (WEA VB01)	08:05	08:43 (WEA VB03)
1	21:24	20:48 (WEA ZB01_wpd)20:37		20:05 (WEA ZB03_wpd)19:29	18:18	16:17	28		08:35 (WEA VB01)	15:50	23 09:06 (WEA VB03)
13	04:56	20:28 (WEA ZB01_wpd)05:42		19:44 (WEA ZB03_wpd)06:34	07:25	07:21			08:07 (WEA VB01)	08:06	08:44 (WEA VB03)
1	21:23	20:48 (WEA ZB01_wpd)20:35		20:04 (WEA ZB03_wpd)19:26	18:16	16:16	28		08:35 (WEA VB01)	15:50	22 09:06 (WEA VB03)
14	04:57	20:28 (WEA ZB01_wpd)05:44		19:45 (WEA ZB03_wpd)06:35	07:26	07:23			08:07 (WEA VB01)	08:07	08:44 (WEA VB03)
1	21:22	20:48 (WEA ZB01_wpd)20:33		20:04 (WEA ZB03_wpd)19:24	18:14	16:14	28		08:35 (WEA VB01)	15:50	22 09:06 (WEA VB03)
15	04:59	20:28 (WEA ZB01_wpd)05:45		19:44 (WEA ZB03_wpd)06:37	07:28	07:24			08:08 (WEA VB01)	08:08	08:45 (WEA VB03)
1	21:21	20:48 (WEA ZB01_wpd)20:31		20:02 (WEA ZB03_wpd)19:22	18:12	16:13	27		08:35 (WEA VB01)	15:50	22 09:07 (WEA VB03)
16	05:00	20:29 (WEA ZB01_wpd)05:47		19:45 (WEA ZB03_wpd)06:39	07:30	07:26			08:08 (WEA VB01)	08:09	08:46 (WEA VB03)
1	21:20	20:48 (WEA ZB01_wpd)20:29		20:01 (WEA ZB03_wpd)19:19	18:09	16:11	27		08:35 (WEA VB01)	15:50	21 09:07 (WEA VB03)
17	05:01	20:29 (WEA ZB01_wpd)05:49		19:45 (WEA ZB03_wpd)06:40	07:32	07:28			08:08 (WEA VB01)	08:09	08:46 (WEA VB03)
1	21:19	20:47 (WEA ZB01_wpd)20:27		19:58 (WEA ZB03_wpd)19:17	18:07	16:10	27		08:35 (WEA VB01)	15:51	22 09:08 (WEA VB03)
18	05:02	20:29 (WEA ZB01_wpd)05:50		19:46 (WEA ZB03_wpd)06:42	07:33	07:30			08:09 (WEA VB01)	08:10	08:47 (WEA VB03)
1	21:18	20:46 (WEA ZB01_wpd)20:25		19:57 (WEA ZB03_wpd)19:15	18:05	16:08	26		08:35 (WEA VB01)	15:51	22 09:09 (WEA VB03)
19	05:04	20:30 (WEA ZB01_wpd)05:52		19:48 (WEA ZB03_wpd)06:44	07:35	07:31			08:10 (WEA VB01)	08:11	08:47 (WEA VB03)
1	21:17	20:44 (WEA ZB01_wpd)20:23		19:55 (WEA ZB03_wpd)19:12	18:03	16:07	25		08:35 (WEA VB01)	15:51	24 10:14 (WEA VB02)
20	05:05	20:30 (WEA ZB01_wpd)05:54		19:50 (WEA ZB03_wpd)06:45	07:37	07:33			08:10 (WEA VB01)	08:12	08:48 (WEA VB03)
1	21:15	20:43 (WEA ZB01_wpd)20:21		19:53 (WEA ZB03_wpd)19:10	18:01	16:06	24		08:34 (WEA VB01)	15:51	25 10:15 (WEA VB02)
21	05:06	20:32 (WEA ZB01_wpd)05:55			06:47	07:39			08:11 (WEA VB01)	08:12	08:49 (WEA VB03)
1	21:14	20:42 (WEA ZB01_wpd)20:19			19:07	17:59	16:05	23	08:34 (WEA VB01)	15:52	26 10:17 (WEA VB02)
22	05:08	20:32 (WEA ZB01_wpd)05:57			06:49	07:41			08:12 (WEA VB01)	08:13	08:49 (WEA VB03)
1	21:13	20:41 (WEA ZB01_wpd)20:17			19:05	17:56	16:03	22	08:34 (WEA VB01)	15:52	26 10:17 (WEA VB02)
23	05:09	20:33 (WEA ZB01_wpd)05:59			06:50	07:42			08:13 (WEA VB01)	08:13	08:49 (WEA VB03)
1	21:11	20:39 (WEA ZB01_wpd)20:15			19:03	17:54	16:02	25	08:50 (WEA VB03)	15:53	26 10:17 (WEA VB02)
24	05:11	20:36 (WEA ZB01_wpd)06:00			06:52	07:44			08:14 (WEA VB01)	08:14	08:50 (WEA VB03)
1	21:10	20:39 (WEA ZB01_wpd)20:12			19:00	17:52	16:01	29	08:53 (WEA VB03)	15:53	24 10:17 (WEA VB02)
25	05:12	06:02			06:54	06:46	07:42		08:16 (WEA VB01)	08:14	08:50 (WEA VB03)
1	21:09	20:10			18:58	16:50	16:00	29	08:55 (WEA VB03)	15:54	22 09:12 (WEA VB03)
26	05:14	06:04			06:55	06:48	07:43		08:17 (WEA VB01)	08:14	08:50 (WEA VB03)
1	21:07	20:08			18:56	16:48	15:59	29	08:56 (WEA VB03)	15:55	22 09:12 (WEA VB03)
27	05:15	06:05			06:57	06:50	07:45		08:19 (WEA VB01)	08:15	08:50 (WEA VB03)
1	21:06	20:06			18:53	16:46	15:58	26	08:57 (WEA VB03)	15:56	22 09:12 (WEA VB03)
28	05:17	06:07			06:59	06:51	07:46		08:22 (WEA VB01)	08:15	08:52 (WEA VB03)
1	21:04	20:03			18:51	16:44	15:57	23	08:58 (WEA VB03)	15:56	22 09:14 (WEA VB03)
29	05:18	06:09			07:00	06:53	07:48		08:40 (WEA VB03)	08:15	08:52 (WEA VB03)
1	21:03	20:01			18:48	16:42	15:56	19	08:59 (WEA VB03)	15:57	22 09:14 (WEA VB03)
30	05:20	06:10			07:02	06:55	07:49		08:40 (WEA VB03)	08:15	08:52 (WEA VB03)
1	21:01	19:59			18:46	16:40	15:56	20	09:00 (WEA VB03)	15:58	22 09:14 (WEA VB03)
31	05:21	06:12			06:57	06:50				08:15	08:52 (WEA VB03)
1	20:59	19:57			16:38					15:59	22 09:14 (WEA VB03)
	Sonnenscheinstunden	505			381	331	264	683		241	698
	astr. max. mögl. Beschattung	407	226								

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-71 - SR-71, Grünstraße 32/32a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15 09:00 (WEA VB03) 07:47		08:46 (WEA VB01) 06:53	06:41	05:35	19:35 (WEA ZB03_wpd)04:49
2	16:00 23 09:23 (WEA VB03) 16:40	24	09:10 (WEA VB01) 17:42	19:37	20:29	18 19:53 (WEA ZB03_wpd)11:16
3	08:15 09:01 (WEA VB03) 07:46		08:46 (WEA VB01) 06:51	06:39	05:33	19:36 (WEA ZB03_wpd)04:48
4	16:01 22 09:23 (WEA VB03) 16:51	23	09:09 (WEA VB01) 17:44	19:39	20:31	16 19:52 (WEA ZB03_wpd)11:17
5	08:15 09:02 (WEA VB03) 07:44		08:47 (WEA VB01) 06:48	06:36	05:31	19:37 (WEA ZB03_wpd)04:47
6	16:03 22 09:24 (WEA VB03) 16:53	21	09:08 (WEA VB01) 17:45	19:41	20:33	13 19:50 (WEA ZB03_wpd)11:18
7	08:15 09:02 (WEA VB03) 07:42		08:50 (WEA VB01) 06:46	06:34	05:29	19:38 (WEA ZB03_wpd)04:46
8	16:04 21 09:23 (WEA VB03) 16:55	18	09:08 (WEA VB01) 17:47	19:42	20:34	11 19:49 (WEA ZB03_wpd)11:19
9	08:14 09:03 (WEA VB03) 07:41		08:51 (WEA VB01) 06:44	06:32	05:27	19:40 (WEA ZB03_wpd)04:45
10	16:05 21 09:24 (WEA VB03) 16:57	15	09:06 (WEA VB01) 17:49	19:44	20:36	6 19:46 (WEA ZB03_wpd)11:20
11	08:14 09:03 (WEA VB03) 07:39		08:54 (WEA VB01) 06:42	06:29	05:25	19:45 (WEA ZB03_wpd)04:45
12	16:06 21 09:24 (WEA VB03) 16:59	9	09:03 (WEA VB01) 17:51	19:46	20:38	21:21 16 20:35 (WEA ZB01_wpd)
13	08:14 09:04 (WEA VB03) 07:37		06:39 06:27	06:25	05:24	04:44 16 20:19 (WEA ZB01_wpd)
14	16:07 21 09:25 (WEA VB03) 17:00		17:53 19:48	20:39	21:22	16 20:35 (WEA ZB01_wpd)
15	08:13 08:49 (WEA VB01) 07:35		06:37 06:25	05:22	04:44	20:20 (WEA ZB01_wpd)
16	16:09 23 09:24 (WEA VB03) 17:02		17:55 19:49	20:41	21:23	15 20:35 (WEA ZB01_wpd)
17	08:13 08:46 (WEA VB01) 07:34		06:25 06:22	05:20	04:43	20:20 (WEA ZB01_wpd)
18	16:10 29 09:24 (WEA VB03) 17:04		17:56 19:51	20:42	21:24	14 20:34 (WEA ZB01_wpd)
19	08:12 08:46 (WEA VB01) 07:32		06:23 06:20	05:18	04:43	20:21 (WEA ZB01_wpd)
20	16:12 30 09:25 (WEA VB03) 17:06		17:58 19:53	20:44	21:25	13 20:34 (WEA ZB01_wpd)
21	08:11 08:45 (WEA VB01) 07:30		06:20 06:18	05:17	04:42	20:22 (WEA ZB01_wpd)
22	16:13 33 09:25 (WEA VB03) 17:08		18:00 19:54	20:46	21:26	12 20:34 (WEA ZB01_wpd)
23	08:11 08:44 (WEA VB01) 07:28		06:28 06:16	05:15	04:42	20:21 (WEA ZB01_wpd)
24	16:15 33 09:24 (WEA VB03) 17:10		18:02 19:56	20:48	21:26	14 20:51 (WEA 13)
25	08:10 08:43 (WEA VB01) 07:26		06:26 06:13	05:13	04:42	20:22 (WEA ZB01_wpd)
26	16:16 34 09:24 (WEA VB03) 17:12		18:04 19:58	20:49	21:27	18 20:53 (WEA 13)
27	08:09 08:43 (WEA VB01) 07:24		06:23 06:11	05:12	04:41	20:23 (WEA ZB01_wpd)
28	16:18 32 09:23 (WEA VB03) 17:14		18:05 20:00	20:51	21:28	18 20:54 (WEA 13)
29	08:08 08:43 (WEA VB01) 07:22		06:21 06:09	05:10	04:41	20:24 (WEA ZB01_wpd)
30	16:19 31 09:22 (WEA VB03) 17:16		18:07 20:01	20:52	21:28	17 20:54 (WEA 13)
31	08:08 08:42 (WEA VB01) 07:20		06:19 06:07	05:08	04:41	20:24 (WEA ZB01_wpd)
1	16:21 28 09:20 (WEA VB03) 17:18		18:09 20:03	20:54	2 20:23 (WEA ZB01_wpd)11:29	17 20:55 (WEA 13)
2	08:07 08:42 (WEA VB01) 07:18		06:16 06:04	05:07	20:20 (WEA ZB01_wpd)04:41	17 20:25 (WEA ZB01_wpd)
3	16:22 25 09:07 (WEA VB01) 17:19		18:11 20:05	20:56	5 20:25 (WEA ZB01_wpd)11:29	17 20:55 (WEA 13)
4	08:06 08:42 (WEA VB01) 07:16		06:14 06:02	05:05	20:18 (WEA ZB01_wpd)04:41	17 20:25 (WEA ZB01_wpd)
5	16:24 26 09:08 (WEA VB01) 17:21		18:12 20:07	20:57	6 20:26 (WEA ZB01_wpd)11:30	18 20:56 (WEA 13)
6	08:05 08:41 (WEA VB01) 07:14		06:12 06:00	05:04	20:17 (WEA ZB01_wpd)04:41	18 20:25 (WEA ZB01_wpd)
7	16:26 27 09:08 (WEA VB01) 17:23		18:14 20:08	20:59	10 20:27 (WEA ZB01_wpd)11:30	18 20:56 (WEA 13)
8	08:04 08:41 (WEA VB01) 07:12		06:09 05:58	05:02	20:17 (WEA ZB01_wpd)04:41	18 20:26 (WEA ZB01_wpd)
9	16:27 27 09:08 (WEA VB01) 17:25		18:16 20:10	21:00	12 20:29 (WEA ZB01_wpd)11:30	17 20:56 (WEA 13)
10	08:02 08:42 (WEA VB01) 07:10		06:07 05:56	05:01	19:43 (WEA ZB03_wpd)05:01	20:16 (WEA ZB01_wpd)04:41
11	16:29 27 09:09 (WEA VB01) 17:27		18:18 20:12	1 19:44 (WEA ZB03_wpd)11:02	15 20:31 (WEA ZB01_wpd)11:31	17 20:56 (WEA 13)
12	08:01 08:42 (WEA VB01) 07:08		06:05 05:54	05:00	19:40 (WEA ZB03_wpd)05:00	20:15 (WEA ZB01_wpd)04:41
13	16:31 28 09:10 (WEA VB01) 17:29		18:20 20:14	6 19:46 (WEA ZB03_wpd)11:03	16 20:31 (WEA ZB01_wpd)11:31	17 20:57 (WEA 13)
14	08:00 08:42 (WEA VB01) 07:06		06:02 05:51	05:00	19:36 (WEA ZB03_wpd)04:58	20:15 (WEA ZB01_wpd)04:42
15	16:33 28 09:10 (WEA VB01) 17:31		18:21 20:15	9 19:47 (WEA ZB03_wpd)11:04	17 20:32 (WEA ZB01_wpd)11:31	18 20:26 (WEA ZB01_wpd)
16	07:59 08:42 (WEA VB01) 07:04		06:00 05:49	05:00	19:37 (WEA ZB03_wpd)04:57	20:15 (WEA ZB01_wpd)04:42
17	16:34 29 09:11 (WEA VB01) 17:33		18:23 20:17	12 19:49 (WEA ZB03_wpd)11:06	19 20:34 (WEA ZB01_wpd)11:31	18 20:57 (WEA 13)
18	07:57 08:42 (WEA VB01) 07:02		05:57 05:47	05:00	17 19:52 (WEA ZB03_wpd)11:09	20:15 (WEA ZB01_wpd)04:42
19	16:36 29 09:11 (WEA VB01) 17:34		18:25 20:19	15 19:51 (WEA ZB03_wpd)11:07	20 20:35 (WEA ZB01_wpd)11:31	17 20:56 (WEA 13)
20	07:56 08:43 (WEA VB01) 06:59		05:55 05:45	05:00	19:35 (WEA ZB03_wpd)04:55	20:15 (WEA ZB01_wpd)04:43
21	16:38 28 09:11 (WEA VB01) 17:36		18:27 20:21	17 19:52 (WEA ZB03_wpd)11:09	20 20:35 (WEA ZB01_wpd)11:31	18 20:26 (WEA ZB01_wpd)
22	07:55 08:42 (WEA VB01) 06:57		05:53 05:43	05:00	19:35 (WEA ZB03_wpd)04:54	20:15 (WEA ZB01_wpd)04:43
23	16:40 29 09:11 (WEA VB01) 17:38		18:28 20:22	19 19:54 (WEA ZB03_wpd)11:10	20 20:35 (WEA ZB01_wpd)11:31	18 20:57 (WEA 13)
24	07:53 08:43 (WEA VB01) 06:55		05:50 05:41	05:00	19:34 (WEA ZB03_wpd)04:52	20:15 (WEA ZB01_wpd)04:44
25	16:42 29 09:12 (WEA VB01) 17:40		18:30 20:24	19 19:53 (WEA ZB03_wpd)11:11	20 20:35 (WEA ZB01_wpd)11:31	18 20:57 (WEA 13)
26	07:52 08:44 (WEA VB01) 06:54		06:48 05:39	05:00	19:34 (WEA ZB03_wpd)04:51	20:15 (WEA ZB01_wpd)04:44
27	16:43 29 09:11 (WEA VB01) 17:39		18:32 20:26	19 19:53 (WEA ZB03_wpd)11:12	20 20:35 (WEA ZB01_wpd)11:31	18 20:56 (WEA 13)
28	07:50 08:44 (WEA VB01) 06:53		06:46 05:37	05:00	19:35 (WEA ZB03_wpd)04:50	20:15 (WEA ZB01_wpd)04:45
29	16:45 27 09:11 (WEA VB01) 17:37		18:34 20:27	18 19:53 (WEA ZB03_wpd)11:14	20 20:35 (WEA ZB01_wpd)11:31	16 20:56 (WEA ZB01_wpd)
30	07:49 08:45 (WEA VB01) 06:52		06:43 05:35	05:00	19:34 (WEA ZB03_wpd)04:49	20:16 (WEA ZB01_wpd)
31	16:47 26 09:11 (WEA VB01) 17:35		18:35 20:28	19 19:54 (WEA ZB03_wpd)11:15	20 20:35 (WEA ZB01_wpd)11:31	16 20:56 (WEA ZB01_wpd)
Sonnenscheinstunden	256	276	367	417	488	502
astr.max.mögl.Beschattung	836	110		135	307	504

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) Schatteneinde	Schattenanfang (WEA mit erstem Schatten)	Schatteneinde (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-71 - SR-71, Grünstraße 32/32a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

Juli		August		September		Oktober		November		Dezember	
1	04:45	20:26 (WEA ZB01_wpd)05:23		06:14	07:04	06:59		07:51	08:27 (WEA VB01,)		
	21:30	20:38 (WEA ZB01_wpd)20:58		19:54	18:44	16:36		15:55	09:07 (WEA VB03)	33	
2	04:46	20:25 (WEA ZB01_wpd)05:24		06:15	07:05	07:01		07:52	08:28 (WEA VB01,)		
	21:30	20:38 (WEA ZB01_wpd)20:56		19:52	18:41	16:34		15:54	30 09:07 (WEA VB03)		
3	04:47	20:25 (WEA ZB01_wpd)05:26		06:17	07:07	07:02		07:54	08:30 (WEA VB01,)		
	21:30	20:39 (WEA ZB01_wpd)20:54		19:50	18:39	16:33		15:54	29 09:08 (WEA VB03)		
4	04:47	20:25 (WEA ZB01_wpd)05:27		06:19	07:09	07:04		07:55	08:32 (WEA VB01,)		
	21:29	20:40 (WEA ZB01_wpd)20:52		19:47	18:37	16:31		15:53	25 09:09 (WEA VB03)		
5	04:48	20:25 (WEA ZB01_wpd)05:29		06:20	07:11	07:06		08:23 (WEA VB01,)	07:56		08:49 (WEA VB03)
	21:29	20:41 (WEA ZB01_wpd)20:51		19:45	18:34	16:29	10	08:33 (WEA VB01,)	15:52	21	09:10 (WEA VB03)
6	04:49	20:24 (WEA ZB01_wpd)05:31		06:22	07:12	07:08		08:21 (WEA VB01,)	07:58		08:49 (WEA VB03)
	21:28	20:40 (WEA ZB01_wpd)20:49		19:43	18:32	16:27	15	08:36 (WEA VB01,)	15:52	21	09:10 (WEA VB03)
7	04:50	20:24 (WEA ZB01_wpd)05:32		06:24	07:14	07:10		08:19 (WEA VB01,)	07:59		08:49 (WEA VB03)
	21:28	20:41 (WEA ZB01_wpd)20:47		19:40	18:30	16:25	19	08:38 (WEA VB01,)	15:52	21	09:10 (WEA VB03)
8	04:51	20:24 (WEA ZB01_wpd)05:34		06:26	07:16	07:12		08:18 (WEA VB01,)	08:00		08:50 (WEA VB03)
	21:27	20:42 (WEA ZB01_wpd)20:45		19:57 (WEA ZB03_wpd)19:38	18:27	16:24	21	08:39 (WEA VB01,)	15:51	22	09:12 (WEA VB03)
9	04:52	20:24 (WEA ZB01_wpd)05:35		19:47 (WEA ZB03_wpd)06:27	07:18	07:13		08:17 (WEA VB01,)	08:02		08:50 (WEA VB03)
	21:26	20:42 (WEA ZB01_wpd)20:43	12	19:59 (WEA ZB03_wpd)19:36	18:25	16:22	23	08:40 (WEA VB01,)	15:51	22	09:12 (WEA VB03)
10	04:53	20:24 (WEA ZB01_wpd)05:37		19:45 (WEA ZB03_wpd)06:29	07:19	07:15		08:16 (WEA VB01,)	08:03		08:50 (WEA VB03)
	21:25	20:42 (WEA ZB01_wpd)20:41	14	19:59 (WEA ZB03_wpd)19:33	18:23	16:20	25	08:41 (WEA VB01,)	15:51	22	09:12 (WEA VB03)
11	04:54	20:24 (WEA ZB01_wpd)05:39		19:44 (WEA ZB03_wpd)06:30	07:21	07:17		08:16 (WEA VB01,)	08:04		08:50 (WEA VB03)
	21:25	20:43 (WEA ZB01_wpd)20:39	16	20:00 (WEA ZB03_wpd)19:31	18:21	16:19	26	08:42 (WEA VB01,)	15:50	23	09:13 (WEA VB03)
12	04:55	20:24 (WEA ZB01_wpd)05:40		19:44 (WEA ZB03_wpd)06:32	07:23	07:19		08:16 (WEA VB01,)	08:05		08:51 (WEA VB03)
	21:24	20:43 (WEA ZB01_wpd)20:37	17	20:01 (WEA ZB03_wpd)19:29	18:18	16:17	27	08:43 (WEA VB01,)	15:50	22	09:13 (WEA VB03)
13	04:56	20:24 (WEA ZB01_wpd)05:42		19:43 (WEA ZB03_wpd)06:34	07:25	07:21		08:15 (WEA VB01,)	08:06		08:51 (WEA VB03)
	21:23	20:43 (WEA ZB01_wpd)20:35	18	20:01 (WEA ZB03_wpd)19:26	18:16	16:16	28	08:43 (WEA VB01,)	15:50	22	09:13 (WEA VB03)
14	04:57	20:24 (WEA ZB01_wpd)05:44		19:43 (WEA ZB03_wpd)06:35	07:26	07:23		08:15 (WEA VB01,)	08:07		08:51 (WEA VB03)
	21:22	20:44 (WEA ZB01_wpd)20:33	19	20:02 (WEA ZB03_wpd)19:24	18:14	16:14	29	08:44 (WEA VB01,)	15:50	23	09:14 (WEA VB03)
15	04:59	20:24 (WEA ZB01_wpd)05:45		19:42 (WEA ZB03_wpd)06:37	07:28	07:24		08:15 (WEA VB01,)	08:08		08:52 (WEA VB03)
	21:21	20:44 (WEA ZB01_wpd)20:31	19	20:01 (WEA ZB03_wpd)19:22	18:12	16:13	29	08:44 (WEA VB01,)	15:50	23	09:15 (WEA VB03)
16	05:00	20:25 (WEA ZB01_wpd)05:47		19:42 (WEA ZB03_wpd)06:39	07:30	07:26		08:16 (WEA VB01,)	08:09		08:52 (WEA VB03)
	21:20	20:45 (WEA ZB01_wpd)20:29	19	20:01 (WEA ZB03_wpd)19:19	18:09	16:11	28	08:44 (WEA VB01,)	15:50	23	09:15 (WEA VB03)
17	05:01	20:25 (WEA ZB01_wpd)05:49		19:42 (WEA ZB03_wpd)06:40	07:32	07:28		08:16 (WEA VB01,)	08:09		08:53 (WEA VB03)
	21:19	20:45 (WEA ZB01_wpd)20:27	16	19:58 (WEA ZB03_wpd)19:17	18:07	16:10	29	08:45 (WEA VB01,)	15:51	23	09:16 (WEA VB03)
18	05:02	20:25 (WEA ZB01_wpd)05:50		19:42 (WEA ZB03_wpd)06:42	07:33	07:30		08:16 (WEA VB01,)	08:10		08:54 (WEA VB03)
	21:18	20:44 (WEA ZB01_wpd)20:25	15	19:57 (WEA ZB03_wpd)19:15	18:05	16:08	29	08:45 (WEA VB01,)	15:51	23	09:17 (WEA VB03)
19	05:04	20:25 (WEA ZB01_wpd)05:52		19:43 (WEA ZB03_wpd)06:44	07:35	07:31		08:17 (WEA VB01,)	08:11		08:54 (WEA VB03)
	21:17	20:44 (WEA ZB01_wpd)20:23	12	19:55 (WEA ZB03_wpd)19:12	18:03	16:07	28	08:45 (WEA VB01,)	15:51	22	09:16 (WEA VB03)
20	05:05	20:25 (WEA ZB01_wpd)05:54		19:44 (WEA ZB03_wpd)06:45	07:37	07:33		08:16 (WEA VB01,)	08:12		08:54 (WEA VB03)
	21:15	20:43 (WEA ZB01_wpd)20:21	9	19:53 (WEA ZB03_wpd)19:10	18:01	16:06	28	08:44 (WEA VB01,)	15:51	23	09:17 (WEA VB03)
21	05:06	20:26 (WEA ZB01_wpd)05:55		19:46 (WEA ZB03_wpd)06:47	07:39	07:35		08:17 (WEA VB01,)	08:12		08:55 (WEA VB03)
	21:14	20:42 (WEA ZB01_wpd)20:19	5	19:51 (WEA ZB03_wpd)19:07	17:59	16:05	27	08:44 (WEA VB01,)	15:52	23	09:18 (WEA VB03)
22	05:08	20:26 (WEA ZB01_wpd)05:57		06:49	07:41	07:37		08:17 (WEA VB01,)	08:13		08:55 (WEA VB03)
	21:13	20:41 (WEA ZB01_wpd)20:17		19:05	17:56	16:03	28	08:45 (WEA VB01,)	15:52	23	09:18 (WEA VB03)
23	05:09	20:26 (WEA ZB01_wpd)05:59		06:50	07:42	07:38		08:18 (WEA VB01,)	08:13		08:55 (WEA VB03)
	21:11	20:39 (WEA ZB01_wpd)20:15	13	19:03	17:54	16:02	27	08:45 (WEA VB01,)	15:53	23	09:18 (WEA VB03)
24	05:11	20:27 (WEA ZB01_wpd)06:00		06:52	07:44	07:40		08:19 (WEA VB01,)	08:14		08:56 (WEA VB03)
	21:10	20:39 (WEA ZB01_wpd)20:12		19:00	17:52	16:01	26	08:45 (WEA VB01,)	15:53	23	09:19 (WEA VB03)
25	05:12	20:28 (WEA ZB01_wpd)06:02		06:54	06:46	07:42		08:20 (WEA VB01,)	08:14		08:57 (WEA VB03)
	21:09	20:37 (WEA ZB01_wpd)20:10	9	18:58	16:50	16:00	25	08:45 (WEA VB01,)	15:54	22	09:19 (WEA VB03)
26	05:14	20:29 (WEA ZB01_wpd)06:04		06:55	06:48	07:43		08:20 (WEA VB01,)	08:14		08:57 (WEA VB03)
	21:07	20:35 (WEA ZB01_wpd)20:08	6	18:56	16:48	15:59	29	08:56 (WEA VB03)	15:55	23	09:20 (WEA VB03)
27	05:15	20:31 (WEA ZB01_wpd)06:05		06:57	06:50	07:45		08:22 (WEA VB01,)	08:15		08:57 (WEA VB03)
	21:06	20:35 (WEA ZB01_wpd)20:06	4	18:53	16:46	15:58	32	09:01 (WEA VB03)	15:56	23	09:20 (WEA VB03)
28	05:17	06:07		06:59	06:51	07:46		08:23 (WEA VB01,)	08:15		08:59 (WEA VB03)
	21:04	20:03		18:51	16:44	15:57	32	09:03 (WEA VB03)	15:56	22	09:21 (WEA VB03)
29	05:18	06:09		07:00	06:53	07:48		08:23 (WEA VB01,)	08:15		08:59 (WEA VB03)
	21:03	20:01		18:48	16:42	15:56	34	09:04 (WEA VB03)	15:57	23	09:22 (WEA VB03)
30	05:20	06:10		07:02	06:55	07:49		08:25 (WEA VB01,)	08:15		08:59 (WEA VB03)
	21:01	19:59		18:46	16:40	15:56	33	09:05 (WEA VB03)	15:58	22	09:21 (WEA VB03)
31	05:21	06:12		06:57	06:50	07:49		08:26 (WEA VB01,)	08:15		08:59 (WEA VB03)
	20:59	19:57		16:38	16:31	15:59		09:06 (WEA VB03)	15:59	23	09:22 (WEA VB03)
	Sonnenscheinstunden	505									
	astr. max. mögl. Beschattung	425	200		381	331	264	687		241	723

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

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-72 - SR-72, Grünstraße 33, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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 08:15	09:06 (WEA VB03) 07:47	08:53 (WEA VB01) 06:53	06:41	05:35	04:49
1 16:00	09:27 (WEA VB03) 16:49	09:15 (WEA VB01) 17:42	19:37	20:29	21:16
2 08:15	08:52 (WEA VB01) 07:46	08:54 (WEA VB01) 06:51	06:39	05:33	04:48
1 16:01	09:28 (WEA VB03) 16:51	20 09:14 (WEA VB01) 17:44	19:39	20:31	21:17
3 08:15	08:51 (WEA VB01) 07:44	08:56 (WEA VB01) 06:48	06:36	05:31	04:47
1 16:03	09:29 (WEA VB03) 16:53	16 09:12 (WEA VB01) 17:45	19:41	20:33	21:18
4 08:15	08:50 (WEA VB01) 07:42	08:59 (WEA VB01) 06:46	06:34	05:29	04:46
1 16:04	09:28 (WEA VB03) 16:55	11 09:10 (WEA VB01) 17:47	19:42	20:34	21:19
5 08:14	08:49 (WEA VB01) 07:41	06:44	06:32	05:27	04:45
1 16:05	09:29 (WEA VB03) 16:57	17:49	19:44	20:36	21:20
6 08:14	08:48 (WEA VB01) 07:39	06:42	06:29	05:25	04:45
1 16:06	09:28 (WEA VB03) 16:59	17:51	19:46	20:38	21:21
7 08:14	08:49 (WEA VB01) 07:37	06:39	06:27	05:24	04:44
1 16:07	09:29 (WEA VB03) 17:00	17:53	19:48	20:39	21:22
8 08:13	08:48 (WEA VB01) 07:35	06:37	06:25	05:22	04:44
1 16:09	09:29 (WEA VB03) 17:02	17:55	19:49	20:41	21:23
9 08:13	08:47 (WEA VB01) 07:34	06:35	06:22	05:20	04:43
1 16:10	09:28 (WEA VB03) 17:04	17:56	19:51	20:43	21:24
10 08:12	08:48 (WEA VB01) 07:32	06:32	06:20	05:18	04:43
1 16:12	09:29 (WEA VB03) 17:06	17:58	19:53	20:44	21:25
11 08:11	08:47 (WEA VB01) 07:30	06:30	06:18	05:17	04:42
1 16:13	09:28 (WEA VB03) 17:08	18:00	19:54	20:46	21:26
12 08:11	08:47 (WEA VB01) 07:28	06:28	06:16	05:15	04:42
1 16:14	09:27 (WEA VB03) 17:10	18:02	19:56	20:48	21:26
13 08:10	08:47 (WEA VB01) 07:26	06:26	06:13	05:13	04:42
1 16:16	09:26 (WEA VB03) 17:12	18:04	19:58	20:49	21:27
14 08:09	08:47 (WEA VB01) 07:24	06:23	06:11	05:12	04:41
1 16:18	09:12 (WEA VB01) 17:14	18:05	20:00	20:51	20:19 (WEA ZB01_wpd) 04:41
15 08:08	08:46 (WEA VB01) 07:22	06:21	06:09	05:10	20:20 (WEA ZB01_wpd) 21:28
1 16:19	09:13 (WEA VB01) 17:16	18:07	20:01	20:52	5 20:21 (WEA ZB01_wpd) 21:28
16 08:08	08:47 (WEA VB01) 07:20	06:19	06:07	05:08	20:15 (WEA ZB01_wpd) 04:41
1 16:21	09:14 (WEA VB01) 17:18	18:09	20:03	20:54	8 20:23 (WEA ZB01_wpd) 21:29
17 08:07	08:47 (WEA VB01) 07:18	06:16	06:04	05:07	20:15 (WEA ZB01_wpd) 04:41
1 16:22	09:14 (WEA VB01) 17:19	18:11	20:05	20:56	10 20:25 (WEA ZB01_wpd) 21:29
18 08:06	08:47 (WEA VB01) 07:16	06:14	06:02	05:05	20:13 (WEA ZB01_wpd) 04:41
1 16:24	09:15 (WEA VB01) 17:21	18:12	20:07	20:57	13 20:26 (WEA ZB01_wpd) 21:30
19 08:05	08:46 (WEA VB01) 07:14	06:12	06:00	05:04	20:13 (WEA ZB01_wpd) 04:41
1 16:25	09:15 (WEA VB01) 17:23	18:14	20:08	20:59	14 20:27 (WEA ZB01_wpd) 21:30
20 08:04	08:46 (WEA VB01) 07:12	06:09	05:58	05:02	20:13 (WEA ZB01_wpd) 04:41
1 16:27	09:16 (WEA VB01) 17:25	18:16	20:10	21:00	16 20:29 (WEA ZB01_wpd) 21:30
21 08:02	08:47 (WEA VB01) 07:10	06:07	05:56	05:01	20:13 (WEA ZB01_wpd) 04:41
1 16:29	09:17 (WEA VB01) 17:27	18:18	20:12	21:02	18 20:31 (WEA ZB01_wpd) 21:31
22 08:01	08:48 (WEA VB01) 07:08	06:05	05:54	05:00	20:12 (WEA ZB01_wpd) 04:41
1 16:31	09:17 (WEA VB01) 17:29	18:20	20:14	21:03	19 20:31 (WEA ZB01_wpd) 21:31
23 08:00	08:47 (WEA VB01) 07:06	06:02	05:51	04:58	20:12 (WEA ZB01_wpd) 04:42
1 16:33	09:17 (WEA VB01) 17:31	18:21	20:15	21:04	20 20:32 (WEA ZB01_wpd) 21:31
24 07:59	08:48 (WEA VB01) 07:04	06:00	05:49	04:57	20:13 (WEA ZB01_wpd) 04:42
1 16:34	09:18 (WEA VB01) 17:33	18:23	20:17	21:06	19 20:32 (WEA ZB01_wpd) 21:31
25 07:57	08:48 (WEA VB01) 07:02	05:57	05:47	04:56	20:13 (WEA ZB01_wpd) 04:42
1 16:36	09:17 (WEA VB01) 17:34	18:25	20:19	21:07	19 20:32 (WEA ZB01_wpd) 21:31
26 07:56	08:49 (WEA VB01) 06:59	05:55	05:45	04:55	20:13 (WEA ZB01_wpd) 04:43
1 16:38	09:18 (WEA VB01) 17:36	18:27	20:21	21:09	19 20:32 (WEA ZB01_wpd) 21:31
27 07:55	08:49 (WEA VB01) 06:57	05:53	05:43	04:54	20:13 (WEA ZB01_wpd) 04:43
1 16:40	09:17 (WEA VB01) 17:38	18:28	20:22	21:10	19 20:32 (WEA ZB01_wpd) 21:31
28 07:53	08:50 (WEA VB01) 06:55	05:50	05:41	04:52	20:13 (WEA ZB01_wpd) 04:43
1 16:42	09:18 (WEA VB01) 17:40	18:30	20:24	21:11	19 20:32 (WEA ZB01_wpd) 21:31
29 07:52	08:50 (WEA VB01)	06:48	05:39	04:51	20:14 (WEA ZB01_wpd) 04:44
1 16:43	09:17 (WEA VB01)	19:32	20:26	21:12	18 20:32 (WEA ZB01_wpd) 21:31
30 07:50	08:51 (WEA VB01)	06:46	05:37	04:50	20:14 (WEA ZB01_wpd) 04:45
1 16:45	09:16 (WEA VB01)	19:34	20:27	21:14	17 20:31 (WEA ZB01_wpd) 21:31
31 07:49	08:52 (WEA VB01)	06:43	05:37	04:49	20:14 (WEA ZB01_wpd)
1 16:47	09:16 (WEA VB01)	19:35	20:28	21:15	17 20:31 (WEA ZB01_wpd)
Sonnenscheinstunden	256				
astr. max. mögl. Beschattung	921	276	69	367	417
					488
					271
					502
					484

**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		



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB **Schattenrezeptor:**SR-72 - SR-72, Grünstraße 33, 15518 Steinhöfel

**Annahmen für Schattenwurfberechnung**

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

Juli		August		September		Oktober		November		Dezember	
1	04:45   21:30	20:43 (WEA 13)	05:23	06:14	07:04	06:59				07:51   15:55	08:29 (WEA VB01.) 09:10 (WEA VB03)
2	04:46   21:30	20:43 (WEA 13)	05:24	06:15	07:05	07:01				07:52   15:54	08:30 (WEA VB01.) 09:11 (WEA VB03)
3	04:47   21:30	20:28 (WEA ZB01_wpd)	05:26	06:17	07:07	07:02				07:54   15:54	08:31 (WEA VB01.) 09:12 (WEA VB03)
4	04:47   21:29	20:27 (WEA ZB01_wpd)	05:27	06:19	07:09	07:04				07:55   15:53	08:32 (WEA VB01.) 09:13 (WEA VB03)
5	04:48   21:29	20:26 (WEA ZB01_wpd)	05:29	06:20	07:11	07:06				07:56   15:52	08:34 (WEA VB01.) 09:14 (WEA VB03)
6	04:49   21:28	20:25 (WEA ZB01_wpd)	05:31	06:22	07:12	07:08				07:58   15:52	08:34 (WEA VB01.) 09:14 (WEA VB03)
7	04:50   21:28	20:24 (WEA ZB01_wpd)	05:32	06:24	07:14	07:10	08:29 (WEA VB01.)			07:59   15:52	08:35 (WEA VB01.) 09:15 (WEA VB03)
8	04:51   21:27	20:24 (WEA ZB01_wpd)	05:34	06:25	07:16	07:12	08:27 (WEA VB01.)			08:00   15:51	08:38 (WEA VB01.) 09:16 (WEA VB03)
9	04:52   21:26	20:24 (WEA ZB01_wpd)	05:35	06:27	07:18	07:13	08:25 (WEA VB01.)			08:02   15:51	08:39 (WEA VB01.) 09:17 (WEA VB03)
10	04:53   21:25	20:23 (WEA ZB01_wpd)	05:37	06:29	07:19	07:15	08:24 (WEA VB01.)			08:03   15:51	08:41 (WEA VB01.) 09:17 (WEA VB03)
11	04:54   21:25	20:23 (WEA ZB01_wpd)	05:39	06:30	07:21	07:17	08:23 (WEA VB01.)			08:04   15:50	08:56 (WEA VB03) 09:17 (WEA VB03)
12	04:55   21:24	20:23 (WEA ZB01_wpd)	05:40	06:32	07:23	07:19	08:23 (WEA VB01.)			08:05   15:50	08:56 (WEA VB03) 09:18 (WEA VB03)
13	04:56   21:23	20:23 (WEA ZB01_wpd)	05:42	06:34	07:25	07:21	08:22 (WEA VB01.)			08:06   15:50	08:56 (WEA VB03) 09:18 (WEA VB03)
14	04:57   21:22	20:22 (WEA ZB01_wpd)	05:44	06:35	07:26	07:23	08:22 (WEA VB01.)			08:07   15:50	08:57 (WEA VB03) 09:19 (WEA VB03)
15	04:59   21:21	20:22 (WEA ZB01_wpd)	05:45	06:37	07:28	07:24	08:22 (WEA VB01.)			08:08   15:50	08:57 (WEA VB03) 09:20 (WEA VB03)
16	05:00   21:20	20:23 (WEA ZB01_wpd)	05:47	06:39	07:30	07:26	08:22 (WEA VB01.)			08:09   15:50	08:58 (WEA VB03) 09:20 (WEA VB03)
17	05:01   21:19	20:23 (WEA ZB01_wpd)	05:49	06:40	07:32	07:28	08:22 (WEA VB01.)			08:09   15:51	08:58 (WEA VB03) 09:21 (WEA VB03)
18	05:02   21:18	20:22 (WEA ZB01_wpd)	05:50	06:42	07:33	07:30	08:22 (WEA VB01.)			08:10   15:51	08:59 (WEA VB03) 09:22 (WEA VB03)
19	05:04   21:16	20:22 (WEA ZB01_wpd)	05:52	06:44	07:35	07:31	08:22 (WEA VB01.)			08:11   15:51	08:59 (WEA VB03) 09:22 (WEA VB03)
20	05:05   21:15	20:22 (WEA ZB01_wpd)	05:54	06:45	07:37	07:33	08:22 (WEA VB01.)			08:12   15:51	09:00 (WEA VB03) 09:22 (WEA VB03)
21	05:06   21:14	20:23 (WEA ZB01_wpd)	05:55	06:47	07:39	07:35	08:22 (WEA VB01.)			08:12   15:52	09:01 (WEA VB03) 09:23 (WEA VB03)
22	05:08   21:13	20:23 (WEA ZB01_wpd)	05:57	06:49	07:41	07:37	08:23 (WEA VB01.)			08:13   15:52	09:01 (WEA VB03) 09:23 (WEA VB03)
23	05:09   21:11	20:23 (WEA ZB01_wpd)	05:59	06:50	07:42	07:38	08:23 (WEA VB01.)			08:13   15:53	09:01 (WEA VB03) 09:23 (WEA VB03)
24	05:11   21:10	20:24 (WEA ZB01_wpd)	06:00	06:52	07:44	07:40	08:24 (WEA VB01.)			08:14   15:53	09:02 (WEA VB03) 09:23 (WEA VB03)
25	05:12   21:09	20:24 (WEA ZB01_wpd)	06:02	06:54	07:46	07:42	08:25 (WEA VB01.)			08:14   15:54	09:02 (WEA VB03) 09:25 (WEA VB03)
26	05:14   21:07	20:24 (WEA ZB01_wpd)	06:04	06:55	07:48	07:43	08:25 (WEA VB01.)			08:14   15:55	09:03 (WEA VB03) 09:25 (WEA VB03)
27	05:15   21:06	20:25 (WEA ZB01_wpd)	06:05	06:57	07:50	07:45	08:26 (WEA VB01.)			08:15   15:56	09:03 (WEA VB03) 09:25 (WEA VB03)
28	05:16   21:04	20:25 (WEA ZB01_wpd)	06:06	06:59	07:52	07:46	08:27 (WEA VB01.)			08:15   15:57	09:04 (WEA VB03) 09:27 (WEA VB03)
29	05:18   21:03	20:26 (WEA ZB01_wpd)	06:07	07:00	07:54	07:48	08:28 (WEA VB01.)			08:15   15:58	09:05 (WEA VB03) 09:27 (WEA VB03)
30	05:20   21:01	20:27 (WEA ZB01_wpd)	06:08	07:02	07:56	07:50	08:29 (WEA VB01.)			08:15   15:59	09:06 (WEA VB03) 09:27 (WEA VB03)
31	05:21   20:59	20:28 (WEA ZB01_wpd)	06:09	07:04	07:58	07:52	08:30 (WEA VB01.)			08:15   15:59	09:07 (WEA VB03) 09:27 (WEA VB03)
Sonnenscheinstunden			456	455	381	331	264	637		241	803
astr.max.mögl.Beschattung											

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM)	Schattenanfang	Zeitpunkt (SS:MM)	Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-73 - SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:47 (WEA VB03) 07:47	08:24 (WEA VB01) 06:53	06:41	05:35	19:51 (WEA ZB03_wpd)04:49
2	16:00	45 10:26 (WEA VB02) 16:40	28 08:52 (WEA VB01) 17:42	19:37	20:29	10 20:01 (WEA ZB03_wpd)1:16
3	08:15	08:47 (WEA VB03) 07:44	08:23 (WEA VB01) 06:51	06:39	05:33	19:50 (WEA ZB03_wpd)04:48
4	16:01	45 10:26 (WEA VB02) 16:51	29 08:52 (WEA VB01) 17:44	19:39	20:31	12 20:02 (WEA ZB03_wpd)1:17
5	08:15	08:47 (WEA VB03) 07:44	08:23 (WEA VB01) 06:48	06:36	05:31	19:49 (WEA ZB03_wpd)04:47
6	16:03	44 10:26 (WEA VB02) 16:53	29 08:52 (WEA VB01) 17:45	19:41	20:33	15 20:04 (WEA ZB03_wpd)1:18
7	08:15	08:47 (WEA VB03) 07:42	08:24 (WEA VB01) 06:46	06:34	05:29	19:48 (WEA ZB03_wpd)04:46
8	16:04	43 10:25 (WEA VB02) 16:55	29 08:53 (WEA VB01) 17:47	19:42	20:34	17 20:05 (WEA ZB03_wpd)1:19
9	08:14	08:47 (WEA VB03) 07:41	08:24 (WEA VB01) 06:44	06:32	05:27	19:47 (WEA ZB03_wpd)04:45
10	16:05	43 10:26 (WEA VB02) 16:57	29 08:53 (WEA VB01) 17:49	19:44	05:25	19:48 (WEA ZB03_wpd)04:45
11	08:14	08:47 (WEA VB03) 07:39	08:24 (WEA VB01) 06:42	06:29	05:23	19:48 (WEA ZB03_wpd)04:45
12	16:06	42 10:25 (WEA VB02) 16:59	29 08:53 (WEA VB01) 17:51	19:46	05:21	20:38 19 20:07 (WEA ZB03_wpd)1:21
13	08:14	08:48 (WEA VB03) 07:37	08:24 (WEA VB01) 06:39	06:27	05:20	19:48 (WEA ZB03_wpd)04:44
14	16:07	40 10:25 (WEA VB02) 17:00	29 08:53 (WEA VB01) 17:53	19:48	20:39	19 20:07 (WEA ZB03_wpd)1:22
15	08:13	08:48 (WEA VB03) 07:35	08:24 (WEA VB01) 06:37	06:25	05:22	19:47 (WEA ZB03_wpd)04:44
16	16:09	38 10:24 (WEA VB02) 17:02	29 08:53 (WEA VB01) 17:55	19:49	05:20	20:41 19 20:06 (WEA ZB03_wpd)1:23
17	08:13	08:48 (WEA VB03) 07:34	08:25 (WEA VB01) 06:35	06:22	05:20	19:48 (WEA ZB03_wpd)04:43
18	16:10	36 10:23 (WEA VB02) 17:04	27 08:52 (WEA VB01) 17:56	19:51	20:43	19 20:07 (WEA ZB03_wpd)1:22
19	08:12	08:49 (WEA VB03) 07:32	08:25 (WEA VB01) 06:33	06:20	05:18	19:48 (WEA ZB03_wpd)04:42
20	16:12	32 10:22 (WEA VB02) 17:06	27 08:52 (WEA VB01) 17:58	19:53	20:44	18 20:06 (WEA ZB03_wpd)1:25
21	08:11	08:49 (WEA VB03) 07:30	08:26 (WEA VB01) 06:30	06:18	05:17	19:48 (WEA ZB03_wpd)04:42
22	16:13	23 09:12 (WEA VB03) 17:08	25 08:51 (WEA VB01) 18:00	19:54	20:46	17 20:05 (WEA ZB03_wpd)1:26
23	08:11	08:49 (WEA VB03) 07:28	08:27 (WEA VB01) 06:28	06:16	05:15	19:50 (WEA ZB03_wpd)04:42
24	16:15	23 09:12 (WEA VB03) 17:10	23 08:50 (WEA VB01) 18:02	19:56	20:48	14 20:04 (WEA ZB03_wpd)1:26
25	08:10	08:49 (WEA VB03) 07:26	08:28 (WEA VB01) 06:26	06:13	05:13	19:50 (WEA ZB03_wpd)04:42
26	16:16	24 09:13 (WEA VB03) 17:12	21 08:49 (WEA VB01) 18:04	19:58	20:49	13 20:03 (WEA ZB03_wpd)1:27
27	08:09	08:50 (WEA VB03) 07:24	08:30 (WEA VB01) 06:23	06:11	05:12	19:52 (WEA ZB03_wpd)04:41
28	16:18	23 09:13 (WEA VB03) 17:14	17 08:47 (WEA VB01) 18:05	20:00	20:51	10 20:02 (WEA ZB03_wpd)1:28
29	08:08	08:50 (WEA VB03) 07:22	08:32 (WEA VB01) 06:21	06:09	05:10	19:55 (WEA ZB03_wpd)04:41
30	16:19	23 09:13 (WEA VB03) 17:16	12 08:44 (WEA VB01) 18:07	20:01	20:52	3 19:58 (WEA ZB03_wpd)1:28
31	08:08	08:51 (WEA VB03) 07:20	06:19	06:07	05:08	04:41
1	16:21	23 09:14 (WEA VB03) 17:18	18:09	20:03	20:54	21:29
2	08:07	08:51 (WEA VB03) 07:18	06:16	06:04	05:07	04:41
3	16:22	23 09:14 (WEA VB03) 17:19	18:11	20:05	20:56	21:29
4	08:06	08:52 (WEA VB03) 07:16	06:14	06:02	05:05	04:41
5	16:24	22 09:14 (WEA VB03) 17:21	18:12	20:07	20:57	21:30
6	08:05	08:52 (WEA VB03) 07:14	06:12	06:00	05:04	04:41
7	16:26	21 09:13 (WEA VB03) 17:23	18:14	20:08	20:59	21:30
8	08:04	08:53 (WEA VB03) 07:12	06:09	05:58	05:02	04:41
9	16:27	20 09:13 (WEA VB03) 17:25	18:16	20:10	21:00	21:30
10	08:02	08:55 (WEA VB03) 07:10	06:07	05:56	05:01	04:41
11	16:29	18 09:13 (WEA VB03) 17:27	18:18	20:12	21:02	21:31
12	08:01	08:56 (WEA VB03) 07:08	06:05	05:54	05:00	04:41
13	16:31	17 09:13 (WEA VB03) 17:29	18:20	20:14	21:03	21:31
14	08:00	08:57 (WEA VB03) 07:06	06:02	05:51	04:58	04:42
15	16:33	14 09:11 (WEA VB03) 17:31	18:22	20:17	21:04	21:34
16	07:59	08:31 (WEA VB01) 07:04	06:00	05:49	04:57	04:42
17	16:34	23 09:11 (WEA VB03) 17:33	18:23	20:17	21:06	21:31
18	07:57	08:28 (WEA VB01) 07:02	05:57	05:47	04:56	04:42
19	16:36	22 09:08 (WEA VB03) 17:34	18:25	20:19	21:07	21:31
20	07:56	08:28 (WEA VB01) 06:59	05:55	05:45	04:55	04:42
21	16:38	18 08:46 (WEA VB01) 07:00	18:27	20:21	21:09	21:31
22	07:55	08:26 (WEA VB01) 06:55	05:53	05:43	04:54	04:42
23	16:40	21 08:47 (WEA VB01) 17:38	18:28	20:22	21:10	21:31
24	07:53	08:26 (WEA VB01) 06:55	05:50	05:41	04:53	04:42
25	16:42	23 08:49 (WEA VB01) 17:40	18:30	20:24	21:11	21:31
26	07:52	08:25 (WEA VB01) 06:54	06:48	05:39	19:54 (WEA ZB03_wpd)04:51	3 20:39 (WEA ZB01_wpd)1:31
27	16:43	24 08:49 (WEA VB01) 17:41	19:32	20:26	3 19:57 (WEA ZB03_wpd)04:51	20:35 (WEA ZB01_wpd)04:44
28	07:50	08:24 (WEA VB01) 06:53	06:46	05:37	5 20:40 (WEA ZB01_wpd)1:31	20:56 (WEA ZB01_wpd)04:45
29	16:45	26 08:50 (WEA VB01) 17:42	19:34	20:27	6 19:59 (WEA ZB03_wpd)04:50	20:34 (WEA ZB01_wpd)04:45
30	07:49	08:24 (WEA VB01) 06:53	06:43	05:36	7 20:41 (WEA ZB01_wpd)1:31	20:56 (WEA ZB01_wpd)04:45
31	16:47	27 08:51 (WEA VB01) 17:43	19:35	20:27	8 20:42 (WEA ZB01_wpd)1:31	19 20:56 (WEA ZB01_wpd)04:45
	Sonnenscheinstunden	256	276	367	417	487
	astr.max.mögl.Beschattung	866	383	9	248	544

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-73 - SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	04:45	20:37 (WEA ZB01_wpd) 05:23	20:00 (WEA ZB03_wpd) 06:14	07:04	06:59	07:55 (WEA VB01) 07:51
2	21:30	20:57 (WEA ZB01_wpd) 05:58	15 20:15 (WEA ZB03_wpd) 06:15	18:44	07:01	08:01 (WEA VB01) 07:55
3	04:46	20:37 (WEA ZB01_wpd) 05:24	16 20:15 (WEA ZB03_wpd) 06:15	07:05	16:35	08:22 (WEA VB01) 07:52
4	04:47	20:37 (WEA ZB01_wpd) 05:26	16 20:15 (WEA ZB03_wpd) 06:17	07:07	07:02	07:54 (WEA VB01) 07:54
5	21:30	19 20:56 (WEA ZB01_wpd) 05:54	17 20:16 (WEA ZB03_wpd) 06:19	18:39	16:33	08:22 (WEA VB01) 07:55
6	04:47	20:38 (WEA ZB01_wpd) 05:27	19:58 (WEA ZB03_wpd) 06:19	07:09	07:04	07:53 (WEA VB01) 07:55
7	21:29	18 20:56 (WEA ZB01_wpd) 05:52	18 20:16 (WEA ZB03_wpd) 06:19	18:37	16:29	08:23 (WEA VB01) 07:55
8	04:48	20:39 (WEA ZB01_wpd) 05:29	19:58 (WEA ZB03_wpd) 06:20	07:11	07:06	07:53 (WEA VB01) 07:56
9	21:29	16 20:55 (WEA ZB01_wpd) 05:51	19 20:17 (WEA ZB03_wpd) 06:20	18:34	16:29	08:23 (WEA VB01) 07:56
10	04:49	20:38 (WEA ZB01_wpd) 05:31	19:57 (WEA ZB03_wpd) 06:22	07:12	07:08	07:53 (WEA VB01) 07:58
11	21:28	16 20:54 (WEA ZB01_wpd) 05:32	19 20:16 (WEA ZB03_wpd) 06:24	18:32	16:27	08:23 (WEA VB01) 07:58
12	04:50	20:39 (WEA ZB01_wpd) 05:32	19:57 (WEA ZB03_wpd) 06:24	07:14	07:10	07:54 (WEA VB01) 07:59
13	21:28	15 20:54 (WEA ZB01_wpd) 05:34	20 20:17 (WEA ZB03_wpd) 06:25	18:30	16:25	08:23 (WEA VB01) 07:59
14	04:51	20:39 (WEA ZB01_wpd) 05:34	19:57 (WEA ZB03_wpd) 06:25	07:16	07:12	07:54 (WEA VB01) 08:00
15	21:27	14 20:53 (WEA ZB01_wpd) 05:35	18 20:15 (WEA ZB03_wpd) 06:25	18:27	16:24	08:23 (WEA VB01) 08:00
16	04:52	20:40 (WEA ZB01_wpd) 05:35	19:58 (WEA ZB03_wpd) 06:27	07:18	07:13	07:54 (WEA VB01) 08:01
17	21:26	13 20:53 (WEA ZB01_wpd) 05:37	16 20:14 (WEA ZB03_wpd) 06:29	18:25	16:22	08:23 (WEA VB01) 08:01
18	04:53	20:40 (WEA ZB01_wpd) 05:37	19:57 (WEA ZB03_wpd) 06:29	07:19	07:15	07:55 (WEA VB01) 08:03
19	21:25	12 20:52 (WEA ZB01_wpd) 05:41	15 20:12 (WEA ZB03_wpd) 06:30	18:23	16:20	08:22 (WEA VB01) 08:03
20	04:54	20:41 (WEA ZB01_wpd) 05:39	19:58 (WEA ZB03_wpd) 06:30	07:21	07:17	07:55 (WEA VB01) 08:04
21	21:25	10 20:51 (WEA ZB01_wpd) 05:40	12 20:10 (WEA ZB03_wpd) 06:31	18:21	16:19	08:22 (WEA VB01) 08:04
22	04:55	20:41 (WEA ZB01_wpd) 05:40	20:00 (WEA ZB03_wpd) 06:32	07:23	07:19	07:56 (WEA VB01) 08:05
23	21:24	10 20:51 (WEA ZB01_wpd) 05:42	9 20:09 (WEA ZB03_wpd) 06:34	18:18	16:17	08:22 (WEA VB01) 08:05
24	04:56	20:42 (WEA ZB01_wpd) 05:42	20:01 (WEA ZB03_wpd) 06:34	07:25	07:21	07:57 (WEA VB01) 08:06
25	21:23	8 20:50 (WEA ZB01_wpd) 05:45	5 20:06 (WEA ZB03_wpd) 06:36	18:16	16:16	08:21 (WEA VB01) 08:06
26	04:57	20:43 (WEA ZB01_wpd) 05:44	2 20:05 (WEA ZB03_wpd) 06:37	07:26	07:23	07:58 (WEA VB01) 08:07
27	21:22	6 20:49 (WEA ZB01_wpd) 05:47	2 20:05 (WEA ZB03_wpd) 06:38	18:14	16:14	08:20 (WEA VB01) 08:07
28	04:59	20:44 (WEA ZB01_wpd) 05:45	06:37	07:28	07:24	07:59 (WEA VB01) 08:08
29	21:21	4 20:48 (WEA ZB01_wpd) 05:47	19:22	18:12	16:13	08:20 (WEA VB01) 08:08
30	05:00	20:47 (WEA ZB01_wpd) 05:47	06:39	07:30	07:26	08:01 (WEA VB01) 08:09
31	21:20	1 20:48 (WEA ZB01_wpd) 05:49	19:19	18:09	16:11	08:19 (WEA VB01) 08:09
1	05:01	20:27	06:40	07:32	07:28	08:02 (WEA VB01) 08:09
2	21:19	05:49	19:17	18:07	16:10	08:19 (WEA VB01) 08:09
3	05:02	05:50	06:42	07:33	07:30	08:05 (WEA VB01) 08:10
4	21:18	20:25	19:15	18:05	16:09	08:19 (WEA VB01) 08:10
5	05:04	05:52	06:44	07:35	07:31	08:32 (WEA VB03) 08:11
6	21:16	20:23	19:12	18:03	16:07	08:19 (WEA VB01) 08:11
7	05:05	05:54	06:45	07:37	07:33	08:30 (WEA VB03) 08:12
8	21:15	20:21	19:10	18:01	16:06	08:19 (WEA VB01) 08:12
9	05:06	05:55	06:47	07:39	07:35	08:30 (WEA VB03) 08:12
10	21:14	20:19	19:07	17:59	16:05	08:19 (WEA VB01) 08:12
11	05:08	05:57	06:49	07:41	07:37	08:30 (WEA VB03) 08:13
12	21:13	20:17	19:05	17:56	16:03	08:19 (WEA VB01) 08:13
13	05:09	05:59	06:50	07:42	07:38	08:29 (WEA VB03) 08:13
14	21:11	20:15	19:03	17:54	16:02	08:19 (WEA VB01) 08:13
15	05:11	06:00	06:52	07:44	07:40	08:29 (WEA VB03) 08:14
16	21:10	20:12	19:00	17:52	16:01	08:19 (WEA VB01) 08:14
17	05:12	06:02	06:54	07:46	07:42	08:30 (WEA VB03) 08:14
18	21:09	20:10	18:58	16:50	16:00	08:29 (WEA VB03) 08:14
19	05:14	06:04	06:55	07:48	08:05 (WEA VB01) 07:43	08:29 (WEA VB03) 08:14
20	21:07	20:08	18:56	16:48	5 08:10 (WEA VB01) 07:45	08:29 (WEA VB03) 08:14
21	05:15	06:05	06:57	07:50	08:01 (WEA VB01) 07:45	08:29 (WEA VB03) 08:15
22	21:06	20:06	18:53	16:46	14 08:15 (WEA VB01) 07:48	08:29 (WEA VB03) 08:15
23	05:17	06:07	06:59	07:51	07:59 (WEA VB01) 07:46	08:29 (WEA VB03) 08:15
24	21:04	20:03	18:51	16:44	18 08:17 (WEA VB01) 07:49	08:29 (WEA VB03) 08:15
25	05:18	20:05 (WEA ZB03_wpd) 06:09	07:00	06:53	07:57 (WEA VB01) 07:48	08:29 (WEA VB03) 08:15
26	21:03	6 20:11 (WEA ZB03_wpd) 06:10	18:48	16:42	21 08:18 (WEA VB01) 07:49	08:29 (WEA VB03) 08:15
27	05:20	20:02 (WEA ZB03_wpd) 06:10	07:02	06:55	07:56 (WEA VB01) 07:49	08:30 (WEA VB03) 08:15
28	21:01	11 20:13 (WEA ZB03_wpd) 06:11	18:46	16:40	24 08:20 (WEA VB01) 07:49	08:29 (WEA VB03) 08:15
29	05:21	20:00 (WEA ZB03_wpd) 06:12	06:57	06:51	07:55 (WEA VB01) 07:49	08:30 (WEA VB03) 08:15
30	20:59	14 20:14 (WEA ZB03_wpd) 06:12	16:38	16:38	26 08:21 (WEA VB01) 07:49	08:15
31	Sonnenscheinstunden	505	455	381	331	264
	astr.max.mögl.Beschattung	232	201	108	719	1288

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-74 - SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:47 (WEA VB03) 07:47	08:17 (WEA VB01) 06:53	06:41	05:35	04:49
2	16:00	10:11 (WEA VB02) 16:49	08:38 (WEA VB01) 17:42	19:37	20:29	21:16
3	08:15	08:47 (WEA VB03) 07:46	08:16 (WEA VB01) 06:51	06:39	05:33	19:57 (WEA ZB03_wpd) 04:48
4	16:01	10:12 (WEA VB02) 16:51	23 08:39 (WEA VB01) 17:44	19:39	20:31	5 20:02 (WEA ZB03_wpd) 21:17
5	08:15	08:47 (WEA VB03) 07:44	08:15 (WEA VB01) 06:48	06:36	05:31	19:55 (WEA ZB03_wpd) 04:47
6	16:03	10:12 (WEA VB02) 16:53	25 08:40 (WEA VB01) 17:46	19:41	20:33	9 20:04 (WEA ZB03_wpd) 21:18
7	08:15	08:46 (WEA VB03) 07:42	08:16 (WEA VB01) 06:46	06:34	05:29	19:54 (WEA ZB03_wpd) 04:46
8	16:04	10:12 (WEA VB02) 16:55	25 08:41 (WEA VB01) 17:47	19:42	20:34	11 20:05 (WEA ZB03_wpd) 21:19
9	08:14	08:46 (WEA VB03) 07:41	08:15 (WEA VB01) 06:44	06:32	05:27	19:52 (WEA ZB03_wpd) 04:45
10	16:05	10:12 (WEA VB02) 16:57	27 08:42 (WEA VB01) 17:49	19:44	20:36	14 20:06 (WEA ZB03_wpd) 21:20
11	08:14	08:45 (WEA VB03) 07:39	08:15 (WEA VB01) 06:42	06:29	05:25	19:52 (WEA ZB03_wpd) 04:45
12	16:06	10:12 (WEA VB02) 16:59	27 08:42 (WEA VB01) 17:51	19:46	20:38	17 20:09 (WEA ZB03_wpd) 21:21
13	08:14	08:45 (WEA VB03) 07:37	08:15 (WEA VB01) 06:39	06:27	05:24	19:51 (WEA ZB03_wpd) 04:44
14	16:07	10:13 (WEA VB02) 17:00	27 08:42 (WEA VB01) 17:53	19:48	20:39	19 20:10 (WEA ZB03_wpd) 21:22
15	08:13	08:44 (WEA VB03) 07:36	08:14 (WEA VB01) 06:37	06:25	05:22	19:51 (WEA ZB03_wpd) 04:44
16	16:09	10:12 (WEA VB02) 17:02	29 08:43 (WEA VB01) 17:55	19:49	20:41	20 20:11 (WEA ZB03_wpd) 21:23
17	08:13	08:43 (WEA VB03) 07:34	08:14 (WEA VB01) 06:35	06:22	05:20	19:51 (WEA ZB03_wpd) 04:43
18	16:10	10:12 (WEA VB02) 17:04	28 08:42 (WEA VB01) 17:56	19:51	20:43	20 20:11 (WEA ZB03_wpd) 21:24
19	08:12	08:43 (WEA VB03) 07:32	08:15 (WEA VB01) 06:33	06:20	05:18	19:51 (WEA ZB03_wpd) 04:43
20	16:12	10:12 (WEA VB02) 17:06	27 08:42 (WEA VB01) 17:58	19:53	20:44	20 20:11 (WEA ZB03_wpd) 21:25
21	08:11	08:42 (WEA VB03) 07:30	08:15 (WEA VB01) 06:30	06:18	05:17	19:50 (WEA ZB03_wpd) 04:42
22	16:13	10:12 (WEA VB02) 17:08	27 08:42 (WEA VB01) 18:00	19:54	20:46	20 20:10 (WEA ZB03_wpd) 21:26
23	08:11	08:41 (WEA VB03) 07:28	08:15 (WEA VB01) 06:28	06:16	05:15	19:51 (WEA ZB03_wpd) 04:42
24	16:15	10:11 (WEA VB02) 17:10	27 08:42 (WEA VB01) 18:02	19:56	20:48	20 20:11 (WEA ZB03_wpd) 21:26
25	08:10	08:41 (WEA VB03) 07:26	08:16 (WEA VB01) 06:26	06:13	05:13	19:51 (WEA ZB03_wpd) 04:42
26	16:16	10:10 (WEA VB02) 17:12	25 08:41 (WEA VB01) 18:04	19:58	20:49	19 20:10 (WEA ZB03_wpd) 21:27
27	08:09	08:42 (WEA VB03) 07:24	08:17 (WEA VB01) 06:23	06:11	05:12	19:52 (WEA ZB03_wpd) 04:41
28	16:18	10:09 (WEA VB02) 17:14	23 08:40 (WEA VB01) 18:05	20:00	20:51	18 20:10 (WEA ZB03_wpd) 21:28
29	08:08	08:42 (WEA VB03) 07:22	08:18 (WEA VB01) 06:21	06:09	05:10	19:52 (WEA ZB03_wpd) 04:41
30	16:19	10:08 (WEA VB02) 17:16	21 08:39 (WEA VB01) 18:07	20:01	20:52	17 20:09 (WEA ZB03_wpd) 21:28
31	08:08	08:42 (WEA VB03) 07:20	08:19 (WEA VB01) 06:19	06:07	05:08	19:53 (WEA ZB03_wpd) 04:41
32	16:21	10:06 (WEA VB02) 17:18	19 08:38 (WEA VB01) 18:09	20:03	20:54	15 20:08 (WEA ZB03_wpd) 21:29
33	08:07	08:42 (WEA VB03) 07:18	08:21 (WEA VB01) 06:16	06:04	05:07	19:54 (WEA ZB03_wpd) 04:41
34	16:22	09:05 (WEA VB03) 17:19	15 08:36 (WEA VB01) 18:11	20:05	20:56	14 20:08 (WEA ZB03_wpd) 21:29
35	08:06	08:43 (WEA VB03) 07:16	08:24 (WEA VB01) 06:14	06:02	05:05	19:55 (WEA ZB03_wpd) 04:41
36	16:24	09:05 (WEA VB03) 17:21	9 08:33 (WEA VB01) 18:12	20:07	20:57	11 20:06 (WEA ZB03_wpd) 21:30
37	08:05	08:42 (WEA VB03) 07:14	08:12	06:00	05:04	19:57 (WEA ZB03_wpd) 04:41
38	16:26	09:05 (WEA VB03) 17:23	18:14	20:08	20:59	8 20:05 (WEA ZB03_wpd) 21:30
39	08:04	08:43 (WEA VB03) 07:12	06:09	05:58	05:02	04:41
40	16:27	09:05 (WEA VB03) 17:25	18:16	20:10	21:00	04:42
41	08:02	08:44 (WEA VB03) 07:10	06:07	05:56	05:01	04:41
42	16:29	09:06 (WEA VB03) 17:27	18:18	20:12	21:02	04:41
43	08:01	08:45 (WEA VB03) 07:08	06:05	05:54	05:00	04:41
44	16:31	09:06 (WEA VB03) 17:29	18:20	20:14	21:03	04:41
45	08:00	08:45 (WEA VB03) 07:06	06:02	05:51	04:58	04:42
46	16:33	09:05 (WEA VB03) 17:31	18:21	20:15	21:04	04:42
47	08:00	08:46 (WEA VB03) 07:04	06:00	05:49	04:57	04:42
48	16:34	09:05 (WEA VB03) 17:33	18:23	20:17	21:06	04:42
49	08:00	08:47 (WEA VB03) 07:02	05:57	05:47	04:56	04:42
50	16:36	09:04 (WEA VB03) 17:34	18:25	20:19	21:07	04:42
51	08:00	08:49 (WEA VB03) 06:59	05:55	05:45	04:55	04:43
52	16:38	09:04 (WEA VB03) 17:36	18:27	20:21	21:09	04:43
53	08:00	08:50 (WEA VB03) 06:57	05:53	05:43	04:54	04:43
54	16:40	09:02 (WEA VB03) 17:38	18:28	20:22	21:10	04:43
55	08:00	08:26 (WEA VB01) 06:55	05:50	05:41	04:53	04:44
56	16:42	09:01 (WEA VB03) 17:40	18:30	20:24	21:11	04:44
57	08:00	08:21 (WEA VB01)	06:48	05:39	04:51	04:44
58	16:43	08:33 (WEA VB01)	19:32	20:26	21:12	04:44
59	08:00	08:19 (WEA VB01)	06:46	05:37	04:50	04:45
60	16:45	08:35 (WEA VB01)	19:34	20:27	21:14	04:45
61	08:00	08:19 (WEA VB01)	06:43	05:35	04:49	04:45
62	16:47	08:37 (WEA VB01)	19:35	20:28	21:15	04:45
63	Sonnenscheinstunden	256		367	417	487
64	astr. max. mögl. Beschattung	896	425			502
65						320

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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-74 - SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Juli	August	September	Oktober	November	Dezember
1	04:45	20:45 (WEA ZB01_wpd) 05:23	20:01 (WEA ZB03_wpd) 06:14	07:04	06:59	07:44 (WEA VB01) 07:51
2	11:30	12 20:57 (WEA ZB01_wpd) 20:58	20 20:21 (WEA ZB03_wpd) 19:54	18:44	16:35	28 08:12 (WEA VB01) 15:55
3	04:46	20:45 (WEA ZB01_wpd) 05:24	20:01 (WEA ZB03_wpd) 06:15	07:05	07:01	07:44 (WEA VB01) 07:52
4	21:30	11 20:56 (WEA ZB01_wpd) 20:56	20 20:21 (WEA ZB03_wpd) 19:52	18:41	16:35	28 08:12 (WEA VB01) 15:54
5	04:47	20:46 (WEA ZB01_wpd) 05:26	20:01 (WEA ZB03_wpd) 06:17	07:07	07:02	07:44 (WEA VB01) 07:54
6	21:30	10 20:56 (WEA ZB01_wpd) 20:54	20 20:21 (WEA ZB03_wpd) 19:50	18:39	16:33	28 08:12 (WEA VB01) 15:54
7	04:47	20:47 (WEA ZB01_wpd) 05:27	20:01 (WEA ZB03_wpd) 06:19	07:09	07:04	07:44 (WEA VB01) 07:55
8	21:29	9 20:56 (WEA ZB01_wpd) 20:52	20 20:21 (WEA ZB03_wpd) 19:47	18:37	16:31	28 08:12 (WEA VB01) 15:53
9	04:48	20:48 (WEA ZB01_wpd) 05:29	20:01 (WEA ZB03_wpd) 06:20	07:11	07:06	07:45 (WEA VB01) 07:56
10	21:29	7 20:55 (WEA ZB01_wpd) 20:51	20 20:21 (WEA ZB03_wpd) 19:45	18:34	16:29	27 08:12 (WEA VB01) 15:52
11	04:49	20:47 (WEA ZB01_wpd) 05:31	20:01 (WEA ZB03_wpd) 06:22	07:12	07:08	07:45 (WEA VB01) 07:58
12	21:28	7 20:54 (WEA ZB01_wpd) 20:49	18 20:19 (WEA ZB03_wpd) 19:43	18:32	16:27	27 08:12 (WEA VB01) 15:52
13	04:50	20:49 (WEA ZB01_wpd) 05:32	20:02 (WEA ZB03_wpd) 06:24	07:14	07:10	07:46 (WEA VB01) 07:59
14	21:28	5 20:54 (WEA ZB01_wpd) 20:47	15 20:17 (WEA ZB03_wpd) 19:41	18:30	16:25	25 08:11 (WEA VB01) 15:52
15	04:51	20:50 (WEA ZB01_wpd) 05:34	20:02 (WEA ZB03_wpd) 06:25	07:16	07:12	07:46 (WEA VB01) 08:00
16	21:27	3 20:53 (WEA ZB01_wpd) 20:45	13 20:15 (WEA ZB03_wpd) 19:38	18:27	16:24	25 08:11 (WEA VB01) 15:51
17	04:52	20:52 (WEA ZB01_wpd) 05:35	20:03 (WEA ZB03_wpd) 06:27	07:18	07:13	07:47 (WEA VB01) 08:02
18	21:26	1 20:53 (WEA ZB01_wpd) 20:43	11 20:14 (WEA ZB03_wpd) 19:36	18:25	16:22	23 08:10 (WEA VB01) 15:51
19	04:53	05:37	20:05 (WEA ZB03_wpd) 06:29	07:19	07:15	07:48 (WEA VB01) 08:03
20	21:25	20:41	8 20:13 (WEA ZB03_wpd) 19:33	18:23	16:20	21 08:09 (WEA VB01) 15:51
21	04:54	05:39	3 20:10 (WEA ZB03_wpd) 19:31	18:21	07:17	07:50 (WEA VB01) 08:04
22	21:25	20:39			16:19	18 08:08 (WEA VB01) 15:50
23	04:55	05:40			07:19	07:51 (WEA VB01) 08:05
24	21:24	20:37			16:17	16 08:07 (WEA VB01) 15:50
25	04:56	05:42			07:21	07:53 (WEA VB01) 08:06
26	21:23	20:35			16:16	12 08:05 (WEA VB01) 15:50
27	04:57	05:44			07:23	07:58 (WEA VB01) 08:07
28	21:22	20:33			16:14	12 08:33 (WEA VB03) 15:50
29	04:59	05:45			07:24	08:22 (WEA VB03) 08:08
30	21:21	20:31			16:13	13 08:35 (WEA VB03) 15:50
31	05:00	05:47			07:26	08:21 (WEA VB03) 08:09
1	21:20	20:29			16:11	16 08:37 (WEA VB03) 15:50
2	05:01	05:49			07:28	08:21 (WEA VB03) 08:09
3	21:19	20:27			16:10	17 08:38 (WEA VB03) 15:51
4	05:02	05:50			07:30	08:20 (WEA VB03) 08:10
5	21:18	20:25			16:09	19 08:39 (WEA VB03) 15:51
6	05:04	05:52			07:31	08:20 (WEA VB03) 08:11
7	21:17	20:23			16:07	20 08:40 (WEA VB03) 15:51
8	05:05	05:54			07:33	08:19 (WEA VB03) 08:12
9	21:15	20:21			16:06	21 08:40 (WEA VB03) 15:51
10	05:06	05:55			07:35	08:19 (WEA VB03) 08:12
11	21:14	20:19			16:05	22 08:41 (WEA VB03) 15:52
12	05:08	05:57			07:37	08:19 (WEA VB03) 08:13
13	21:13	20:17			16:03	22 08:41 (WEA VB03) 15:52
14	05:09	05:59			07:38	08:20 (WEA VB03) 08:13
15	21:11	20:15			16:02	22 08:42 (WEA VB03) 15:53
16	05:11	20:10 (WEA ZB03_wpd) 06:00			07:40	08:20 (WEA VB03) 08:14
17	21:10	4 20:14 (WEA ZB03_wpd) 20:12			16:01	22 08:42 (WEA VB03) 15:53
18	05:12	20:07 (WEA ZB03_wpd) 06:02			07:42	08:20 (WEA VB03) 08:14
19	21:09	9 20:16 (WEA ZB03_wpd) 20:10			16:00	23 08:43 (WEA VB03) 15:54
20	05:14	20:05 (WEA ZB03_wpd) 06:04			07:43	08:20 (WEA VB03) 08:14
21	21:07	12 20:17 (WEA ZB03_wpd) 20:08			16:00	29 09:43 (WEA VB01) 15:53
22	05:15	20:04 (WEA ZB03_wpd) 06:05			07:45	08:21 (WEA VB03) 08:15
23	21:06	15 20:19 (WEA ZB03_wpd) 20:06			16:00	22 08:09 (WEA VB01) 15:58
24	05:17	20:03 (WEA ZB03_wpd) 06:07			07:47	08:21 (WEA VB03) 08:15
25	21:04	16 20:19 (WEA ZB03_wpd) 20:03			16:00	24 08:10 (WEA VB01) 15:57
26	05:18	20:03 (WEA ZB03_wpd) 06:09			07:49	08:21 (WEA VB03) 08:15
27	21:03	17 20:20 (WEA ZB03_wpd) 20:01			16:00	30 09:50 (WEA VB01) 15:57
28	05:20	20:02 (WEA ZB03_wpd) 06:10			07:51	08:22 (WEA VB03) 08:15
29	21:01	19 20:21 (WEA ZB03_wpd) 19:59			16:00	26 08:11 (WEA VB01) 15:56
30	05:21	20:01 (WEA ZB03_wpd) 06:12			07:53	08:22 (WEA VB03) 08:15
31	20:59	19 20:20 (WEA ZB03_wpd) 19:57			16:00	28 08:12 (WEA VB01)
Sonnenscheinstunden	505	455	381	331	264	241
astr.max.mögl.Beschattung	176	168		173	718	1093

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-75 - SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:32 (WEA VB02)	07:47	08:16 (WEA VB01)	06:53	06:41
2	16:00	10:05 (WEA VB02)	16:49	08:32 (WEA VB01)	17:42	19:37
3	08:15	09:31 (WEA VB02)	07:46	08:13 (WEA VB01)	06:51	06:39
4	16:01	10:06 (WEA VB02)	16:51	08:33 (WEA VB01)	17:44	19:39
5	08:15	09:34 (WEA VB02)	07:44	08:13 (WEA VB01)	06:48	06:36
6	16:03	10:06 (WEA VB02)	16:53	08:34 (WEA VB01)	17:45	19:41
7	08:15	08:46 (WEA VB02)	07:42	08:13 (WEA VB01)	06:46	06:34
8	16:04	10:06 (WEA VB02)	16:55	08:36 (WEA VB01)	17:47	19:42
9	08:14	08:46 (WEA VB02)	07:41	08:13 (WEA VB01)	06:44	06:32
10	16:05	10:06 (WEA VB02)	16:57	08:37 (WEA VB01)	17:49	19:44
11	08:14	08:45 (WEA VB02)	07:39	08:12 (WEA VB01)	06:42	06:29
12	16:06	10:06 (WEA VB02)	16:59	08:38 (WEA VB01)	17:51	19:46
13	08:14	08:45 (WEA VB02)	07:37	08:12 (WEA VB01)	06:39	06:27
14	16:07	10:07 (WEA VB02)	17:00	08:38 (WEA VB01)	17:53	19:48
15	08:13	08:44 (WEA VB02)	07:36	08:11 (WEA VB01)	06:37	06:25
16	16:09	10:06 (WEA VB02)	17:02	08:38 (WEA VB01)	17:55	19:49
17	08:13	08:43 (WEA VB02)	07:34	08:11 (WEA VB01)	06:35	06:22
18	16:10	10:06 (WEA VB02)	17:04	08:38 (WEA VB01)	17:56	19:51
19	08:12	08:43 (WEA VB02)	07:32	08:11 (WEA VB01)	06:33	06:20
20	16:12	10:07 (WEA VB02)	17:06	08:38 (WEA VB01)	17:58	19:53
21	08:11	08:42 (WEA VB02)	07:30	08:11 (WEA VB01)	06:30	06:18
22	16:13	10:07 (WEA VB02)	17:08	08:38 (WEA VB01)	18:00	19:54
23	08:11	08:41 (WEA VB02)	07:28	08:11 (WEA VB01)	06:28	06:16
24	16:15	10:06 (WEA VB02)	17:10	08:38 (WEA VB01)	18:02	19:56
25	08:10	08:40 (WEA VB02)	07:26	08:12 (WEA VB01)	06:26	06:13
26	16:16	10:06 (WEA VB02)	17:12	08:38 (WEA VB01)	18:04	19:58
27	08:09	08:39 (WEA VB02)	07:24	08:12 (WEA VB01)	06:23	06:11
28	16:18	10:06 (WEA VB02)	17:14	08:37 (WEA VB01)	18:05	19:59
29	08:08	08:39 (WEA VB02)	07:22	08:13 (WEA VB01)	06:21	06:09
30	16:19	10:06 (WEA VB02)	17:16	08:37 (WEA VB01)	18:07	19:59
31	08:08	08:39 (WEA VB02)	07:20	08:14 (WEA VB01)	06:19	06:07
1	16:21	10:04 (WEA VB02)	17:18	08:36 (WEA VB01)	18:09	19:58
2	08:07	08:39 (WEA VB02)	07:18	08:14 (WEA VB01)	06:16	06:04
3	16:22	10:03 (WEA VB02)	17:19	08:34 (WEA VB01)	18:11	19:58
4	08:06	08:40 (WEA VB02)	07:16	08:17 (WEA VB01)	06:14	06:02
5	16:24	10:03 (WEA VB02)	17:21	08:32 (WEA VB01)	18:12	19:58
6	08:05	08:39 (WEA VB02)	07:14	08:20 (WEA VB01)	06:12	06:00
7	16:26	10:03 (WEA VB02)	17:23	08:30 (WEA VB01)	18:14	19:59
8	08:04	08:40 (WEA VB02)	07:12	08:23 (WEA VB01)	06:10	05:58
9	16:27	10:02 (WEA VB02)	17:25	08:28 (WEA VB01)	18:16	19:59
10	08:03	08:40 (WEA VB02)	07:10	08:26 (WEA VB01)	06:07	05:56
11	16:29	10:02 (WEA VB02)	17:27	08:28 (WEA VB01)	18:18	19:58
12	08:03	08:41 (WEA VB02)	07:08	08:29 (WEA VB01)	06:05	05:54
13	16:31	10:02 (WEA VB02)	17:29	08:27 (WEA VB01)	18:20	19:58
14	08:02	08:41 (WEA VB02)	07:06	08:30 (WEA VB01)	06:02	05:51
15	16:33	10:02 (WEA VB02)	17:31	08:27 (WEA VB01)	18:21	19:58
16	07:59	08:42 (WEA VB02)	07:04	08:30 (WEA VB01)	06:00	05:49
17	16:34	10:02 (WEA VB02)	17:33	08:27 (WEA VB01)	18:23	19:57
18	07:57	08:42 (WEA VB02)	07:02	08:31 (WEA VB01)	05:57	05:47
19	16:36	10:02 (WEA VB02)	17:34	08:27 (WEA VB01)	18:25	19:57
20	07:56	08:44 (WEA VB02)	06:59	08:32 (WEA VB01)	05:55	05:45
21	16:38	10:02 (WEA VB02)	17:36	08:27 (WEA VB01)	18:27	19:57
22	07:55	08:44 (WEA VB02)	06:57	08:33 (WEA VB01)	05:53	05:43
23	16:40	10:01 (WEA VB02)	17:38	08:27 (WEA VB01)	18:28	19:57
24	07:53	08:46 (WEA VB02)	06:55	08:34 (WEA VB01)	05:50	05:41
25	16:42	10:01 (WEA VB02)	17:40	08:27 (WEA VB01)	18:30	19:57
26	07:52	08:46 (WEA VB02)	06:54	08:35 (WEA VB01)	05:48	05:39
27	16:43	10:01 (WEA VB02)	17:42	08:27 (WEA VB01)	18:32	19:57
28	07:50	08:21 (WEA VB01)	06:52	08:36 (WEA VB01)	05:46	05:37
29	16:45	10:01 (WEA VB02)	17:44	08:27 (WEA VB01)	18:34	19:57
30	07:49	08:18 (WEA VB01)	06:51	08:37 (WEA VB01)	05:43	05:34
31	16:47	10:01 (WEA VB02)	17:46	08:27 (WEA VB01)	18:36	19:57
Sonnenscheinstunden	256				417	487
astr.mögl.Beschattung	902	429	144	174	302	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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-75 - SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:50 (WEA Z801_wpd)	05:22	20:03 (WEA Z802_wpd)	06:14	07:04
2	04:46	20:51 (WEA Z801_wpd)	05:23	20:03 (WEA Z802_wpd)	06:15	07:05
3	04:47	20:52 (WEA Z801_wpd)	05:24	20:03 (WEA Z802_wpd)	06:15	07:05
4	04:47	20:53 (WEA Z801_wpd)	05:25	20:03 (WEA Z802_wpd)	06:17	07:07
5	04:48	20:54 (WEA Z801_wpd)	05:26	20:03 (WEA Z802_wpd)	06:17	07:07
6	04:49	20:55 (WEA Z801_wpd)	05:27	20:02 (WEA Z803_wpd)	06:19	07:09
7	04:50	20:56 (WEA Z801_wpd)	05:28	20:02 (WEA Z803_wpd)	06:20	07:11
8	04:51	20:57 (WEA Z801_wpd)	05:29	20:02 (WEA Z803_wpd)	06:20	07:11
9	04:52	20:58 (WEA Z801_wpd)	05:30	20:02 (WEA Z803_wpd)	06:21	07:12
10	04:53	20:59 (WEA Z801_wpd)	05:31	20:01 (WEA Z803_wpd)	06:22	07:12
11	04:54	20:59 (WEA Z801_wpd)	05:31	20:01 (WEA Z803_wpd)	06:22	07:12
12	04:55	20:59 (WEA Z801_wpd)	05:32	20:01 (WEA Z803_wpd)	06:22	07:12
13	04:56	20:59 (WEA Z801_wpd)	05:32	20:01 (WEA Z803_wpd)	06:22	07:12
14	04:57	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
15	04:59	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
16	05:00	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
17	05:01	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
18	05:02	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
19	05:04	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
20	05:05	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
21	05:06	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
22	05:08	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
23	05:09	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
24	05:11	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
25	05:12	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
26	05:14	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
27	05:17	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
28	05:18	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
29	05:19	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
30	05:20	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
31	05:21	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
32	05:23	20:59 (WEA Z801_wpd)	05:33	20:01 (WEA Z803_wpd)	06:22	07:12
Sonnenscheinstunden	195	195	195	195	195	195
astronom.mög.Beschattung	179	179	179	179	179	179

**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:  
R-2-2023-0060

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-76 - SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:25 (WEA V802)	07:47	08:16 (WEA V801)	06:53	06:41	05:35	05:35	04:49	04:49		
2	08:15	09:26 (WEA V802)	07:46	08:14 (WEA V801)	06:52	06:41	05:37	05:37	04:50	04:50		
3	08:15	09:27 (WEA V802)	07:44	08:12 (WEA V801)	06:48	06:39	05:40	05:40	04:53	04:53		
4	08:15	09:27 (WEA V802)	07:42	08:11 (WEA V801)	06:46	06:37	05:42	05:42	04:56	04:56		
5	08:14	09:28 (WEA V802)	07:41	08:10 (WEA V801)	06:44	06:35	05:44	05:44	04:59	04:59		
6	08:14	09:28 (WEA V802)	07:39	08:09 (WEA V801)	06:42	06:33	05:46	05:46	05:02	05:02		
7	08:14	09:29 (WEA V802)	07:37	08:09 (WEA V801)	06:39	06:30	05:48	05:48	05:05	05:05		
8	08:13	08:44 (WEA V802)	07:36	08:08 (WEA V801)	06:37	06:28	05:50	05:50	05:08	05:08		
9	08:13	08:44 (WEA V802)	07:34	08:08 (WEA V801)	06:35	06:26	05:52	05:52	05:11	05:11		
10	08:12	08:43 (WEA V802)	07:32	08:08 (WEA V801)	06:33	06:24	05:54	05:54	05:14	05:14		
11	08:11	08:42 (WEA V802)	07:30	08:08 (WEA V801)	06:30	06:21	05:56	05:56	05:17	05:17		
12	08:11	08:42 (WEA V802)	07:28	08:08 (WEA V801)	06:28	06:19	05:58	05:58	05:20	05:20		
13	08:10	08:41 (WEA V802)	07:26	08:08 (WEA V801)	06:26	06:17	06:00	06:00	05:23	05:23		
14	08:09	08:39 (WEA V802)	07:24	08:08 (WEA V801)	06:23	06:14	06:02	06:02	05:26	05:26		
15	08:08	08:38 (WEA V802)	07:22	08:09 (WEA V801)	06:21	06:12	06:04	06:04	05:29	05:29		
16	08:08	08:38 (WEA V802)	07:20	08:09 (WEA V801)	06:19	06:10	06:06	06:06	05:32	05:32		
17	08:07	08:37 (WEA V802)	07:18	08:10 (WEA V801)	06:17	06:08	06:08	06:08	05:35	05:35		
18	08:06	08:37 (WEA V802)	07:16	08:11 (WEA V801)	06:14	06:05	06:10	06:10	05:38	05:38		
19	08:05	08:36 (WEA V802)	07:14	08:12 (WEA V801)	06:12	06:03	06:12	06:12	05:41	05:41		
20	08:04	08:36 (WEA V802)	07:12	08:13 (WEA V801)	06:10	06:01	06:14	06:14	05:44	05:44		
21	08:03	08:36 (WEA V802)	07:10	08:14 (WEA V801)	06:08	06:00	06:16	06:16	05:47	05:47		
22	08:02	08:37 (WEA V802)	07:08	08:15 (WEA V801)	06:07	06:00	06:18	06:18	05:50	05:50		
23	08:01	08:37 (WEA V802)	07:06	08:16 (WEA V801)	06:05	06:00	06:20	06:20	05:53	05:53		
24	07:59	08:38 (WEA V802)	07:04	08:17 (WEA V801)	06:03	06:00	06:22	06:22	05:56	05:56		
25	07:57	08:38 (WEA V802)	07:02	08:18 (WEA V801)	06:02	06:00	06:24	06:24	05:59	05:59		
26	07:56	08:39 (WEA V802)	07:00	08:19 (WEA V801)	06:00	06:00	06:26	06:26	06:02	06:02		
27	07:55	08:40 (WEA V802)	06:58	08:20 (WEA V801)	05:59	06:00	06:28	06:28	06:05	06:05		
28	07:53	08:41 (WEA V802)	06:56	08:21 (WEA V801)	05:58	06:00	06:30	06:30	06:08	06:08		
29	07:52	08:42 (WEA V802)	06:54	08:22 (WEA V801)	05:57	06:00	06:32	06:32	06:11	06:11		
30	07:50	08:43 (WEA V802)	06:52	08:23 (WEA V801)	05:56	06:00	06:34	06:34	06:14	06:14		
31	07:49	08:44 (WEA V802)	06:50	08:24 (WEA V801)	05:55	06:00	06:36	06:36	06:17	06:17		
1	08:03	08:47 (WEA V802)	06:48	08:25 (WEA V801)	05:54	06:00	06:38	06:38	06:20	06:20		
2	08:03	08:47 (WEA V802)	06:46	08:26 (WEA V801)	05:53	06:00	06:40	06:40	06:23	06:23		
3	08:03	08:48 (WEA V802)	06:44	08:27 (WEA V801)	05:52	06:00	06:42	06:42	06:26	06:26		
4	08:04	08:49 (WEA V802)	06:42	08:28 (WEA V801)	05:51	06:00	06:44	06:44	06:29	06:29		
5	08:04	08:50 (WEA V802)	06:40	08:29 (WEA V801)	05:50	06:00	06:46	06:46	06:32	06:32		
6	08:05	08:51 (WEA V802)	06:38	08:30 (WEA V801)	05:49	06:00	06:48	06:48	06:35	06:35		
7	08:05	08:52 (WEA V802)	06:36	08:31 (WEA V801)	05:48	06:00	06:50	06:50	06:38	06:38		
8	08:06	08:53 (WEA V802)	06:34	08:32 (WEA V801)	05:47	06:00	06:52	06:52	06:41	06:41		
9	08:06	08:54 (WEA V802)	06:32	08:33 (WEA V801)	05:46	06:00	06:54	06:54	06:44	06:44		
10	08:07	08:55 (WEA V802)	06:30	08:34 (WEA V801)	05:45	06:00	06:56	06:56	06:47	06:47		
11	08:07	08:56 (WEA V802)	06:28	08:35 (WEA V801)	05:44	06:00	06:58	06:58	06:50	06:50		
12	08:08	08:57 (WEA V802)	06:26	08:36 (WEA V801)	05:43	06:00	07:00	07:00	06:53	06:53		
13	08:08	08:58 (WEA V802)	06:24	08:37 (WEA V801)	05:42	06:00	07:02	07:02	06:56	06:56		
14	08:09	08:59 (WEA V802)	06:22	08:38 (WEA V801)	05:41	06:00	07:04	07:04	06:59	06:59		
15	08:09	09:00 (WEA V802)	06:20	08:39 (WEA V801)	05:40	06:00	07:06	07:06	07:02	07:02		
16	08:10	09:01 (WEA V802)	06:18	08:40 (WEA V801)	05:39	06:00	07:08	07:08	07:05	07:05		
17	08:10	09:02 (WEA V802)	06:16	08:41 (WEA V801)	05:38	06:00	07:10	07:10	07:08	07:08		
18	08:11	09:03 (WEA V802)	06:14	08:42 (WEA V801)	05:37	06:00	07:12	07:12	07:11	07:11		
19	08:11	09:04 (WEA V802)	06:12	08:43 (WEA V801)	05:36	06:00	07:14	07:14	07:14	07:14		
20	08:12	09:05 (WEA V802)	06:10	08:44 (WEA V801)	05:35	06:00	07:16	07:16	07:17	07:17		
21	08:12	09:06 (WEA V802)	06:08	08:45 (WEA V801)	05:34	06:00	07:18	07:18	07:20	07:20		
22	08:13	09:07 (WEA V802)	06:06	08:46 (WEA V801)	05:33	06:00	07:20	07:20	07:23	07:23		
23	08:13	09:08 (WEA V802)	06:04	08:47 (WEA V801)	05:32	06:00	07:22	07:22	07:26	07:26		
24	08:14	09:09 (WEA V802)	06:02	08:48 (WEA V801)	05:31	06:00	07:24	07:24	07:29	07:29		
25	08:14	09:10 (WEA V802)	06:00	08:49 (WEA V801)	05:30	06:00	07:26	07:26	07:32	07:32		
26	08:15	09:11 (WEA V802)	05:58	08:50 (WEA V801)	05:29	06:00	07:28	07:28	07:35	07:35		
27	08:15	09:12 (WEA V802)	05:56	08:51 (WEA V801)	05:28	06:00	07:30	07:30	07:38	07:38		
28	08:16	09:13 (WEA V802)	05:54	08:52 (WEA V801)	05:27	06:00	07:32	07:32	07:41	07:41		
29	08:16	09:14 (WEA V802)	05:52	08:53 (WEA V801)	05:26	06:00	07:34	07:34	07:44	07:44		
30	08:17	09:15 (WEA V802)	05:50	08:54 (WEA V801)	05:25	06:00	07:36	07:36	07:47	07:47		
31	08:17	09:16 (WEA V802)	05:48	08:55 (WEA V801)	05:24	06:00	07:38	07:38	07:51	07:51		
Sonnenscheinstunden	256		276		297		318		339		360	
astrmax.mögl.Beschattung	913		419		156		183		331		53	

**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)		Schattenende (WEA mit letztem Schatten)	
	SS	MM		SS	MM	SS	MM	SS	MM

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-76 - SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:04 (WEA2003_wpd)	06:14	07:04	18:10 (WEA2003_ErhW)
2	04:46	05:28	21 20:25 (WEA2003_wpd)	05:54	18:44	6 18:36 (WEA2003_ErhW)
3	04:48	05:34	20:04 (WEA2003_wpd)	06:15	07:05	07:05
4	04:47	05:36	20:05 (WEA2003_wpd)	06:17	18:41	07:07
5	04:48	05:31	20:04 (WEA2003_wpd)	06:22	18:39	07:02
6	04:47	05:27	20:05 (WEA2003_wpd)	06:19	07:09	18:39
7	04:49	05:32	20:06 (WEA2003_wpd)	06:20	18:37	07:06
8	04:51	05:39	20:21 (WEA2003_wpd)	06:25	18:34	07:06
9	04:52	05:43	20:08 (WEA2003_wpd)	06:24	18:32	07:02
10	04:53	05:37	06:29	18:30	07:16	07:16
11	04:54	05:30	06:30	18:29	07:14	07:14
12	04:55	05:24	06:32	18:27	07:19	07:19
13	04:56	05:18	06:34	18:25	07:25	07:25
14	04:57	05:12	06:36	18:23	07:31	07:31
15	04:59	05:06	06:37	18:21	07:37	07:37
16	05:00	05:00	06:39	18:19	07:43	07:43
17	05:01	04:54	19:33 (WEA2005_wpd)	06:40	07:50	07:50
18	05:02	04:48	19:37 (WEA2005_wpd)	06:42	07:56	07:56
19	05:04	04:42	19:40 (WEA2005_wpd)	06:44	08:02	08:02
20	05:05	04:36	19:28 (WEA2005_wpd)	06:45	08:08	08:08
21	05:06	04:30	19:25 (WEA2005_wpd)	06:47	08:14	08:14
22	05:08	04:24	19:25 (WEA2005_wpd)	06:49	08:20	08:20
23	05:09	04:18	19:43 (WEA2005_wpd)	06:50	08:26	08:26
24	05:11	04:12	19:43 (WEA2005_wpd)	06:52	08:32	08:32
25	05:12	04:06	19:24 (WEA2005_wpd)	06:54	08:38	08:38
26	05:14	04:00	19:24 (WEA2005_wpd)	06:55	08:44	08:44
27	05:15	03:54	19:41 (WEA2005_wpd)	06:57	08:50	08:50
28	05:17	03:48	19:24 (WEA2005_wpd)	06:57	08:56	08:56
29	05:18	03:42	19:38 (WEA2005_wpd)	06:57	09:02	09:02
30	05:20	03:36	19:25 (WEA2005_wpd)	07:00	09:08	09:08
31	05:21	03:30	19:31 (WEA2005_wpd)	07:02	09:14	09:14
Sonnenscheinstunden	156	157	181	131	264	241
str.max.mögl.Beschattung	209	309	147	226	750	1032

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-77 - SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:47 (WEA V02)	07:47	08:17 (WEA V01)	06:53	06:41
2	16:00	10:07 (WEA V02)	16:49	08:38 (WEA V01)	17:42	19:37
3	08:15	08:47 (WEA V02)	07:46	08:36 (WEA V01)	06:51	06:39
4	16:00	10:07 (WEA V02)	16:51	08:39 (WEA V01)	17:44	19:39
5	08:15	08:47 (WEA V02)	07:44	08:15 (WEA V01)	06:48	06:36
6	16:00	10:08 (WEA V02)	16:53	08:40 (WEA V01)	17:46	19:41
7	08:15	08:46 (WEA V02)	07:42	08:16 (WEA V01)	06:46	06:34
8	16:04	10:07 (WEA V02)	16:55	08:41 (WEA V01)	17:47	19:42
9	08:14	08:46 (WEA V02)	07:41	08:15 (WEA V01)	06:44	06:32
10	16:05	10:08 (WEA V02)	16:57	08:42 (WEA V01)	17:49	19:44
11	08:14	08:45 (WEA V02)	07:39	08:15 (WEA V01)	06:42	06:30
12	16:06	10:07 (WEA V02)	16:59	08:42 (WEA V01)	17:51	19:46
13	08:14	08:45 (WEA V02)	07:37	08:15 (WEA V01)	06:39	06:27
14	16:07	10:08 (WEA V02)	17:00	08:42 (WEA V01)	17:53	19:48
15	08:13	08:44 (WEA V02)	07:36	08:15 (WEA V01)	06:37	06:25
16	16:09	10:08 (WEA V02)	17:02	08:42 (WEA V01)	17:55	19:49
17	08:13	08:43 (WEA V02)	07:34	08:15 (WEA V01)	06:35	06:22
18	16:10	10:07 (WEA V02)	17:04	08:42 (WEA V01)	17:56	19:51
19	08:12	08:43 (WEA V02)	07:32	08:15 (WEA V01)	06:33	06:20
20	16:12	10:08 (WEA V02)	17:06	08:42 (WEA V01)	17:58	19:53
21	08:11	08:42 (WEA V02)	07:30	08:16 (WEA V01)	06:30	06:18
22	16:13	10:07 (WEA V02)	17:08	08:41 (WEA V01)	18:00	19:54
23	08:11	08:41 (WEA V02)	07:28	08:16 (WEA V01)	06:28	06:16
24	16:15	10:06 (WEA V02)	17:10	08:41 (WEA V01)	18:02	19:56
25	08:10	08:41 (WEA V02)	07:26	08:17 (WEA V01)	06:26	06:13
26	16:16	10:06 (WEA V02)	17:12	08:40 (WEA V01)	18:04	19:58
27	08:09	08:41 (WEA V02)	07:24	08:18 (WEA V01)	06:23	06:11
28	16:18	10:05 (WEA V02)	17:14	08:39 (WEA V01)	18:05	19:59
29	08:08	08:41 (WEA V02)	07:22	08:19 (WEA V01)	06:21	06:09
30	16:19	10:03 (WEA V02)	17:16	08:38 (WEA V01)	18:07	19:58
31	08:08	08:41 (WEA V02)	07:20	08:21 (WEA V01)	06:19	06:07
1	16:21	10:02 (WEA V02)	17:18	08:36 (WEA V01)	18:09	19:58
2	08:07	08:41 (WEA V02)	07:18	08:24 (WEA V01)	06:16	06:04
3	16:22	10:04 (WEA V02)	17:19	08:33 (WEA V01)	18:11	19:59
4	08:06	08:42 (WEA V02)	07:16	08:25 (WEA V01)	06:14	06:02
5	16:24	10:04 (WEA V02)	17:21	08:32 (WEA V01)	18:12	19:59
6	08:05	08:42 (WEA V02)	07:14	08:26 (WEA V01)	06:12	06:00
7	16:26	10:04 (WEA V02)	17:23	08:31 (WEA V01)	18:14	19:59
8	08:04	08:43 (WEA V02)	07:12	08:27 (WEA V01)	06:10	05:58
9	16:27	10:04 (WEA V02)	17:25	08:30 (WEA V01)	18:16	19:59
10	08:03	08:43 (WEA V02)	07:10	08:28 (WEA V01)	06:07	05:56
11	16:29	10:04 (WEA V02)	17:27	08:29 (WEA V01)	18:18	19:59
12	08:02	08:44 (WEA V02)	07:08	08:25 (WEA V01)	06:05	05:54
13	16:31	10:05 (WEA V02)	17:29	08:28 (WEA V01)	18:20	19:59
14	08:01	08:45 (WEA V02)	07:06	08:24 (WEA V01)	06:02	05:51
15	16:33	10:05 (WEA V02)	17:31	08:27 (WEA V01)	18:21	19:59
16	07:59	08:46 (WEA V02)	07:04	08:20 (WEA V01)	06:00	05:49
17	16:34	10:06 (WEA V02)	17:33	08:26 (WEA V01)	18:23	19:59
18	07:57	08:46 (WEA V02)	07:02	08:22 (WEA V01)	05:57	05:47
19	16:36	10:06 (WEA V02)	17:34	08:25 (WEA V01)	18:25	19:59
20	07:56	08:46 (WEA V02)	06:59	08:21 (WEA V01)	05:55	05:45
21	16:38	10:05 (WEA V02)	17:36	08:24 (WEA V01)	18:27	19:59
22	07:55	08:47 (WEA V02)	06:57	08:20 (WEA V01)	05:53	05:43
23	16:40	10:05 (WEA V02)	17:38	08:23 (WEA V01)	18:28	19:59
24	07:53	08:48 (WEA V02)	06:55	08:19 (WEA V01)	05:50	05:41
25	16:42	10:05 (WEA V02)	17:40	08:22 (WEA V01)	18:30	19:59
26	07:52	08:21 (WEA V01)		08:18 (WEA V01)	06:48	06:40
27	16:43	10:04 (WEA V02)		08:19 (WEA V01)	18:32	19:59
28	07:50	08:25 (WEA V01)		08:20 (WEA V01)	06:46	06:38
29	16:45	10:04 (WEA V02)		08:21 (WEA V01)	18:34	19:59
30	07:49	08:18 (WEA V01)		08:22 (WEA V01)	06:43	06:35
31	16:47	10:04 (WEA V02)		08:23 (WEA V01)	18:35	19:59
Sonnenscheinstunden	256		276		417	487
astr.mög.Beschattung	856	393	145	177	296	334

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-77 - SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Juli		August		September		Oktober		November		Dezember	
1	04:45	20:45 (WEA_Z801_wpd)	05:22	19:59 (WEA_Z802_wpd)	06:14	19:22 (WEA_Z805_wpd)	07:04	18:05 (WEA_Z811_ErbW)	07:59	07:45 (WEA_V001)	07:51	08:24 (WEA_V003)
2	04:39	20:57 (WEA_Z801_wpd)	05:28	20:20 (WEA_Z802_wpd)	06:14	19:22 (WEA_Z805_wpd)	07:04	18:11	07:59	07:45 (WEA_V001)	07:51	08:24 (WEA_V003)
3	04:47	20:56 (WEA_Z801_wpd)	05:29	20:19 (WEA_Z802_wpd)	06:15	19:21	07:05	18:07 (WEA_Z811_ErbW)	07:51	07:45 (WEA_V001)	07:52	08:20 (WEA_V002)
4	04:47	20:56 (WEA_Z801_wpd)	05:29	20:19 (WEA_Z802_wpd)	06:15	19:21	07:05	18:14	07:52	07:45 (WEA_V001)	07:54	08:20 (WEA_V002)
5	04:48	20:57 (WEA_Z801_wpd)	05:29	20:19 (WEA_Z802_wpd)	06:20	19:19	07:07	18:09 (WEA_Z811_ErbW)	07:52	07:45 (WEA_V001)	07:54	08:27 (WEA_V003)
6	04:49	20:57 (WEA_Z801_wpd)	05:31	20:20 (WEA_Z802_wpd)	06:22	19:19	07:09	18:11 (WEA_Z811_ErbW)	07:53	07:45 (WEA_V001)	07:54	08:27 (WEA_V003)
7	04:50	20:58 (WEA_Z801_wpd)	05:31	20:20 (WEA_Z802_wpd)	06:22	19:19	07:09	18:09	07:53	07:45 (WEA_V001)	07:54	08:27 (WEA_V003)
8	04:51	20:59 (WEA_Z801_wpd)	05:34	20:20 (WEA_Z802_wpd)	06:25	19:18	07:10	18:07	07:53 (WEA_V001)	07:55	08:30 (WEA_V003)	
9	04:52	20:52 (WEA_Z801_wpd)	05:35	20:21 (WEA_Z802_wpd)	06:27	19:18	07:11	18:06	07:54 (WEA_V001)	07:56	08:31 (WEA_V003)	
10	04:53	20:53 (WEA_Z801_wpd)	05:37	20:22 (WEA_Z802_wpd)	06:29	19:19	07:12	18:05	07:55 (WEA_V001)	07:58	08:31 (WEA_V003)	
11	04:54	20:54	05:39	20:23 (WEA_Z802_wpd)	06:30	19:19	07:13	18:04	07:56 (WEA_V001)	07:59	08:32 (WEA_V003)	
12	04:55	20:54	05:40	20:23 (WEA_Z802_wpd)	06:32	19:20	07:14	18:03	07:57 (WEA_V001)	08:00	08:33 (WEA_V003)	
13	04:56	20:55	05:42	20:24 (WEA_Z802_wpd)	06:34	19:20	07:15	18:02	07:58 (WEA_V001)	08:01	08:34 (WEA_V003)	
14	04:57	20:56	05:44	20:25 (WEA_Z802_wpd)	06:35	19:21	07:16	18:01	07:59 (WEA_V001)	08:02	08:35 (WEA_V003)	
15	04:59	20:57	05:45	20:25 (WEA_Z802_wpd)	06:37	19:21	07:17	18:00	08:00 (WEA_V001)	08:03	08:36 (WEA_V003)	
16	05:00	20:58	05:46	20:26 (WEA_Z802_wpd)	06:39	19:21	07:18	18:00	08:01 (WEA_V001)	08:04	08:37 (WEA_V003)	
17	05:01	20:59	05:47	20:27 (WEA_Z802_wpd)	06:40	19:22	07:19	18:01	08:02 (WEA_V001)	08:05	08:38 (WEA_V003)	
18	05:02	21:00	05:48	20:27 (WEA_Z802_wpd)	06:41	19:22	07:20	18:02	08:03 (WEA_V001)	08:06	08:39 (WEA_V003)	
19	05:04	21:01	05:49	20:28 (WEA_Z802_wpd)	06:42	19:22	07:21	18:03	08:04 (WEA_V001)	08:07	08:40 (WEA_V003)	
20	05:05	21:02	05:51	20:28 (WEA_Z802_wpd)	06:43	19:23	07:22	18:04	08:05 (WEA_V001)	08:08	08:41 (WEA_V003)	
21	05:06	21:03	05:52	20:29 (WEA_Z802_wpd)	06:44	19:23	07:23	18:05	08:06 (WEA_V001)	08:09	08:42 (WEA_V003)	
22	05:08	21:04	05:53	20:29 (WEA_Z802_wpd)	06:45	19:24	07:24	18:06	08:07 (WEA_V001)	08:10	08:43 (WEA_V003)	
23	05:09	21:05	05:54	20:30 (WEA_Z802_wpd)	06:46	19:24	07:25	18:07	08:08 (WEA_V001)	08:11	08:44 (WEA_V003)	
24	05:11	21:06	05:55	20:31 (WEA_Z802_wpd)	06:47	19:24	07:26	18:08	08:09 (WEA_V001)	08:12	08:45 (WEA_V003)	
25	05:12	21:07	05:56	20:32 (WEA_Z802_wpd)	06:48	19:24	07:27	18:09	08:10 (WEA_V001)	08:13	08:46 (WEA_V003)	
26	05:14	21:08	05:57	20:33 (WEA_Z802_wpd)	06:49	19:25	07:28	18:10	08:11 (WEA_V001)	08:14	08:47 (WEA_V003)	
27	05:15	21:09	05:58	20:33 (WEA_Z802_wpd)	06:50	19:25	07:29	18:11	08:12 (WEA_V001)	08:15	08:48 (WEA_V003)	
28	05:17	21:10	05:59	20:34 (WEA_Z802_wpd)	06:51	19:25	07:30	18:12	08:13 (WEA_V001)	08:16	08:49 (WEA_V003)	
29	05:18	21:11	06:00	20:35 (WEA_Z802_wpd)	06:52	19:26	07:31	18:13	08:14 (WEA_V001)	08:17	08:50 (WEA_V003)	
30	05:20	21:12	06:01	20:35 (WEA_Z802_wpd)	06:53	19:26	07:32	18:14	08:15 (WEA_V001)	08:18	08:51 (WEA_V003)	
31	05:21	21:13	06:02	20:36 (WEA_Z802_wpd)	06:54	19:27	07:33	18:15	08:16 (WEA_V001)	08:19	08:52 (WEA_V003)	
20:59	06:03	20:37	06:03	20:37 (WEA_Z802_wpd)	06:55	19:27	07:34	18:16	08:17 (WEA_V001)	08:20	08:53 (WEA_V003)	
20:59	06:04	20:38	06:04	20:38 (WEA_Z802_wpd)	06:56	19:27	07:35	18:17	08:18 (WEA_V001)	08:21	08:54 (WEA_V003)	
Sonnenscheinstunden	195	195	195	195	195	195	195	195	195	195	195	195
astr.mögl.Beschattung	180	180	180	180	180	180	180	180	180	180	180	180

**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) Schattendenende	Schattenanfang (WEA mit erstem Schatten)	Schattendenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-78 - SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:31 (WEA V02)	07:47	08:16 (WEA V01)	06:53	06:41
2	16:00	10:02 (WEA V02)	16:49	08:34 (WEA V01)	17:42	19:37
3	08:15	09:31 (WEA V02)	07:46	08:15 (WEA V01)	06:51	06:46
4	16:00	10:02 (WEA V02)	16:51	20	08:35 (WEA V01)	17:44
5	08:15	09:31 (WEA V02)	07:44	08:14 (WEA V01)	06:48	06:36
6	16:00	10:03 (WEA V02)	16:53	22	08:36 (WEA V01)	17:46
7	08:15	08:46 (WEA V02)	07:42	08:14 (WEA V01)	06:46	06:34
8	16:00	10:02 (WEA V02)	16:55	23	08:37 (WEA V01)	17:47
9	08:14	08:46 (WEA V02)	07:41	08:13 (WEA V01)	06:44	06:32
10	16:05	10:03 (WEA V02)	16:57	25	08:38 (WEA V01)	17:49
11	08:14	08:45 (WEA V02)	07:39	08:13 (WEA V01)	06:42	06:29
12	16:06	10:03 (WEA V02)	16:59	25	08:39 (WEA V01)	17:51
13	08:14	08:45 (WEA V02)	07:37	08:12 (WEA V01)	06:39	06:27
14	16:07	10:03 (WEA V02)	17:00	27	08:39 (WEA V01)	17:53
15	08:13	08:44 (WEA V02)	07:36	08:12 (WEA V01)	06:37	06:25
16	16:09	10:03 (WEA V02)	17:02	27	08:39 (WEA V01)	17:55
17	08:13	08:43 (WEA V02)	07:34	08:12 (WEA V01)	06:35	06:22
18	16:10	10:03 (WEA V02)	17:04	27	08:39 (WEA V01)	17:56
19	08:13	08:43 (WEA V02)	07:32	08:12 (WEA V01)	06:33	06:20
20	16:12	10:03 (WEA V02)	17:06	27	08:39 (WEA V01)	17:58
21	08:11	08:42 (WEA V02)	07:30	08:13 (WEA V01)	06:30	06:18
22	16:13	10:03 (WEA V02)	17:08	25	08:38 (WEA V01)	18:00
23	08:11	08:41 (WEA V02)	07:28	08:13 (WEA V01)	06:28	06:16
24	16:15	10:02 (WEA V02)	17:10	25	08:38 (WEA V01)	18:02
25	08:10	08:40 (WEA V02)	07:26	08:14 (WEA V01)	06:26	06:13
26	16:16	10:02 (WEA V02)	17:12	24	08:38 (WEA V01)	18:04
27	08:09	08:39 (WEA V02)	07:24	08:14 (WEA V01)	06:23	06:11
28	16:18	10:01 (WEA V02)	17:14	23	08:37 (WEA V01)	18:05
29	08:08	08:39 (WEA V02)	07:22	08:16 (WEA V01)	06:21	06:09
30	16:19	10:00 (WEA V02)	17:16	20	08:36 (WEA V01)	18:07
31	08:08	08:39 (WEA V02)	07:20	17	08:34 (WEA V01)	18:09
1	16:21	09:59 (WEA V02)	17:18	17	08:34 (WEA V01)	18:09
2	08:07	08:39 (WEA V02)	07:18	08:16 (WEA V01)	06:16	06:04
3	16:22	09:58 (WEA V02)	17:19	13	08:32 (WEA V01)	18:11
4	08:06	08:40 (WEA V02)	07:16	17	08:31 (WEA V01)	18:12
5	16:24	09:51 (WEA V02)	17:21	6	08:29 (WEA V01)	18:12
6	08:05	08:39 (WEA V02)	07:14	08:12	17:23 (WEA ZB1_ErBw)	18:13
7	16:26	09:51 (WEA V02)	17:23	18:14	17:23 (WEA ZB1_ErBw)	18:14
8	08:04	08:40 (WEA V02)	07:12	06:09	17:25 (WEA ZB1_ErBw)	18:15
9	16:27	09:51 (WEA V02)	17:25	18:16	17:27 (WEA ZB1_ErBw)	18:16
10	08:03	08:41 (WEA V02)	07:10	06:07	17:27 (WEA ZB1_ErBw)	18:17
11	16:29	09:52 (WEA V02)	17:27	18:18	8	17:25 (WEA ZB1_ErBw)
12	08:01	08:41 (WEA V02)	07:08	06:05	18:19	17:25 (WEA ZB1_ErBw)
13	16:31	09:52 (WEA V02)	17:29	18:20	10	17:25 (WEA ZB1_ErBw)
14	08:00	08:41 (WEA V02)	07:06	06:02	18:21	17:25 (WEA ZB1_ErBw)
15	16:33	09:52 (WEA V02)	17:31	18:22	18:22	17:25 (WEA ZB1_ErBw)
16	07:59	08:43 (WEA V02)	07:04	06:00	18:23	17:25 (WEA ZB1_ErBw)
17	16:34	09:52 (WEA V02)	17:33	18:23	18:23	17:25 (WEA ZB1_ErBw)
18	07:57	08:43 (WEA V02)	07:02	05:57	18:24	17:25 (WEA ZB1_ErBw)
19	16:36	09:51 (WEA V02)	17:34	18:25	18:25	17:25 (WEA ZB1_ErBw)
20	07:56	08:44 (WEA V02)	06:59	05:55	18:26	17:25 (WEA ZB1_ErBw)
21	16:38	09:51 (WEA V02)	17:36	18:27	18:27	17:25 (WEA ZB1_ErBw)
22	07:55	08:45 (WEA V02)	06:57	05:53	18:28	17:25 (WEA ZB1_ErBw)
23	16:40	09:50 (WEA V02)	17:38	18:28	18:28	17:25 (WEA ZB1_ErBw)
24	07:53	08:47 (WEA V02)	06:55	05:50	18:29	17:25 (WEA ZB1_ErBw)
25	16:42	09:51 (WEA V02)	17:40	18:30	18:30	17:25 (WEA ZB1_ErBw)
26	07:52	08:25 (WEA V02)	06:48	05:48	18:31	17:25 (WEA ZB1_ErBw)
27	16:43	09:52 (WEA V02)	17:42	18:32	18:32	17:25 (WEA ZB1_ErBw)
28	07:50	08:19 (WEA V02)	06:46	05:46	18:33	17:25 (WEA ZB1_ErBw)
29	16:45	09:51 (WEA V02)	17:44	18:34	18:34	17:25 (WEA ZB1_ErBw)
30	07:49	08:17 (WEA V02)	06:43	05:43	18:35	17:25 (WEA ZB1_ErBw)
31	16:47	09:51 (WEA V02)	17:46	18:36	18:36	17:25 (WEA ZB1_ErBw)
Sonnenscheinstunden	256		276		417	487
astr.mögl.Beschattung	842	394	153	181	314	228

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-78 - SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:49 (WEA Z801_wpd)	05:22	20:00 (WEA Z803_wpd)	06:14	19:24 (WEA Z805_wpd)
2	04:46	20:50 (WEA Z801_wpd)	05:23	20:01 (WEA Z803_wpd)	06:15	19:25 (WEA Z805_wpd)
3	04:47	20:51 (WEA Z801_wpd)	05:24	20:02 (WEA Z803_wpd)	06:16	19:26 (WEA Z805_wpd)
4	04:48	20:52 (WEA Z801_wpd)	05:25	20:03 (WEA Z803_wpd)	06:17	19:27 (WEA Z805_wpd)
5	04:49	20:53 (WEA Z801_wpd)	05:26	20:04 (WEA Z803_wpd)	06:18	19:28 (WEA Z805_wpd)
6	04:50	20:54 (WEA Z801_wpd)	05:27	20:05 (WEA Z803_wpd)	06:19	19:29 (WEA Z805_wpd)
7	04:51	20:55 (WEA Z801_wpd)	05:28	20:06 (WEA Z803_wpd)	06:20	19:30 (WEA Z805_wpd)
8	04:52	20:56 (WEA Z801_wpd)	05:29	20:07 (WEA Z803_wpd)	06:21	19:31 (WEA Z805_wpd)
9	04:53	20:57 (WEA Z801_wpd)	05:30	20:08 (WEA Z803_wpd)	06:22	19:32 (WEA Z805_wpd)
10	04:54	20:58 (WEA Z801_wpd)	05:31	20:09 (WEA Z803_wpd)	06:23	19:33 (WEA Z805_wpd)
11	04:55	20:59 (WEA Z801_wpd)	05:32	20:10 (WEA Z803_wpd)	06:24	19:34 (WEA Z805_wpd)
12	04:56	21:00 (WEA Z801_wpd)	05:33	20:11 (WEA Z803_wpd)	06:25	19:35 (WEA Z805_wpd)
13	04:57	21:01 (WEA Z801_wpd)	05:34	20:12 (WEA Z803_wpd)	06:26	19:36 (WEA Z805_wpd)
14	04:58	21:02 (WEA Z801_wpd)	05:35	20:13 (WEA Z803_wpd)	06:27	19:37 (WEA Z805_wpd)
15	04:59	21:03 (WEA Z801_wpd)	05:36	20:14 (WEA Z803_wpd)	06:28	19:38 (WEA Z805_wpd)
16	05:00	21:04 (WEA Z801_wpd)	05:37	20:15 (WEA Z803_wpd)	06:29	19:39 (WEA Z805_wpd)
17	05:01	21:05 (WEA Z801_wpd)	05:38	20:16 (WEA Z803_wpd)	06:30	19:40 (WEA Z805_wpd)
18	05:02	21:06 (WEA Z801_wpd)	05:39	20:17 (WEA Z803_wpd)	06:31	19:41 (WEA Z805_wpd)
19	05:03	21:07 (WEA Z801_wpd)	05:40	20:18 (WEA Z803_wpd)	06:32	19:42 (WEA Z805_wpd)
20	05:04	21:08 (WEA Z801_wpd)	05:41	20:19 (WEA Z803_wpd)	06:33	19:43 (WEA Z805_wpd)
21	05:05	21:09 (WEA Z801_wpd)	05:42	20:20 (WEA Z803_wpd)	06:34	19:44 (WEA Z805_wpd)
22	05:06	21:10 (WEA Z801_wpd)	05:43	20:21 (WEA Z803_wpd)	06:35	19:45 (WEA Z805_wpd)
23	05:07	21:11 (WEA Z801_wpd)	05:44	20:22 (WEA Z803_wpd)	06:36	19:46 (WEA Z805_wpd)
24	05:08	21:12 (WEA Z801_wpd)	05:45	20:23 (WEA Z803_wpd)	06:37	19:47 (WEA Z805_wpd)
25	05:09	21:13 (WEA Z801_wpd)	05:46	20:24 (WEA Z803_wpd)	06:38	19:48 (WEA Z805_wpd)
26	05:10	21:14 (WEA Z801_wpd)	05:47	20:25 (WEA Z803_wpd)	06:39	19:49 (WEA Z805_wpd)
27	05:11	21:15 (WEA Z801_wpd)	05:48	20:26 (WEA Z803_wpd)	06:40	19:50 (WEA Z805_wpd)
28	05:12	21:16 (WEA Z801_wpd)	05:49	20:27 (WEA Z803_wpd)	06:41	19:51 (WEA Z805_wpd)
29	05:13	21:17 (WEA Z801_wpd)	05:50	20:28 (WEA Z803_wpd)	06:42	19:52 (WEA Z805_wpd)
30	05:14	21:18 (WEA Z801_wpd)	05:51	20:29 (WEA Z803_wpd)	06:43	19:53 (WEA Z805_wpd)
31	05:15	21:19 (WEA Z801_wpd)	05:52	20:30 (WEA Z803_wpd)	06:44	19:54 (WEA Z805_wpd)
Sonnenscheinstunden	155	145	135	125	115	105
astronom.mögl.Beschattung	172	158	148	138	128	118

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-79 - SR-79, Neumühler Straße 57/58, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15 16:00 08:15 16:01	09:27 (WEA VB02)   07:47 09:57 (WEA VB02)   16:49 09:27 (WEA VB02)   07:46 09:59 (WEA VB02)   16:51	08:15 (WEA VB01)   06:53 08:32 (WEA VB01)   17:42 08:14 (WEA VB01)   06:51 08:31 (WEA VB01)   17:44		06:41 19:37 06:39 19:39	06:49 20:29 06:46 20:31	06:49 21:16 06:46 21:17
2	08:15 16:03	09:28 (WEA VB02)   07:44 09:58 (WEA VB02)   16:53	08:13 (WEA VB01)   06:48 08:34 (WEA VB01)   17:46		19:41 06:36 19:43	20:04 06:43 20:06	06:47 21:18 06:45
3	08:15 16:04	09:28 (WEA VB02)   07:42 09:58 (WEA VB02)   16:52	08:13 (WEA VB01)   06:46 08:35 (WEA VB01)   17:47		19:41 06:36 19:43	20:04 06:43 20:06	06:47 21:18 06:45
4	08:15 16:04	09:28 (WEA VB02)   07:42 09:58 (WEA VB02)   16:52	08:13 (WEA VB01)   06:46 08:35 (WEA VB01)   17:47		19:41 06:36 19:43	20:04 06:43 20:06	06:47 21:18 06:45
5	08:14 16:05	09:29 (WEA VB02)   07:41 09:59 (WEA VB02)   16:52	08:12 (WEA VB01)   06:44 08:36 (WEA VB01)   17:49		19:44 06:37 19:46	20:05 06:44 20:07	06:48 21:19 06:46
6	08:14 16:06	09:29 (WEA VB02)   07:39 09:59 (WEA VB02)   16:50	08:12 (WEA VB01)   06:42 08:36 (WEA VB01)   17:51		19:44 06:37 19:46	20:05 06:44 20:07	06:48 21:19 06:46
7	08:14 16:07	09:29 (WEA VB02)   07:37 09:59 (WEA VB02)   16:48	08:11 (WEA VB01)   06:39 08:37 (WEA VB01)   17:53		19:44 06:37 19:46	20:05 06:44 20:07	06:48 21:19 06:46
8	08:13 16:09	09:29 (WEA VB02)   07:36 09:59 (WEA VB02)   16:46	08:11 (WEA VB01)   06:37 08:37 (WEA VB01)   17:55		19:48 06:38 19:51	20:09 06:45 20:12	06:49 21:20 06:47
9	08:13 16:10	09:29 (WEA VB02)   07:34 09:59 (WEA VB02)   16:44	08:11 (WEA VB01)   06:35 08:37 (WEA VB01)   17:56		19:48 06:38 19:51	20:09 06:45 20:12	06:49 21:20 06:47
10	08:12 16:12	09:29 (WEA VB02)   07:32 09:59 (WEA VB02)   16:42	08:11 (WEA VB01)   06:33 08:37 (WEA VB01)   17:58		19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
11	08:11 16:13	09:29 (WEA VB02)   07:30 09:59 (WEA VB02)   16:40	08:11 (WEA VB01)   06:30 08:37 (WEA VB01)   18:00	17:27 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
12	08:11 16:15	09:29 (WEA VB02)   07:28 09:59 (WEA VB02)   16:38	08:10 (WEA VB01)   06:28 08:37 (WEA VB01)   18:02	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
13	08:10 16:16	09:29 (WEA VB02)   07:26 09:59 (WEA VB02)   16:36	08:10 (WEA VB01)   06:26 08:37 (WEA VB01)   18:04	17:23 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
14	08:09 16:18	09:29 (WEA VB02)   07:24 09:59 (WEA VB02)   16:34	08:10 (WEA VB01)   06:23 08:37 (WEA VB01)   18:05	17:21 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
15	08:08 16:19	09:29 (WEA VB02)   07:22 09:59 (WEA VB02)   16:32	08:09 (WEA VB01)   06:21 08:37 (WEA VB01)   18:07	17:21 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
16	08:08 16:21	09:29 (WEA VB02)   07:20 09:59 (WEA VB02)   16:30	08:09 (WEA VB01)   06:19 08:37 (WEA VB01)   18:09	17:20 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
17	08:07 16:22	09:29 (WEA VB02)   07:18 09:59 (WEA VB02)   16:28	08:08 (WEA VB01)   06:16 08:37 (WEA VB01)   18:11	17:21 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
18	08:06 16:24	09:29 (WEA VB02)   07:16 09:59 (WEA VB02)   16:26	08:08 (WEA VB01)   06:14 08:37 (WEA VB01)   18:12	17:21 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
19	08:05 16:26	09:29 (WEA VB02)   07:14 09:59 (WEA VB02)   16:24	08:08 (WEA VB01)   06:12 08:37 (WEA VB01)   18:14	17:22 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
20	08:04 16:27	09:29 (WEA VB02)   07:12 09:59 (WEA VB02)   16:22	08:07 (WEA VB01)   06:10 08:37 (WEA VB01)   18:15	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
21	08:03 16:29	09:29 (WEA VB02)   07:10 09:59 (WEA VB02)   16:20	08:07 (WEA VB01)   06:07 08:37 (WEA VB01)   18:16	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
22	08:01 16:31	09:29 (WEA VB02)   07:08 09:59 (WEA VB02)   16:18	08:06 (WEA VB01)   06:05 08:37 (WEA VB01)   18:17	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
23	08:00 16:33	09:29 (WEA VB02)   07:06 09:59 (WEA VB02)   16:16	08:06 (WEA VB01)   06:03 08:37 (WEA VB01)   18:18	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
24	07:59 16:34	09:29 (WEA VB02)   07:04 09:59 (WEA VB02)   16:14	08:05 (WEA VB01)   06:01 08:37 (WEA VB01)   18:19	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
25	07:57 16:36	09:29 (WEA VB02)   07:02 09:59 (WEA VB02)   16:12	08:05 (WEA VB01)   05:59 08:37 (WEA VB01)   18:20	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
26	07:56 16:38	09:29 (WEA VB02)   07:00 09:59 (WEA VB02)   16:10	08:04 (WEA VB01)   05:57 08:37 (WEA VB01)   18:21	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
27	07:55 16:40	09:29 (WEA VB02)   06:58 09:59 (WEA VB02)   16:08	08:04 (WEA VB01)   05:55 08:37 (WEA VB01)   18:22	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
28	07:53 16:42	09:29 (WEA VB02)   06:56 09:59 (WEA VB02)   16:06	08:04 (WEA VB01)   05:53 08:37 (WEA VB01)   18:23	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
29	07:52 16:43	09:29 (WEA VB02)   06:54 09:59 (WEA VB02)   16:04	08:03 (WEA VB01)   05:51 08:37 (WEA VB01)   18:24	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
30	07:50 16:45	09:29 (WEA VB02)   06:52 09:59 (WEA VB02)   16:02	08:03 (WEA VB01)   05:49 08:37 (WEA VB01)   18:25	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
31	07:49 16:47	09:29 (WEA VB02)   06:50 09:59 (WEA VB02)   16:00	08:03 (WEA VB01)   05:47 08:37 (WEA VB01)   18:26	17:24 (WEA ZB11_ErBw)	19:49 06:39 19:52	20:10 06:46 20:13	06:49 21:21 06:47
Sonnenscheinstunden	256	276	307	417	487	502	
astr.max.mögl.Beschattung	825	383	157	189	333	175	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-79 - SR-79, Neumühler Straße 57/58, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:51 (WEA Z803_wpd)	05:22	20:00 (WEA Z803_wpd)	06:14	19:22 (WEA Z805_wpd)
2	04:46	20:51 (WEA Z801_wpd)	05:28	21: 20:21 (WEA Z803_wpd)	05:54	19:27 (WEA Z805_wpd)
3	04:47	20:51 (WEA Z801_wpd)	05:28	20:21 (WEA Z803_wpd)	06:15	19:27 (WEA Z805_wpd)
4	04:47	20:51 (WEA Z801_wpd)	05:28	20:21 (WEA Z803_wpd)	06:15	19:27 (WEA Z805_wpd)
5	04:47	20:51 (WEA Z801_wpd)	05:28	20:21 (WEA Z803_wpd)	06:15	19:27 (WEA Z805_wpd)
6	04:49	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
7	04:49	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
8	04:51	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
9	04:52	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
10	04:53	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
11	04:54	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
12	04:55	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
13	04:56	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
14	04:57	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
15	04:59	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
16	05:00	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
17	05:01	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
18	05:02	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
19	05:04	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
20	05:05	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
21	05:06	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
22	05:08	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
23	05:09	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
24	05:11	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
25	05:12	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
26	05:14	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
27	05:17	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
28	05:17	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
29	05:18	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
30	05:20	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
31	05:21	20:56 (WEA Z801_wpd)	05:29	20:00 (WEA Z803_wpd)	06:20	19:27 (WEA Z805_wpd)
Sonnenscheinstunden	156	145	131	118	104	89
astr.mög.Beschattung	178	162	143	123	106	94

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-80 - SR-80, Neumühler Straße 59, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:00 08:15 16:01	09:22 (WEA V02)   07:47 09:54 (WEA V02)   16:49 09:54 (WEA V02)   07:46 09:54 (WEA V02)   16:51	08:15 (WEA V01)   06:53 08:29 (WEA V01)   17:42 08:13 (WEA V01)   06:51 08:31 (WEA V01)   17:44		06:41 19:37 06:39 19:39	06:49 20:29 06:46 20:31	06:49 21:16 06:46 21:17
2	08:15 16:03	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:32 (WEA V01)   17:46 08:12 (WEA V01)   06:48 08:12 (WEA V01)   06:48		06:36 19:41	06:47 20:44	06:47 21:18
3	08:15 16:04	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:32 (WEA V01)   17:46 08:12 (WEA V01)   06:46 08:12 (WEA V01)   06:46		06:34 19:42	06:46 20:44	06:46 21:19
4	08:15 16:04	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:32 (WEA V01)   17:46 08:12 (WEA V01)   06:44 08:12 (WEA V01)   06:44		06:32 19:44	06:45 20:44	06:45 21:20
5	08:14 16:05	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:34 (WEA V01)   17:49 08:13 (WEA V01)   06:42 08:13 (WEA V01)   06:42		06:29 19:46	06:44 20:44	06:45 21:21
6	08:14 16:06	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:34 (WEA V01)   17:49 08:13 (WEA V01)   06:40 08:13 (WEA V01)   06:40		06:27 19:48	06:44 20:44	06:45 21:22
7	08:14 16:07	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:34 (WEA V01)   17:49 08:13 (WEA V01)   06:38 08:13 (WEA V01)   06:38		06:25 19:48	06:44 20:44	06:45 21:22
8	08:13 16:09	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:36 08:10 (WEA V01)   06:36		06:22 19:49	06:44 20:44	06:45 21:23
9	08:13 16:10	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:34 08:10 (WEA V01)   06:34	2	17:28 (WEA ZB1_ErBw)   06:22 17:38 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
10	08:12 16:11	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:32 08:10 (WEA V01)   06:32	2	17:28 (WEA ZB1_ErBw)   06:22 17:38 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
11	08:11 16:12	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:30 08:10 (WEA V01)   06:30	8	17:33 (WEA ZB1_ErBw)   19:53 17:25 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
12	08:11 16:13	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:28 08:10 (WEA V01)   06:28	11	17:34 (WEA ZB1_ErBw)   19:55 17:22 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
13	08:10 16:15	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:26 08:10 (WEA V01)   06:26	14	17:36 (WEA ZB1_ErBw)   19:56 17:21 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
14	08:09 16:16	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:24 08:10 (WEA V01)   06:24	17	17:38 (WEA ZB1_ErBw)   19:58 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
15	08:08 16:19	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:22 08:10 (WEA V01)   06:22	15	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
16	08:08 16:21	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:20 08:10 (WEA V01)   06:20	17	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
17	08:07 16:22	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:18 08:10 (WEA V01)   06:18	18	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
18	08:06 16:24	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:16 08:10 (WEA V01)   06:16	18	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
19	08:05 16:26	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:14 08:10 (WEA V01)   06:14	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
20	08:04 16:27	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:12 08:10 (WEA V01)   06:12	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
21	08:02 16:29	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:10 08:10 (WEA V01)   06:10	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
22	08:01 16:31	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:08 08:10 (WEA V01)   06:08	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
23	08:00 16:33	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:06 08:10 (WEA V01)   06:06	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
24	07:59 16:34	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:04 08:10 (WEA V01)   06:04	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
25	07:57 16:36	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:02 08:10 (WEA V01)   06:02	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
26	07:56 16:38	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   06:00 08:10 (WEA V01)   06:00	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
27	07:55 16:40	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   05:58 08:10 (WEA V01)   05:58	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
28	07:53 16:42	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   05:56 08:10 (WEA V01)   05:56	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
29	07:52 16:43	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   05:54 08:10 (WEA V01)   05:54	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
30	07:50 16:45	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   05:52 08:10 (WEA V01)   05:52	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
31	07:49 16:47	09:25 (WEA V02)   07:50 09:25 (WEA V02)   16:53	08:35 (WEA V01)   17:52 08:10 (WEA V01)   05:50 08:10 (WEA V01)   05:50	19	17:39 (WEA ZB1_ErBw)   19:59 17:17 (WEA ZB1_ErBw)   19:51	06:43 20:44	06:43 21:24
Sonnenscheinstunden	256	276	307	417	488	502	
astrmax.mögl.Beschattung	816	375	167	199	349	119	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-80 - SR-80, Neumühler Straße 59, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember								
1	04:45	05:22	20:00 (WEA.Z803_wpd)	06:14	19:22 (WEA.Z805_wpd)	07:04	18:00 (WEA.Z811_EhW)	06:59	07:39 (WEA.V801)	07:51	08:24 (WEA.V803)			
2	21:30	20:58	22	20:22 (WEA.Z803_wpd)	19:54	18:44	16	18:16 (WEA.Z811_EhW)	16:36	26	08:05 (WEA.V801)	15:55	36	08:38 (WEA.V802)
3	04:47	05:24	19:59 (WEA.Z803_wpd)	06:15	19:47	18:01	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:54	34	08:28 (WEA.V802)
4	21:29	20:56	22	20:21 (WEA.Z803_wpd)	19:52	18:41	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:54	34	08:28 (WEA.V802)
5	04:47	05:24	20:00 (WEA.Z803_wpd)	06:15	19:47	18:01	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:54	34	08:28 (WEA.V802)
6	21:29	20:56	22	20:21 (WEA.Z803_wpd)	19:52	18:41	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:54	34	08:28 (WEA.V802)
7	04:49	05:26	21	20:21 (WEA.Z803_wpd)	19:49	18:37	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:53	32	08:28 (WEA.V802)
8	21:28	20:55	20:01 (WEA.Z803_wpd)	06:20	19:47	18:01	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:54	34	08:28 (WEA.V802)
9	04:51	05:28	20	20:21 (WEA.Z803_wpd)	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
10	21:27	20:54	20:01 (WEA.Z803_wpd)	06:22	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
11	04:52	05:31	20:17 (WEA.Z803_wpd)	19:41	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
12	21:28	20:54	20:02 (WEA.Z803_wpd)	06:25	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
13	04:51	05:34	13	20:15 (WEA.Z803_wpd)	19:38	18:23	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:51	30	08:43 (WEA.V802)
14	21:27	20:53	20:04 (WEA.Z803_wpd)	06:27	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
15	04:52	05:32	20:07 (WEA.Z803_wpd)	06:29	19:45	18:34	5	18:09 (WEA.Z811_EhW)	16:34	25	08:04 (WEA.V801)	15:52	29	08:28 (WEA.V802)
16	21:28	20:54	6	20:13 (WEA.Z803_wpd)	19:33	18:23	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:51	30	08:43 (WEA.V802)
17	04:54	05:39	19:31	06:30	19:31	18:21	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
18	21:25	20:51	19:31	06:32	19:31	18:21	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
19	04:55	05:40	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
20	21:24	20:50	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
21	04:56	05:42	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
22	21:23	20:49	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
23	04:57	05:44	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
24	21:22	20:48	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
25	04:59	05:45	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
26	21:21	20:47	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
27	04:59	05:45	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
28	21:20	20:46	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
29	05:01	05:47	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
30	21:19	20:45	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
31	05:01	05:47	19:29	06:34	19:29	18:18	13	18:14 (WEA.Z811_EhW)	16:35	26	08:05 (WEA.V801)	15:50	31	08:44 (WEA.V802)
Sonnenscheinstunden	156	157	157	157	157	157	157	157	157	157	157	157	157	157
astr.max.mögl.Beschattung	186	365	132	132	203	693	794							

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-81 - SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:30 (WEA VBD)	07:47		05:35	19:49 (WEA ZB1_wpd)
2	16:00	09:58 (WEA VBD)	16:49	22	08:38 (WEA VBD)	17:42
3	08:15	08:47 (WEA VBD)	07:46	23	08:30 (WEA VBD)	05:31
4	16:01	09:59 (WEA VBD)	16:51	23	08:39 (WEA VBD)	17:44
5	08:15	08:47 (WEA VBD)	07:44		08:15 (WEA VBD)	06:48
6	16:03	09:59 (WEA VBD)	16:53	24	08:39 (WEA VBD)	17:46
7	08:15	08:46 (WEA VBD)	07:42		08:16 (WEA VBD)	06:46
8	16:04	09:58 (WEA VBD)	16:55	24	08:40 (WEA VBD)	17:47
9	08:14	08:46 (WEA VBD)	07:41		08:16 (WEA VBD)	06:44
10	16:05	09:59 (WEA VBD)	16:57	25	08:41 (WEA VBD)	17:49
11	08:14	08:45 (WEA VBD)	07:39		08:15 (WEA VBD)	06:42
12	16:06	09:58 (WEA VBD)	16:59	26	08:41 (WEA VBD)	17:51
13	08:14	08:45 (WEA VBD)	07:37		08:15 (WEA VBD)	06:39
14	16:07	09:59 (WEA VBD)	17:00	26	08:41 (WEA VBD)	17:53
15	08:13	08:44 (WEA VBD)	07:36		08:16 (WEA VBD)	06:37
16	16:09	09:58 (WEA VBD)	17:02	24	08:40 (WEA VBD)	17:55
17	08:13	08:43 (WEA VBD)	07:34		08:16 (WEA VBD)	06:35
18	16:10	09:59 (WEA VBD)	17:04	24	08:40 (WEA VBD)	17:56
19	08:12	08:43 (WEA VBD)	07:32		08:16 (WEA VBD)	06:33
20	16:11	09:58 (WEA VBD)	17:06	24	08:40 (WEA VBD)	17:58
21	08:11	08:42 (WEA VBD)	07:30		08:17 (WEA VBD)	06:30
22	16:12	09:58 (WEA VBD)	17:08	22	08:39 (WEA VBD)	18:00
23	08:11	08:41 (WEA VBD)	07:28		08:18 (WEA VBD)	06:28
24	16:13	09:57 (WEA VBD)	17:10	20	08:38 (WEA VBD)	18:02
25	08:10	08:40 (WEA VBD)	07:26		08:19 (WEA VBD)	06:26
26	16:14	09:56 (WEA VBD)	17:12	18	08:37 (WEA VBD)	18:04
27	08:09	08:40 (WEA VBD)	07:24		08:21 (WEA VBD)	06:23
28	16:15	09:54 (WEA VBD)	17:14	14	08:35 (WEA VBD)	18:05
29	08:08	08:40 (WEA VBD)	07:22		08:24 (WEA VBD)	06:21
30	16:16	09:53 (WEA VBD)	17:16	9	08:33 (WEA VBD)	18:07
31	08:08	08:39 (WEA VBD)	07:20		08:19	06:19
1	16:17	09:52 (WEA VBD)	17:18	15	08:31 (WEA VBD)	18:09
2	08:07	08:41 (WEA VBD)	07:18		08:16	06:16
3	16:22	09:51 (WEA VBD)	17:19	11	08:31 (WEA VBD)	18:11
4	08:06	08:41 (WEA VBD)	07:16		08:14	06:14
5	16:24	09:52 (WEA VBD)	17:21	7	08:29 (WEA VBD)	18:12
6	08:05	08:41 (WEA VBD)	07:14		08:12	06:12
7	16:26	09:51 (WEA VBD)	17:23	14	08:28 (WEA VBD)	18:14
8	08:04	08:41 (WEA VBD)	07:12		08:09	06:10
9	16:27	09:52 (WEA VBD)	17:25	10	08:28 (WEA VBD)	18:16
10	08:03	08:42 (WEA VBD)	07:10		08:07	06:07
11	16:29	09:52 (WEA VBD)	17:27	18	08:28 (WEA VBD)	18:18
12	08:03	08:43 (WEA VBD)	07:08		08:05	06:05
13	16:31	09:52 (WEA VBD)	17:29	17	08:27 (WEA VBD)	18:20
14	08:03	08:44 (WEA VBD)	07:06		08:02	06:02
15	16:33	09:53 (WEA VBD)	17:31	15	08:27 (WEA VBD)	18:21
16	08:02	08:45 (WEA VBD)	07:04		08:00	06:00
17	16:34	09:53 (WEA VBD)	17:33	13	08:25 (WEA VBD)	18:23
18	08:01	08:46 (WEA VBD)	07:02		07:57	06:05
19	16:36	09:54 (WEA VBD)	17:34	11	08:25 (WEA VBD)	18:25
20	08:00	08:46 (WEA VBD)	07:00		07:55	06:05
21	16:38	09:54 (WEA VBD)	17:36	9	08:23 (WEA VBD)	18:27
22	07:55	08:23 (WEA VBD)	06:57		07:53	06:03
23	16:40	09:54 (WEA VBD)	17:38	7	08:23 (WEA VBD)	18:28
24	07:53	08:23 (WEA VBD)	06:55		07:51	06:03
25	16:42	09:54 (WEA VBD)	17:40	5	08:21 (WEA VBD)	18:30
26	07:52	08:23 (WEA VBD)	06:53		07:49	06:04
27	16:43	09:54 (WEA VBD)	17:42	3	08:21 (WEA VBD)	18:32
28	07:50	08:23 (WEA VBD)	06:51		07:47	06:06
29	16:45	09:54 (WEA VBD)	17:44	1	08:20 (WEA VBD)	18:34
30	07:49	08:23 (WEA VBD)	06:49		07:45	06:08
31	16:47	09:54 (WEA VBD)	17:46	31	08:20 (WEA VBD)	18:36
Sonnenscheinstunden	256	276	307	417	511	608
astr.mög.Beschattung	756	325	162	200	317	375

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung: WEA\_GB Schattenrezeptor:SR-81 - SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember						
1	04:45	20:43 (WEA2801_wpd)	05:22	19:55 (WEA2802_wpd)	06:14	19:13 (WEA2805_wpd)	07:04	17:56 (WEA2811_EhW)	07:59	07:46 (WEA060)	07:51	08:24 (WEA080)
2	04:36	20:36 (WEA2801_wpd)	05:14	19:48 (WEA2802_wpd)	06:06	19:06 (WEA2805_wpd)	07:01	17:50 (WEA2811_EhW)	07:54	07:41 (WEA060)	07:46	08:18 (WEA080)
3	04:27	20:29 (WEA2801_wpd)	05:06	19:41 (WEA2802_wpd)	05:58	18:59 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:40 (WEA060)	07:45	08:15 (WEA080)
4	04:19	20:22 (WEA2801_wpd)	04:58	19:34 (WEA2802_wpd)	05:50	18:57 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:39 (WEA060)	07:44	08:12 (WEA080)
5	04:11	20:15 (WEA2801_wpd)	04:50	19:27 (WEA2802_wpd)	05:42	18:55 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:38 (WEA060)	07:43	08:09 (WEA080)
6	04:04	20:08 (WEA2801_wpd)	04:42	19:20 (WEA2802_wpd)	05:34	18:53 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:37 (WEA060)	07:42	08:06 (WEA080)
7	04:04	20:01 (WEA2801_wpd)	04:34	19:13 (WEA2802_wpd)	05:26	18:51 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:36 (WEA060)	07:41	08:03 (WEA080)
8	04:01	19:54 (WEA2801_wpd)	04:26	19:06 (WEA2802_wpd)	05:18	18:49 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:35 (WEA060)	07:40	08:00 (WEA080)
9	04:01	19:47 (WEA2801_wpd)	04:18	18:59 (WEA2802_wpd)	05:10	18:47 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:34 (WEA060)	07:39	07:57 (WEA080)
10	04:01	19:40 (WEA2801_wpd)	04:10	18:52 (WEA2802_wpd)	05:02	18:45 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:33 (WEA060)	07:38	07:54 (WEA080)
11	04:01	19:33 (WEA2801_wpd)	04:02	18:45 (WEA2802_wpd)	04:54	18:43 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:32 (WEA060)	07:37	07:51 (WEA080)
12	04:01	19:26 (WEA2801_wpd)	03:54	18:38 (WEA2802_wpd)	04:46	18:41 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:31 (WEA060)	07:36	07:48 (WEA080)
13	04:01	19:19 (WEA2801_wpd)	03:46	18:31 (WEA2802_wpd)	04:38	18:39 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:30 (WEA060)	07:35	07:45 (WEA080)
14	04:01	19:12 (WEA2801_wpd)	03:38	18:24 (WEA2802_wpd)	04:30	18:37 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:29 (WEA060)	07:34	07:42 (WEA080)
15	04:01	19:05 (WEA2801_wpd)	03:30	18:17 (WEA2802_wpd)	04:22	18:35 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:28 (WEA060)	07:33	07:39 (WEA080)
16	04:01	18:58 (WEA2801_wpd)	03:22	18:10 (WEA2802_wpd)	04:14	18:33 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:27 (WEA060)	07:32	07:36 (WEA080)
17	04:01	18:51 (WEA2801_wpd)	03:14	18:03 (WEA2802_wpd)	04:06	18:31 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:26 (WEA060)	07:31	07:33 (WEA080)
18	04:01	18:44 (WEA2801_wpd)	03:06	17:56 (WEA2802_wpd)	03:58	18:29 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:25 (WEA060)	07:30	07:30 (WEA080)
19	04:01	18:37 (WEA2801_wpd)	02:58	17:49 (WEA2802_wpd)	03:50	18:27 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:24 (WEA060)	07:29	07:27 (WEA080)
20	04:01	18:30 (WEA2801_wpd)	02:50	17:42 (WEA2802_wpd)	03:42	18:25 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:23 (WEA060)	07:28	07:24 (WEA080)
21	04:01	18:23 (WEA2801_wpd)	02:42	17:35 (WEA2802_wpd)	03:34	18:23 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:22 (WEA060)	07:27	07:21 (WEA080)
22	04:01	18:16 (WEA2801_wpd)	02:34	17:28 (WEA2802_wpd)	03:26	18:21 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:21 (WEA060)	07:26	07:18 (WEA080)
23	04:01	18:09 (WEA2801_wpd)	02:26	17:21 (WEA2802_wpd)	03:18	18:19 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:20 (WEA060)	07:25	07:15 (WEA080)
24	04:01	18:02 (WEA2801_wpd)	02:18	17:14 (WEA2802_wpd)	03:10	18:17 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:19 (WEA060)	07:24	07:12 (WEA080)
25	04:01	17:55 (WEA2801_wpd)	02:10	17:07 (WEA2802_wpd)	03:02	18:15 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:18 (WEA060)	07:23	07:09 (WEA080)
26	04:01	17:48 (WEA2801_wpd)	02:02	17:00 (WEA2802_wpd)	02:54	18:13 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:17 (WEA060)	07:22	07:06 (WEA080)
27	04:01	17:41 (WEA2801_wpd)	01:54	16:53 (WEA2802_wpd)	02:46	18:11 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:16 (WEA060)	07:21	07:03 (WEA080)
28	04:01	17:34 (WEA2801_wpd)	01:46	16:46 (WEA2802_wpd)	02:38	18:09 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:15 (WEA060)	07:20	07:00 (WEA080)
29	04:01	17:27 (WEA2801_wpd)	01:38	16:39 (WEA2802_wpd)	02:30	18:07 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:14 (WEA060)	07:19	06:57 (WEA080)
30	04:01	17:20 (WEA2801_wpd)	01:30	16:32 (WEA2802_wpd)	02:22	18:05 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:13 (WEA060)	07:18	06:54 (WEA080)
31	04:01	17:13 (WEA2801_wpd)	01:22	16:25 (WEA2802_wpd)	02:14	18:03 (WEA2805_wpd)	07:00	17:49 (WEA2811_EhW)	07:54	07:12 (WEA060)	07:17	06:51 (WEA080)
Sonnenscheinstunden	195	165	135	105	75	45	15	15	15	15	15	15
astronom.mögl.Beschattung	177	147	117	87	57	27	17	17	17	17	17	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	Zeitpunkt (SS:MM) Schattendenende	Schattenanfang (WEA mit erstem Schatten)	Schattendenende (WEA mit letztem Schatten)
	Sonnenuntergang (SS:MM)					

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-82 - SR-82, Neumühler Straße 14, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:27 (WEA V002)	07:47		05:35	19:50 (WEA Z001_wpd)
2	16:00	09:54 (WEA V002)	16:49	08:37 (WEA V001)	17:42	20:29
3	08:15	09:50 (WEA V002)	07:46	08:37 (WEA V001)	17:42	20:29
4	16:00	09:52 (WEA V002)	16:51	08:37 (WEA V001)	17:44	20:31
5	08:15	08:47 (WEA V002)	07:44	08:34 (WEA V001)	17:46	20:31
6	16:03	09:56 (WEA V002)	16:53	08:39 (WEA V001)	17:46	20:33
7	08:15	08:46 (WEA V002)	07:42	08:15 (WEA V001)	17:46	20:33
8	16:04	09:55 (WEA V002)	16:55	08:39 (WEA V001)	17:47	20:34
9	08:14	08:46 (WEA V002)	07:41	08:14 (WEA V001)	17:44	20:32
10	16:05	09:56 (WEA V002)	16:57	08:39 (WEA V001)	17:49	20:34
11	08:14	08:45 (WEA V002)	07:39	08:14 (WEA V001)	17:42	20:32
12	16:06	09:51 (WEA V002)	16:59	08:39 (WEA V001)	17:51	20:38
13	08:14	08:45 (WEA V002)	07:37	08:14 (WEA V001)	17:39	20:32
14	16:07	09:56 (WEA V002)	17:00	08:39 (WEA V001)	17:53	20:39
15	08:13	08:44 (WEA V002)	07:36	08:14 (WEA V001)	17:37	20:32
16	16:09	09:57 (WEA V002)	17:02	08:39 (WEA V001)	17:55	20:41
17	08:13	08:43 (WEA V002)	07:34	08:15 (WEA V001)	17:35	20:32
18	16:10	09:55 (WEA V002)	17:04	08:39 (WEA V001)	17:56	20:43
19	08:12	08:43 (WEA V002)	07:32	08:15 (WEA V001)	17:33	20:30
20	16:12	09:55 (WEA V002)	17:06	08:38 (WEA V001)	17:58	20:44
21	08:11	08:42 (WEA V002)	07:30	08:16 (WEA V001)	17:30	20:31
22	16:13	09:56 (WEA V002)	17:08	08:38 (WEA V001)	18:00	20:46
23	08:11	08:41 (WEA V002)	07:28	08:17 (WEA V001)	17:28	20:31
24	16:15	09:54 (WEA V002)	17:10	08:37 (WEA V001)	18:02	20:48
25	08:10	08:40 (WEA V002)	07:26	08:18 (WEA V001)	17:26	20:31
26	16:16	09:52 (WEA V002)	17:12	08:36 (WEA V001)	18:04	20:49
27	08:09	08:39 (WEA V002)	07:24	08:20 (WEA V001)	17:22	20:30
28	16:18	09:52 (WEA V002)	17:14	08:34 (WEA V001)	18:05	20:51
29	08:08	08:39 (WEA V002)	07:22	08:22 (WEA V001)	17:21	20:30
30	16:19	09:50 (WEA V002)	17:16	08:31 (WEA V001)	18:07	20:51
31	08:08	08:39 (WEA V002)	07:20	08:19	17:17 (WEA Z001_ErW)	20:30
1	16:21	09:59 (WEA V002)	17:18	18:09	17:31 (WEA Z001_ErW)	20:53
2	08:07	08:39 (WEA V002)	07:18	08:16	17:18 (WEA Z001_ErW)	20:34
3	16:22	09:59 (WEA V002)	17:19	18:11	17:29 (WEA Z001_ErW)	20:56
4	08:06	08:40 (WEA V002)	07:16	08:14	17:22 (WEA Z001_ErW)	20:35
5	16:24	09:59 (WEA V002)	17:21	18:12	17:25 (WEA Z001_ErW)	20:57
6	08:05	08:39 (WEA V002)	07:14	08:12	17:20	20:34
7	16:26	09:59 (WEA V002)	17:23	18:14	17:28	20:59
8	08:04	08:40 (WEA V002)	07:12	08:09	17:16 (WEA Z001_ErW)	20:32
9	16:27	09:59 (WEA V002)	17:25	18:16	17:32 (WEA Z001_ErW)	20:59
10	08:03	08:41 (WEA V002)	07:10	08:07	17:15 (WEA Z001_ErW)	20:31
11	16:29	09:59 (WEA V002)	17:27	18:18	17:35	20:59
12	08:03	08:42 (WEA V002)	07:08	08:05	17:13 (WEA Z001_ErW)	20:30
13	16:31	09:59 (WEA V002)	17:29	18:20	17:38	20:59
14	08:02	08:42 (WEA V002)	07:06	08:02	17:11 (WEA Z001_ErW)	20:29
15	16:33	09:59 (WEA V002)	17:31	18:21	17:41	20:59
16	07:59	08:43 (WEA V002)	07:04	08:00	17:09	20:29
17	16:34	09:59 (WEA V002)	17:33	18:23	17:43	20:59
18	07:57	08:44 (WEA V002)	07:02	07:57	17:07	20:29
19	16:36	09:59 (WEA V002)	17:34	18:25	17:45	20:59
20	07:56	08:46 (WEA V002)	06:59	07:55	17:05	20:29
21	16:38	09:58 (WEA V002)	17:36	18:27	17:47	20:59
22	07:55	08:24 (WEA V002)	06:57	07:53	17:03	20:29
23	16:40	09:58 (WEA V002)	17:38	18:28	17:49	20:59
24	07:53	08:21 (WEA V002)	06:55	07:50	17:01	20:29
25	16:42	09:58 (WEA V002)	17:40	18:30	17:51	20:59
26	07:52	08:21 (WEA V002)	06:54	07:49	17:00	20:29
27	16:43	09:58 (WEA V002)	17:42	18:32	17:53	20:59
28	07:50	08:17 (WEA V002)	06:52	07:46	16:58	20:29
29	16:45	09:58 (WEA V002)	17:44	18:34	17:55	20:59
30	07:49	08:17 (WEA V002)	06:51	07:45	16:57	20:29
31	16:47	09:58 (WEA V002)	17:46	18:35	17:57	20:59
Sonnenscheinstunden	256			417		468
astr.mögl.Beschattung	732	321	163	210	334	333

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-82 - SR-82, Neumühler Straße 14, 15518 Steinhöfel  
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Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:  
Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember										
1	04:45	20:45 (WEA Z801_wpd)	05:22	19:55 (WEA Z802_wpd)	06:14	19:12 (WEA Z805_wpd)	07:04	17:54 (WEA Z811_ErhW)	06:59	07:45 (WEA A801)	07:51	08:24 (WEA A803)				
2	04:46	20:57 (WEA Z801_wpd)	20:58	21:20 (WEA Z803_wpd)	19:54	15	19:27 (WEA Z805_wpd)	18:44	19	18:13 (WEA Z811_ErhW)	16:36	23	08:08 (WEA A801)	15:55	33	08:37 (WEA A802)
3	04:47	20:56 (WEA Z801_wpd)	05:26	19:54 (WEA Z803_wpd)	06:15	19:14 (WEA Z805_wpd)	07:05	17:54 (WEA Z811_ErhW)	07:01	07:44 (WEA A801)	07:52	08:25 (WEA A802)				
4	04:47	20:46 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	18:41	19	18:11 (WEA Z811_ErhW)	16:35	24	08:08 (WEA A801)	15:54	33	08:27 (WEA A803)		
5	04:48	20:47 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
6	04:49	20:58 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
7	04:50	20:56 (WEA Z801_wpd)	05:31	19:54 (WEA Z803_wpd)	06:22	19:12	17:55 (WEA Z811_ErhW)	07:06	17:54 (WEA Z811_ErhW)	07:06	07:44 (WEA A801)	07:56	08:31 (WEA A803)			
8	04:51	20:47 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
9	04:52	20:57 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
10	04:53	20:56 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	18:41	19	18:11 (WEA Z811_ErhW)	16:35	24	08:08 (WEA A801)	15:54	33	08:27 (WEA A803)		
11	04:54	20:57 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
12	04:55	20:58 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
13	04:56	20:56 (WEA Z801_wpd)	05:31	19:54 (WEA Z803_wpd)	06:22	19:12	17:55 (WEA Z811_ErhW)	07:06	17:54 (WEA Z811_ErhW)	07:06	07:44 (WEA A801)	07:56	08:31 (WEA A803)			
14	04:57	20:47 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
15	04:58	20:57 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
16	04:59	20:56 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	18:41	19	18:11 (WEA Z811_ErhW)	16:35	24	08:08 (WEA A801)	15:54	33	08:27 (WEA A803)		
17	05:00	20:57 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
18	05:01	20:58 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
19	05:02	20:56 (WEA Z801_wpd)	05:31	19:54 (WEA Z803_wpd)	06:22	19:12	17:55 (WEA Z811_ErhW)	07:06	17:54 (WEA Z811_ErhW)	07:06	07:44 (WEA A801)	07:56	08:31 (WEA A803)			
20	05:03	20:47 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
21	05:04	20:57 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
22	05:05	20:56 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	18:41	19	18:11 (WEA Z811_ErhW)	16:35	24	08:08 (WEA A801)	15:54	33	08:27 (WEA A803)		
23	05:06	20:57 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
24	05:07	20:58 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
25	05:08	20:56 (WEA Z801_wpd)	05:31	19:54 (WEA Z803_wpd)	06:22	19:12	17:55 (WEA Z811_ErhW)	07:06	17:54 (WEA Z811_ErhW)	07:06	07:44 (WEA A801)	07:56	08:31 (WEA A803)			
26	05:09	20:47 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
27	05:10	20:57 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
28	05:11	20:56 (WEA Z801_wpd)	05:26	19:55 (WEA Z803_wpd)	06:17	18:41	19	18:11 (WEA Z811_ErhW)	16:35	24	08:08 (WEA A801)	15:54	33	08:27 (WEA A803)		
29	05:12	20:57 (WEA Z801_wpd)	05:27	19:54 (WEA Z803_wpd)	06:19	19:17 (WEA Z805_wpd)	07:09	17:55 (WEA Z811_ErhW)	07:04	07:44 (WEA A801)	07:55	08:28 (WEA A802)				
30	05:13	20:58 (WEA Z801_wpd)	05:28	19:54 (WEA Z803_wpd)	19:47	3	18:37	14	18:09 (WEA Z811_ErhW)	16:31	25	08:09 (WEA A801)	15:53	33	08:30 (WEA A802)	
31	05:14	20:56 (WEA Z801_wpd)	05:31	19:54 (WEA Z803_wpd)	06:22	19:12	17:55 (WEA Z811_ErhW)	07:06	17:54 (WEA Z811_ErhW)	07:06	07:44 (WEA A801)	07:56	08:31 (WEA A803)			
Sonnenscheinstunden	165		165		165		165		165		165		165		165	
astronom.mögl.Beschattung	166		405		112		178		178		632		909		909	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-83 - SR-83, Neumühler Straße 12/13, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:19 (WEA V02)	07:47		05:35	04:49
2	16:00	09:49 (WEA V02)	16:49	15	08:29 (WEA V01)	17:42
3	08:15	09:21 (WEA V02)	07:44	18	08:30 (WEA V01)	17:44
4	16:03	09:50 (WEA V02)	16:53	20	08:31 (WEA V01)	17:46
5	08:15	09:21 (WEA V02)	07:42	22	08:33 (WEA V01)	17:47
6	16:04	09:52 (WEA V02)	16:51	24	08:31 (WEA V01)	17:44
7	08:15	09:21 (WEA V02)	07:39	26	08:33 (WEA V01)	17:49
8	16:06	09:50 (WEA V02)	16:59	28	08:34 (WEA V01)	17:51
9	08:13	09:44 (WEA V02)	07:36	30	08:30 (WEA V01)	17:47
10	16:07	09:51 (WEA V02)	17:00	1	08:34 (WEA V01)	17:53
11	08:13	09:43 (WEA V02)	07:34	3	08:30 (WEA V01)	17:45
12	16:10	09:50 (WEA V02)	17:04	5	08:34 (WEA V01)	17:56
13	08:13	09:43 (WEA V02)	07:34	7	08:30 (WEA V01)	17:45
14	16:11	09:51 (WEA V02)	17:05	9	08:34 (WEA V01)	17:57
15	08:13	09:43 (WEA V02)	07:34	11	08:30 (WEA V01)	17:45
16	16:12	09:51 (WEA V02)	17:06	13	08:34 (WEA V01)	17:58
17	08:11	09:42 (WEA V02)	07:30	15	08:30 (WEA V01)	17:40
18	16:13	09:51 (WEA V02)	17:08	17	08:34 (WEA V01)	18:00
19	08:11	09:42 (WEA V02)	07:28	19	08:30 (WEA V01)	17:38
20	16:15	09:51 (WEA V02)	17:10	21	08:33 (WEA V01)	18:02
21	08:10	09:40 (WEA V02)	07:26	23	08:31 (WEA V01)	17:36
22	16:16	09:51 (WEA V02)	17:12	25	08:33 (WEA V01)	18:04
23	08:09	09:39 (WEA V02)	07:24	27	08:32 (WEA V01)	17:38
24	16:18	09:50 (WEA V02)	17:14	29	08:32 (WEA V01)	18:05
25	08:08	09:38 (WEA V02)	07:22	31	08:33 (WEA V01)	17:40
26	16:19	09:50 (WEA V02)	17:16	1	08:31 (WEA V01)	18:07
27	08:08	09:37 (WEA V02)	07:20	3	08:35 (WEA V01)	18:19
28	16:21	09:49 (WEA V02)	17:18	5	08:29 (WEA V01)	18:09
29	08:07	09:36 (WEA V02)	07:18	7	08:35 (WEA V01)	18:14
30	16:22	09:48 (WEA V02)	17:19	9	08:26 (WEA V01)	18:11
31	08:06	09:34 (WEA V02)	07:16	11	08:32 (WEA V01)	18:14
1	16:24	09:46 (WEA V02)	17:21	13	08:31 (WEA V01)	18:13
2	08:05	09:33 (WEA V02)	07:14	15	08:32 (WEA V01)	18:12
3	16:26	09:45 (WEA V02)	17:23	17	08:31 (WEA V01)	18:14
4	08:04	09:32 (WEA V02)	07:12	19	08:30 (WEA V01)	18:12
5	16:27	09:46 (WEA V02)	17:25	21	08:30 (WEA V01)	18:16
6	08:03	09:31 (WEA V02)	07:10	23	08:30 (WEA V01)	18:17
7	16:29	09:47 (WEA V02)	17:27	25	08:29 (WEA V01)	18:18
8	08:03	09:31 (WEA V02)	07:08	27	08:30 (WEA V01)	18:16
9	16:31	09:47 (WEA V02)	17:29	29	08:30 (WEA V01)	18:20
10	08:03	09:31 (WEA V02)	07:06	31	08:30 (WEA V01)	18:20
11	16:33	09:47 (WEA V02)	17:31	1	08:30 (WEA V01)	18:21
12	07:59	09:38 (WEA V02)	07:04	3	08:30 (WEA V01)	18:20
13	16:34	09:47 (WEA V02)	17:33	5	08:29 (WEA V01)	18:23
14	07:57	09:38 (WEA V02)	07:02	7	08:29 (WEA V01)	18:23
15	16:36	09:46 (WEA V02)	17:34	9	08:29 (WEA V01)	18:25
16	07:56	09:40 (WEA V02)	06:59	11	08:29 (WEA V01)	18:25
17	16:38	09:46 (WEA V02)	17:36	13	08:29 (WEA V01)	18:27
18	07:55	09:40 (WEA V02)	06:57	15	08:29 (WEA V01)	18:27
19	16:40	09:45 (WEA V02)	17:38	17	08:29 (WEA V01)	18:28
20	07:53	09:42 (WEA V02)	06:55	19	08:29 (WEA V01)	18:28
21	16:42	09:45 (WEA V02)	17:40	21	08:29 (WEA V01)	18:30
22	07:52	09:41 (WEA V02)	06:54	23	08:29 (WEA V01)	18:30
23	16:43	09:45 (WEA V02)	17:41	25	08:29 (WEA V01)	18:32
24	07:50	09:39 (WEA V02)	06:52	27	08:29 (WEA V01)	18:32
25	16:45	09:45 (WEA V02)	17:42	29	08:29 (WEA V01)	18:34
26	07:49	09:36 (WEA V02)	06:51	31	08:29 (WEA V01)	18:34
27	16:47	09:45 (WEA V02)	17:43	1	08:29 (WEA V01)	18:35
28	07:48	09:35 (WEA V02)	06:50	3	08:29 (WEA V01)	18:35
29	16:49	09:45 (WEA V02)	17:44	5	08:29 (WEA V01)	18:37
30	07:47	09:34 (WEA V02)	06:49	7	08:29 (WEA V01)	18:37
31	16:51	09:45 (WEA V02)	17:45	9	08:29 (WEA V01)	18:39
Sommerschneidstunden	256	276	307	417	488	502
astrmax.mögl.Beschattung	766	346	174	213	374	81

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-83 - SR-83, Neumühler Straße 12/13, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	19:58 (WEA2803_wpd)	06:14	19:17 (WEA2805_wpd)	07:04
2	21:30	20:58	23 20:21 (WEA2803_wpd)	19:54	18:44	20 18:15 (WEA2811_EhW)
3	04:46	05:24	19:58 (WEA2803_wpd)	06:15	07:05	17:56 (WEA2811_EhW)
4	21:29	20:56	22 20:20 (WEA2803_wpd)	19:52	18:41	18 18:14 (WEA2811_EhW)
5	04:46	05:26	19:58 (WEA2803_wpd)	06:17	07:07	17:56 (WEA2811_EhW)
6	21:28	20:54	22 20:20 (WEA2803_wpd)	19:50	18:39	15 18:11 (WEA2811_EhW)
7	04:46	05:27	19:58 (WEA2803_wpd)	06:19	07:09	17:57 (WEA2811_EhW)
8	21:29	20:52	22 20:20 (WEA2803_wpd)	19:47	18:37	12 18:09 (WEA2811_EhW)
9	04:46	05:29	19:59 (WEA2803_wpd)	06:20	07:11	17:57 (WEA2811_EhW)
10	21:29	20:51	21 20:20 (WEA2803_wpd)	19:45	18:34	9 18:06 (WEA2811_EhW)
11	04:46	05:31	19:59 (WEA2803_wpd)	06:22	07:12	18:00 (WEA2811_EhW)
12	21:28	20:49	20 20:19 (WEA2803_wpd)	19:43	18:32	4 18:04 (WEA2811_EhW)
13	04:46	05:32	20:00 (WEA2803_wpd)	06:24	07:14	18:00 (WEA2811_EhW)
14	21:28	20:47	17 20:17 (WEA2803_wpd)	19:41	18:30	16:26 21 08:02 (WEA2803_wpd)
15	04:45	05:34	20:00 (WEA2803_wpd)	06:25	07:16	17:42 (WEA2803_wpd)
16	21:27	20:45	15 20:15 (WEA2803_wpd)	19:38	18:27	16:24 20 08:02 (WEA2803_wpd)
17	04:45	05:35	20:02 (WEA2803_wpd)	06:27	07:18	17:43 (WEA2803_wpd)
18	21:26	20:43	12 20:14 (WEA2803_wpd)	19:36	18:25	16:22 18 08:01 (WEA2803_wpd)
19	04:45	05:37	20:04 (WEA2803_wpd)	06:29	07:19	17:45 (WEA2803_wpd)
20	21:25	20:41	9 20:13 (WEA2803_wpd)	19:33	18:23	16:20 15 08:00 (WEA2803_wpd)
21	04:45	05:39	20:07 (WEA2803_wpd)	06:30	07:21	17:47 (WEA2803_wpd)
22	21:25	20:39	3 20:10 (WEA2803_wpd)	19:31	18:21	16:19 11 07:58 (WEA2803_wpd)
23	04:45	05:40	20:09	06:32	07:23	17:50 (WEA2803_wpd)
24	21:24	20:37	19:29	19:29	18:18	16:17 7 08:21 (WEA2803_wpd)
25	04:45	05:42	06:34	06:34	07:25	18:16 (WEA2803_wpd)
26	21:23	20:35	19:26	19:26	18:16	16:16 9 08:20 (WEA2803_wpd)
27	04:45	05:44	06:35	06:35	07:26	18:14 (WEA2803_wpd)
28	21:22	20:33	19:24	19:24	18:14	16:14 13 08:20 (WEA2803_wpd)
29	04:45	05:45	06:37	06:37	07:28	18:13 (WEA2803_wpd)
30	21:21	20:31	19:22	19:22	18:12	16:13 15 08:20 (WEA2803_wpd)
31	04:45	05:47	06:38	06:38	07:30	18:11 (WEA2803_wpd)
1	21:20	20:29	19:19	19:19	18:09	16:11 16 08:20 (WEA2803_wpd)
2	04:45	05:48	06:40	06:40	07:32	18:08 (WEA2803_wpd)
3	21:19	20:27	19:17	19:17	18:07	16:10 18 08:30 (WEA2803_wpd)
4	04:45	05:50	06:42	06:42	07:33	18:07 (WEA2803_wpd)
5	21:18	20:25	19:15	19:15	18:05	16:09 19 08:31 (WEA2803_wpd)
6	04:45	05:52	06:44	06:44	07:35	18:07 (WEA2803_wpd)
7	21:17	20:23	19:12	19:12	18:03	16:07 20 08:32 (WEA2803_wpd)
8	04:45	05:54	06:45	06:45	07:37	18:03 (WEA2803_wpd)
9	21:15	20:21	19:10	19:10	18:01	16:06 20 08:31 (WEA2803_wpd)
10	04:45	05:56	06:47	06:47	07:39	18:01 (WEA2803_wpd)
11	21:14	20:19	19:07	19:07	17:59	16:05 21 08:32 (WEA2803_wpd)
12	04:45	05:57	06:49	06:49	07:41	18:00 (WEA2803_wpd)
13	21:13	20:17	19:04	19:04	17:57	16:04 20 08:32 (WEA2803_wpd)
14	04:45	05:59	06:50	06:50	07:42	18:00 (WEA2803_wpd)
15	21:11	20:16	19:03	19:03	17:54	16:02 20 08:32 (WEA2803_wpd)
16	04:45	06:00	06:52	06:52	07:44	18:00 (WEA2803_wpd)
17	21:10	20:14	19:00	19:00	17:52	16:01 30 08:31 (WEA2803_wpd)
18	04:45	06:02	06:54	06:54	07:46	18:00 (WEA2803_wpd)
19	21:09	20:13	18:58	18:58	17:50	16:00 31 08:31 (WEA2803_wpd)
20	04:45	06:04	06:55	06:55	07:48	18:00 (WEA2803_wpd)
21	21:07	20:11	18:56	18:56	17:48	16:00 34 08:31 (WEA2803_wpd)
22	04:45	06:05	06:57	06:57	07:50	18:00 (WEA2803_wpd)
23	21:06	20:10	18:53	18:53	17:46	16:00 35 08:31 (WEA2803_wpd)
24	04:45	06:07	06:59	06:59	07:51	18:00 (WEA2803_wpd)
25	21:04	20:09	18:51	18:51	17:44	16:00 35 08:31 (WEA2803_wpd)
26	04:45	06:09	07:00	07:00	07:53	18:00 (WEA2803_wpd)
27	21:03	20:08	18:48	18:48	17:42	16:00 36 08:31 (WEA2803_wpd)
28	04:45	06:10	07:02	07:02	07:54	18:00 (WEA2803_wpd)
29	21:02	20:07	18:46	18:46	17:40	16:00 36 08:31 (WEA2803_wpd)
30	04:45	06:11	07:04	07:04	07:55	18:00 (WEA2803_wpd)
31	21:01	20:06	18:44	18:44	17:38	16:00 36 08:31 (WEA2803_wpd)
Sonnenscheinstunden	156	157	157	157	156	156
astr.mögl.Beschattung	190	384	115	211	264	932

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-84 - SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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 08:15	09:12 (WEA VB02) 07:47	08:14 (WEA VB01)06:53		05:35	04:49
16:00	30 09:42 (WEA VB02) 16:49	7 08:21 (WEA VB01)17:42		20:29	21:16
2 08:15	09:13 (WEA VB02) 07:46	08:12 (WEA VB01)06:51		05:33	04:48
16:01	30 09:43 (WEA VB02) 16:51	11 08:23 (WEA VB01)17:44		20:31	21:17
3 08:15	09:14 (WEA VB02) 07:44	08:10 (WEA VB01)06:48		05:31	04:47
16:03	29 09:43 (WEA VB02) 16:53	15 08:25 (WEA VB01)17:46		20:33	21:18
4 08:15	09:14 (WEA VB02) 07:42	08:09 (WEA VB01)06:46		05:29	19:57 (WEA ZB03_wpd)04:46
16:04	29 09:43 (WEA VB02) 16:55	18 08:27 (WEA VB01)17:47		20:34	8 20:05 (WEA ZB03_wpd)21:19
5 08:14	09:15 (WEA VB02) 07:41	08:08 (WEA VB01)06:44		05:27	19:55 (WEA ZB03_wpd)04:45
16:05	29 09:44 (WEA VB02) 16:57	20 08:28 (WEA VB01)17:49		20:36	11 20:06 (WEA ZB03_wpd)21:20
6 08:14	09:15 (WEA VB02) 07:39	08:07 (WEA VB01)06:42		05:25	19:54 (WEA ZB03_wpd)04:45
16:06	29 09:44 (WEA VB02) 16:59	22 08:29 (WEA VB01)17:51		05:23	15 20:09 (WEA ZB03_wpd)21:21
7 08:14	09:16 (WEA VB02) 07:37	08:07 (WEA VB01)06:39	17:24 (WEA ZB11_EnBW)06:27	05:24	19:52 (WEA ZB03_wpd)04:44
16:07	28 09:44 (WEA VB02) 17:00	22 08:29 (WEA VB01)17:53	3 17:27 (WEA ZB11_EnBW)19:48	20:30	18 20:10 (WEA ZB03_wpd)21:22
8 08:13	09:16 (WEA VB02) 07:36	08:06 (WEA VB01)06:37	17:20 (WEA ZB11_EnBW)06:25	05:22	19:51 (WEA ZB03_wpd)04:44
16:09	28 09:44 (WEA VB02) 17:02	24 08:30 (WEA VB01)17:55	8 17:28 (WEA ZB11_EnBW)19:49	05:21	20 20:11 (WEA ZB03_wpd)21:23
9 08:13	09:16 (WEA VB02) 07:34	08:06 (WEA VB01)06:35	17:19 (WEA ZB11_EnBW)06:22	05:20	19:51 (WEA ZB03_wpd)04:43
16:10	28 09:44 (WEA VB02) 17:04	24 08:30 (WEA VB01)17:56	11 17:30 (WEA ZB11_EnBW)19:51	20:43	21 20:12 (WEA ZB03_wpd)21:24
10 08:12	09:18 (WEA VB02) 07:32	08:06 (WEA VB01)06:33	17:18 (WEA ZB11_EnBW)06:20	05:18	19:50 (WEA ZB03_wpd)04:43
16:12	27 09:45 (WEA VB02) 17:06	24 08:30 (WEA VB01)17:58	15 17:33 (WEA ZB11_EnBW)19:53	20:44	22 20:12 (WEA ZB03_wpd)21:25
11 08:11	09:18 (WEA VB02) 07:30	08:06 (WEA VB01)06:30	17:16 (WEA ZB11_EnBW)06:18	19:21 (WEA ZB05_wpd)05:17	19:50 (WEA ZB03_wpd)04:42
16:13	27 09:45 (WEA VB02) 17:08	24 08:30 (WEA VB01)18:00	18 17:34 (WEA ZB11_EnBW)19:55	7 19:28 (WEA ZB05_wpd)20:46	23 20:13 (WEA ZB03_wpd)21:26
12 08:11	09:19 (WEA VB02) 07:28	08:06 (WEA VB01)06:28	17:16 (WEA ZB11_EnBW)06:16	19:19 (WEA ZB05_wpd)05:15	19:50 (WEA ZB03_wpd)04:42
16:15	26 09:45 (WEA VB02) 17:10	24 08:30 (WEA VB01)18:02	19 17:35 (WEA ZB11_EnBW)19:56	11 19:30 (WEA ZB05_wpd)20:48	23 20:13 (WEA ZB03_wpd)21:26
13 08:10	09:19 (WEA VB02) 07:26	08:07 (WEA VB01)06:26	17:16 (WEA ZB11_EnBW)06:13	19:17 (WEA ZB05_wpd)05:13	19:49 (WEA ZB03_wpd)04:42
16:16	26 09:45 (WEA VB02) 17:12	22 08:29 (WEA VB01)18:04	20 17:36 (WEA ZB11_EnBW)19:58	15 19:32 (WEA ZB05_wpd)20:49	23 20:12 (WEA ZB03_wpd)21:27
14 08:09	09:20 (WEA VB02) 07:24	08:07 (WEA VB01)06:23	17:15 (WEA ZB11_EnBW)06:11	19:15 (WEA ZB05_wpd)05:12	19:50 (WEA ZB03_wpd)04:41
16:18	25 09:45 (WEA VB02) 17:14	22 08:29 (WEA VB01)18:05	20 17:35 (WEA ZB11_EnBW)20:00	17 19:32 (WEA ZB05_wpd)20:51	23 20:13 (WEA ZB03_wpd)21:28
15 08:08	09:21 (WEA VB02) 07:22	08:08 (WEA VB01)06:21	17:15 (WEA ZB11_EnBW)06:09	19:15 (WEA ZB05_wpd)05:10	19:49 (WEA ZB03_wpd)04:41
16:19	23 09:44 (WEA VB02) 17:16	20 08:28 (WEA VB01)18:07	19 17:34 (WEA ZB11_EnBW)20:01	19 19:34 (WEA ZB05_wpd)20:52	23 20:12 (WEA ZB03_wpd)21:28
16 08:08	09:22 (WEA VB02) 07:20	08:09 (WEA VB01)06:19	17:16 (WEA ZB11_EnBW)06:07	19:14 (WEA ZB05_wpd)05:08	19:50 (WEA ZB03_wpd)04:41
16:21	22 09:44 (WEA VB02) 17:18	18 08:27 (WEA VB01)18:09	18 17:34 (WEA ZB11_EnBW)20:03	21 19:35 (WEA ZB05_wpd)20:54	23 20:13 (WEA ZB03_wpd)21:29
17 08:07	09:24 (WEA VB02) 07:18	08:11 (WEA VB01)06:16	17:16 (WEA ZB11_EnBW)06:04	19:14 (WEA ZB05_wpd)05:07	19:50 (WEA ZB03_wpd)04:41
16:22	20 09:44 (WEA VB02) 17:19	14 08:25 (WEA VB01)18:11	16 17:32 (WEA ZB11_EnBW)20:05	21 19:35 (WEA ZB05_wpd)20:56	23 20:13 (WEA ZB03_wpd)21:29
18 08:06	09:25 (WEA VB02) 07:16	08:14 (WEA VB01)06:14	17:18 (WEA ZB11_EnBW)06:02	19:14 (WEA ZB05_wpd)05:05	19:50 (WEA ZB03_wpd)04:41
16:24	18 09:43 (WEA VB02) 17:21	9 08:23 (WEA VB01)18:13	12 17:30 (WEA ZB11_EnBW)20:07	21 19:35 (WEA ZB05_wpd)20:57	22 20:12 (WEA ZB03_wpd)21:30
19 08:05	09:26 (WEA VB02) 07:14	06:12	17:20 (WEA ZB11_EnBW)06:00	19:14 (WEA ZB05_wpd)05:04	19:51 (WEA ZB03_wpd)04:41
16:26	15 09:41 (WEA VB02) 17:23	18:14	7 17:27 (WEA ZB11_EnBW)20:08	20 19:34 (WEA ZB05_wpd)20:59	21 20:12 (WEA ZB03_wpd)21:30
20 08:04	09:29 (WEA VB02) 07:12	06:09		20:10	20 19:33 (WEA ZB05_wpd)21:00
16:27	11 09:40 (WEA VB02) 17:25	18:16		05:56	19:53 (WEA ZB03_wpd)04:41
21 08:02	09:32 (WEA VB02) 07:10	06:07		05:56	19:53 (WEA ZB03_wpd)04:41
22 08:01	5 09:37 (WEA VB02) 17:27	18:18		20:12	18 19:32 (WEA ZB05_wpd)21:02
16:31		06:05		05:54	19:52 (WEA ZB03_wpd)04:41
23 08:00		06:02		05:51	19:51 (WEA ZB03_wpd)04:41
16:33		17:31		05:49	19:50 (WEA ZB03_wpd)04:41
24 07:59		07:04		05:49	19:55 (WEA ZB03_wpd)04:42
16:34		17:33		20:17	9 19:27 (WEA ZB05_wpd)21:06
25 07:58		07:02		05:47	13 20:08 (WEA ZB03_wpd)21:31
16:36		18:25		20:19	19:56 (WEA ZB03_wpd)04:42
26 07:56		06:59		05:45	11 20:07 (WEA ZB03_wpd)21:31
16:38		17:35		20:21	8 20:06 (WEA ZB03_wpd)21:31
27 07:55		06:57		05:43	
16:40		17:38		20:22	
28 07:53		06:55		05:41	
16:42		17:40		20:24	
29 07:52				05:39	
16:44				20:26	
30 07:50				05:37	
31 07:49				20:27	
16:47					
Sonnenscheinstunden	256	276	367	417	488
astr.max.mögl.Beschattung	505	340	186	228	420

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-84 - SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember																																																													
1	04:45	05:22	20:00 (WEA Z803_wpd)	06:14	19:20 (WEA Z805_wpd)	07:04	17:54 (WEA Z811_EhW)	06:59	07:25 (WEA A801)	07:51	09:00 (WEA A802)																																																								
2	04:30	05:08	20:23 (WEA Z803_wpd)	05:54	18:44	20	18:14 (WEA Z811_EhW)	06:36	25	08:00 (WEA A801)	15:55	27	09:27 (WEA A802)																																																						
3	04:15	04:54	20:46 (WEA Z803_wpd)	05:34	18:14	19	17:55 (WEA Z811_EhW)	07:01	23	07:36 (WEA A801)	15:54	27	09:00 (WEA A802)																																																						
4	04:00	04:39	21:09 (WEA Z803_wpd)	05:14	17:44	18	17:35 (WEA Z811_EhW)	07:02	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
5	03:45	04:24	21:32 (WEA Z803_wpd)	04:54	17:14	17	17:15 (WEA Z811_EhW)	07:03	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
6	03:30	04:09	21:55 (WEA Z803_wpd)	04:34	16:44	16	16:55 (WEA Z811_EhW)	07:04	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
7	03:15	03:54	22:18 (WEA Z803_wpd)	04:14	16:14	15	16:35 (WEA Z811_EhW)	07:05	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
8	03:00	03:39	22:41 (WEA Z803_wpd)	03:54	15:44	14	16:15 (WEA Z811_EhW)	07:06	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
9	02:45	03:24	23:04 (WEA Z803_wpd)	03:34	15:14	13	15:55 (WEA Z811_EhW)	07:07	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
10	02:30	03:09	23:27 (WEA Z803_wpd)	03:14	14:44	12	15:35 (WEA Z811_EhW)	07:08	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
11	02:15	02:54	23:50 (WEA Z803_wpd)	02:54	14:14	11	15:15 (WEA Z811_EhW)	07:09	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
12	02:00	02:39	24:13 (WEA Z803_wpd)	02:34	13:44	10	14:55 (WEA Z811_EhW)	07:10	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
13	01:45	02:24	24:36 (WEA Z803_wpd)	02:14	13:14	9	14:35 (WEA Z811_EhW)	07:11	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
14	01:30	02:09	24:59 (WEA Z803_wpd)	01:54	12:44	8	14:15 (WEA Z811_EhW)	07:12	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
15	01:15	01:54	25:22 (WEA Z803_wpd)	01:34	12:14	7	13:55 (WEA Z811_EhW)	07:13	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
16	01:00	01:39	25:45 (WEA Z803_wpd)	01:14	11:44	6	13:35 (WEA Z811_EhW)	07:14	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
17	00:45	01:24	26:08 (WEA Z803_wpd)	00:54	11:14	5	13:15 (WEA Z811_EhW)	07:15	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
18	00:30	01:09	26:31 (WEA Z803_wpd)	00:34	10:44	4	12:55 (WEA Z811_EhW)	07:16	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
19	00:15	00:54	26:54 (WEA Z803_wpd)	00:14	10:14	3	12:35 (WEA Z811_EhW)	07:17	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
20	00:00	00:39	27:17 (WEA Z803_wpd)	00:00	09:44	2	12:15 (WEA Z811_EhW)	07:18	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
21	00:00	00:24	27:40 (WEA Z803_wpd)	00:00	09:14	1	11:55 (WEA Z811_EhW)	07:19	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
22	00:00	00:09	28:03 (WEA Z803_wpd)	00:00	08:44	0	11:35 (WEA Z811_EhW)	07:20	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
23	00:00	00:00	28:26 (WEA Z803_wpd)	00:00	08:14	0	11:15 (WEA Z811_EhW)	07:21	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
24	00:00	00:00	28:49 (WEA Z803_wpd)	00:00	07:44	0	10:55 (WEA Z811_EhW)	07:22	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
25	00:00	00:00	29:12 (WEA Z803_wpd)	00:00	07:14	0	10:35 (WEA Z811_EhW)	07:23	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
26	00:00	00:00	29:35 (WEA Z803_wpd)	00:00	06:44	0	10:15 (WEA Z811_EhW)	07:24	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
27	00:00	00:00	29:58 (WEA Z803_wpd)	00:00	06:14	0	09:55 (WEA Z811_EhW)	07:25	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
28	00:00	00:00	30:21 (WEA Z803_wpd)	00:00	05:44	0	09:35 (WEA Z811_EhW)	07:26	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
29	00:00	00:00	30:44 (WEA Z803_wpd)	00:00	05:14	0	09:15 (WEA Z811_EhW)	07:27	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
30	00:00	00:00	31:07 (WEA Z803_wpd)	00:00	04:44	0	08:55 (WEA Z811_EhW)	07:28	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
31	00:00	00:00	31:30 (WEA Z803_wpd)	00:00	04:14	0	08:35 (WEA Z811_EhW)	07:29	23	07:36 (WEA A801)	15:54	28	09:00 (WEA A802)																																																						
Sonnenscheinstunden	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200																						
astr.max.mögl.Beschattung	269	271	273	275	277	279	281	283	285	287	289	291	293	295	297	299	301	303	305	307	309	311	313	315	317	319	321	323	325	327	329	331	333	335	337	339	341	343	345	347	349	351	353	355	357	359	361	363	365	367	369	371	373	375	377	379	381	383	385	387	389	391	393	395	397	399	401

**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	Schattenanfang (WEA mit erstem Schatten)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.636

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-85 - SR-85, Neumühler Straße 10, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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 08:15	09:08 (WEA VB02) 07:47	06:53	06:41	05:35	04:49
16:00	29 09:37 (WEA VB02) 16:49	17:42	19:37	20:29	21:16
2 08:15	09:09 (WEA VB02) 07:46	08:12 (WEA VB01) 06:51	06:39	05:33	04:48
16:01	29 09:38 (WEA VB02) 16:51	8 08:20 (WEA VB01) 17:44	19:39	20:31	21:17
3 08:15	09:10 (WEA VB02) 07:44	08:10 (WEA VB01) 06:48	06:36	05:31	04:47
16:03	29 09:39 (WEA VB02) 16:53	12 08:22 (WEA VB01) 17:46	19:41	20:33	21:18
4 08:15	09:09 (WEA VB02) 07:42	08:09 (WEA VB01) 06:46	06:34	05:29	04:46
16:04	30 09:39 (WEA VB02) 16:55	15 08:24 (WEA VB01) 17:47	19:42	20:34	21:19
5 08:14	09:10 (WEA VB02) 07:41	08:07 (WEA VB01) 06:44	06:32	05:27	04:45
16:05	29 09:39 (WEA VB02) 16:57	18 08:25 (WEA VB01) 17:49	19:44	20:36	21:20
6 08:14	09:10 (WEA VB02) 07:39	08:06 (WEA VB01) 06:42	06:29	05:25	04:45
16:06	29 09:39 (WEA VB02) 16:59	20 08:26 (WEA VB01) 17:51	19:46	20:38	21:21
7 08:14	09:11 (WEA VB02) 07:37	08:05 (WEA VB01) 06:39	17:21 (WEA ZB11_EnBW) 06:27	05:24	19:54 (WEA ZB03_wpd) 04:44
16:07	29 09:40 (WEA VB02) 17:00	22 08:27 (WEA VB01) 17:53	6 17:27 (WEA ZB11_EnBW) 19:48	16 20:10 (WEA ZB03_wpd) 21:22	20:39
8 08:13	09:12 (WEA VB02) 07:36	08:05 (WEA VB01) 06:37	17:18 (WEA ZB11_EnBW) 06:25	05:22	19:52 (WEA ZB03_wpd) 04:44
16:09	28 09:40 (WEA VB02) 17:02	22 08:27 (WEA VB01) 17:55	10 17:28 (WEA ZB11_EnBW) 19:49	12 20:11 (WEA ZB03_wpd) 21:23	20:41
9 08:13	09:12 (WEA VB02) 07:34	08:04 (WEA VB01) 06:35	17:16 (WEA ZB11_EnBW) 06:22	05:20	19:52 (WEA ZB03_wpd) 04:43
16:10	28 09:40 (WEA VB02) 17:04	23 08:27 (WEA VB01) 17:56	14 17:30 (WEA ZB11_EnBW) 19:51	16 20:13 (WEA ZB03_wpd) 21:24	20:43
10 08:12	09:13 (WEA VB02) 07:32	08:04 (WEA VB01) 06:33	17:16 (WEA ZB11_EnBW) 06:20	05:18	19:51 (WEA ZB03_wpd) 04:43
16:12	28 09:41 (WEA VB02) 17:06	24 08:28 (WEA VB01) 17:58	17 17:33 (WEA ZB11_EnBW) 19:53	19 20:15 (WEA ZB03_wpd) 21:25	20:44
11 08:11	09:14 (WEA VB02) 07:30	08:04 (WEA VB01) 06:30	17:14 (WEA ZB11_EnBW) 06:18	19:21 (WEA ZB05_wpd) 05:17	19:51 (WEA ZB03_wpd) 04:42
16:13	27 09:41 (WEA VB02) 17:08	24 08:28 (WEA VB01) 18:00	20 17:34 (WEA ZB11_EnBW) 19:55	7 19:28 (WEA ZB05_wpd) 20:46	23 20:14 (WEA ZB03_wpd) 21:26
12 08:11	09:14 (WEA VB02) 07:28	08:04 (WEA VB01) 06:28	17:14 (WEA ZB11_EnBW) 06:16	19:19 (WEA ZB05_wpd) 05:15	19:50 (WEA ZB03_wpd) 04:42
16:15	27 09:41 (WEA VB02) 17:10	24 08:28 (WEA VB01) 18:02	20 17:34 (WEA ZB11_EnBW) 19:56	11 19:30 (WEA ZB05_wpd) 20:48	24 20:14 (WEA ZB03_wpd) 21:26
13 08:10	09:15 (WEA VB02) 07:26	08:05 (WEA VB01) 06:26	17:14 (WEA ZB11_EnBW) 06:13	19:17 (WEA ZB05_wpd) 05:13	19:50 (WEA ZB03_wpd) 04:42
16:16	26 09:41 (WEA VB02) 17:12	22 08:27 (WEA VB01) 18:04	20 17:34 (WEA ZB11_EnBW) 19:58	15 19:32 (WEA ZB05_wpd) 20:49	23 20:13 (WEA ZB03_wpd) 21:27
14 08:09	09:16 (WEA VB02) 07:24	08:05 (WEA VB01) 06:23	17:13 (WEA ZB11_EnBW) 06:11	19:15 (WEA ZB05_wpd) 05:12	19:50 (WEA ZB03_wpd) 04:41
16:18	25 09:41 (WEA VB02) 17:14	22 08:27 (WEA VB01) 18:05	20 17:33 (WEA ZB11_EnBW) 20:00	17 19:32 (WEA ZB05_wpd) 20:51	24 20:14 (WEA ZB03_wpd) 21:28
15 08:08	09:16 (WEA VB02) 07:22	08:06 (WEA VB01) 06:21	17:14 (WEA ZB11_EnBW) 06:09	19:14 (WEA ZB05_wpd) 05:10	19:51 (WEA ZB03_wpd) 04:41
16:19	25 09:41 (WEA VB02) 17:16	20 08:26 (WEA VB01) 18:07	19 17:33 (WEA ZB11_EnBW) 20:01	20 19:34 (WEA ZB05_wpd) 20:52	23 20:14 (WEA ZB03_wpd) 21:28
16 08:08	09:17 (WEA VB02) 07:20	08:07 (WEA VB01) 06:19	17:15 (WEA ZB11_EnBW) 06:07	19:14 (WEA ZB05_wpd) 05:08	19:50 (WEA ZB03_wpd) 04:41
16:21	23 09:40 (WEA VB02) 17:18	18 08:25 (WEA VB01) 18:09	17 17:32 (WEA ZB11_EnBW) 20:03	21 19:35 (WEA ZB05_wpd) 20:54	24 20:14 (WEA ZB03_wpd) 21:29
17 08:07	09:19 (WEA VB02) 07:18	08:09 (WEA VB01) 06:16	17:15 (WEA ZB11_EnBW) 06:04	19:14 (WEA ZB05_wpd) 05:07	19:51 (WEA ZB03_wpd) 04:41
16:22	21 09:40 (WEA VB02) 17:19	15 08:24 (WEA VB01) 18:11	15 17:30 (WEA ZB11_EnBW) 20:05	21 19:35 (WEA ZB05_wpd) 20:56	23 20:14 (WEA ZB03_wpd) 21:29
18 08:06	09:20 (WEA VB02) 07:16	08:11 (WEA VB01) 06:14	17:17 (WEA ZB11_EnBW) 06:02	19:13 (WEA ZB05_wpd) 05:05	19:50 (WEA ZB03_wpd) 04:41
16:24	20 09:40 (WEA VB02) 17:21	10 08:21 (WEA VB01) 18:13	11 17:28 (WEA ZB11_EnBW) 20:07	22 19:35 (WEA ZB05_wpd) 20:57	23 20:13 (WEA ZB03_wpd) 21:30
19 08:05	09:21 (WEA VB02) 07:14	06:12	17:20 (WEA ZB11_EnBW) 06:00	19:14 (WEA ZB05_wpd) 05:04	19:51 (WEA ZB03_wpd) 04:41
16:26	17 09:38 (WEA VB02) 17:23	18:14	3 17:23 (WEA ZB11_EnBW) 20:08	20 19:34 (WEA ZB05_wpd) 20:59	22 20:13 (WEA ZB03_wpd) 21:30
20 08:04	09:22 (WEA VB02) 07:12	06:09	05:58	19:13 (WEA ZB05_wpd) 05:02	19:52 (WEA ZB03_wpd) 04:41
16:27	15 09:37 (WEA VB02) 17:25	18:16	20:10	20 19:33 (WEA ZB05_wpd) 21:00	21 20:13 (WEA ZB03_wpd) 21:30
21 08:02	09:25 (WEA VB02) 07:10	06:07	05:56	19:13 (WEA ZB05_wpd) 05:01	19:52 (WEA ZB03_wpd) 04:41
16:29	11 09:36 (WEA VB02) 17:27	18:18	20:12	19 19:32 (WEA ZB05_wpd) 21:02	21 20:13 (WEA ZB03_wpd) 21:31
22 08:01	09:29 (WEA VB02) 07:08	06:05	05:54	19:14 (WEA ZB05_wpd) 05:00	19:52 (WEA ZB03_wpd) 04:41
16:31	4 09:33 (WEA VB02) 17:29	18:20	20:14	17 19:31 (WEA ZB05_wpd) 21:03	20 20:12 (WEA ZB03_wpd) 21:31
23 08:00	07:06	06:02	05:51	19:15 (WEA ZB05_wpd) 04:58	19:53 (WEA ZB03_wpd) 04:42
16:33	17:31	18:21	20:15	15 19:30 (WEA ZB05_wpd) 21:04	19:52 (WEA ZB03_wpd) 21:31
24 07:59	07:04	06:00	05:49	19:17 (WEA ZB05_wpd) 04:57	19:54 (WEA ZB03_wpd) 04:42
16:34	17:33	18:23	20:17	11 19:28 (WEA ZB05_wpd) 21:06	17 20:11 (WEA ZB03_wpd) 21:31
25 07:58	07:02	05:57	05:47	19:20 (WEA ZB05_wpd) 04:56	19:55 (WEA ZB03_wpd) 04:42
16:36	17:34	18:25	20:19	4 19:24 (WEA ZB05_wpd) 21:07	15 20:10 (WEA ZB03_wpd) 21:31
26 07:56	06:59	05:55	05:45	04:55	19:56 (WEA ZB03_wpd) 04:43
16:38	17:36	18:27	20:21	13 19:09 (WEA ZB05_wpd) 21:09	13 20:09 (WEA ZB03_wpd) 21:31
27 07:55	06:57	05:53	05:43	04:54	19:57 (WEA ZB03_wpd) 04:43
16:40	17:38	18:28	20:22	21:10	11 20:08 (WEA ZB03_wpd) 21:31
28 07:53	06:55	05:50	05:41	04:53	19:59 (WEA ZB03_wpd) 04:44
16:42	17:40	18:30	20:24	21:11	7 20:06 (WEA ZB03_wpd) 21:31
29 07:52	06:54	05:48	05:39	04:51	04:44
16:44	17:42	18:32	20:26	21:13	21:31
30 07:50	06:53	05:46	05:37	04:50	04:45
16:45	17:44	18:34	20:27	21:14	21:31
31 07:49	06:52	05:44	05:36	04:49	04:45
16:47	17:46	18:36	20:29	21:15	21:31
Sonnenscheinstunden	256	276	367	417	240
astr.max.mögl.Beschattung	529	319	192	64	502

**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)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-85 - SR-85, Neumühler Straße 10, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember							
1	04:45	05:23	20:01 (WEA Z803_wpd)	06:14	19:20 (WEA Z805_wpd)	07:04	17:53 (WEA Z811_EhW)	06:59	07:24 (WEA A801)	07:51	08:56 (WEA A802)		
2	04:46	05:28	20:24 (WEA Z803_wpd)	06:14	18:44	20	18:13 (WEA Z811_EhW)	06:56	23	07:57 (WEA A801)	07:55	27	08:51 (WEA A802)
3	04:48	05:29	20:01 (WEA Z803_wpd)	06:15	18:41	20	18:11 (WEA Z811_EhW)	06:56	23	07:57 (WEA A801)	07:54	28	08:51 (WEA A802)
4	04:47	05:26	20:02 (WEA Z803_wpd)	06:17	18:37	20	17:53 (WEA Z811_EhW)	07:02	23	07:57 (WEA A801)	07:54	28	08:56 (WEA A802)
5	04:49	05:31	20:23 (WEA Z803_wpd)	06:19	18:39	18	18:11 (WEA Z811_EhW)	06:53	23	07:57 (WEA A801)	07:58	28	08:56 (WEA A802)
6	04:48	05:27	20:02 (WEA Z803_wpd)	06:19	18:37	15	18:09 (WEA Z811_EhW)	07:04	23	07:56 (WEA A801)	07:55	28	08:56 (WEA A802)
7	04:50	05:29	20:01 (WEA Z803_wpd)	06:20	18:34	12	17:54 (WEA Z811_EhW)	07:06	20	07:56 (WEA A801)	07:56	28	08:56 (WEA A802)
8	04:51	05:31	20:21 (WEA Z803_wpd)	06:20	18:34	12	18:06 (WEA Z811_EhW)	06:59	20	07:56 (WEA A801)	07:55	28	08:56 (WEA A802)
9	04:51	05:31	20:04 (WEA Z803_wpd)	06:22	18:32	9	18:04 (WEA Z811_EhW)	06:57	18	07:55 (WEA A801)	07:55	29	08:56 (WEA A802)
10	04:51	05:32	20:05 (WEA Z803_wpd)	06:24	18:30	4	18:02 (WEA Z811_EhW)	06:56	15	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
11	04:51	05:34	20:07 (WEA Z803_wpd)	06:25	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
12	04:51	05:35	20:08 (WEA Z803_wpd)	06:26	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
13	04:51	05:35	20:09 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
14	04:51	05:35	20:10 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
15	04:51	05:35	20:11 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
16	04:51	05:35	20:12 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
17	04:51	05:35	20:13 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
18	04:51	05:35	20:14 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
19	04:51	05:35	20:15 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
20	04:51	05:35	20:16 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
21	04:51	05:35	20:17 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
22	04:51	05:35	20:18 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
23	04:51	05:35	20:19 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
24	04:51	05:35	20:20 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
25	04:51	05:35	20:21 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
26	04:51	05:35	20:22 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
27	04:51	05:35	20:23 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
28	04:51	05:35	20:24 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
29	04:51	05:35	20:25 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
30	04:51	05:35	20:26 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
31	04:51	05:35	20:27 (WEA Z803_wpd)	06:27	18:27	11	18:02 (WEA Z811_EhW)	06:56	11	07:54 (WEA A801)	07:55	29	08:56 (WEA A802)
Sonnenscheinstunden	156	156	156	156	156	156	156	156	156	156	156	156	156
astr.max.mögl.Beschattung	320	374	404	404	381	311	261	264	273	281	285	285	285

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-86 - SR-86, Neumühler Straße 9, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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 08:15 16:00	09:04 (WEA VB02) 07:47 29 09:33 (WEA VB02) 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16
2 08:15 16:01	09:05 (WEA VB02) 07:46 29 09:34 (WEA VB02) 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:17
3 08:15 16:03	09:06 (WEA VB02) 07:44 29 09:35 (WEA VB02) 16:53	08:10 (WEA VB01) 06:48 7 08:17 (WEA VB01) 17:46	06:36 19:41	05:31 20:33	04:47 21:18
4 08:15 16:04	09:06 (WEA VB02) 07:42 29 09:35 (WEA VB02) 16:55	08:09 (WEA VB01) 06:46 11 08:20 (WEA VB01) 17:47	06:34 19:42	05:29 20:34	04:46 21:19
5 08:14 16:05	09:07 (WEA VB02) 07:39 28 09:35 (WEA VB02) 16:57	08:07 (WEA VB01) 06:44 15 08:22 (WEA VB01) 17:49	06:32 19:44	05:27 20:36	04:45 21:20
6 08:14 16:06	09:07 (WEA VB02) 07:39 28 09:35 (WEA VB02) 16:59	08:05 (WEA VB01) 06:42 18 08:23 (WEA VB01) 17:51	06:29 19:46	05:25 20:38	04:45 21:21
7 08:14 16:07	09:08 (WEA VB02) 07:37 28 09:36 (WEA VB02) 17:00	08:04 (WEA VB01) 06:39 20 08:24 (WEA VB01) 17:53	17:21 (WEA ZB11_EnBW) 06:27 6 17:27 (WEA ZB11_EnBW) 19:48	05:24 20:39	04:44 21:22
8 08:13 16:09	09:08 (WEA VB02) 07:36 28 09:36 (WEA VB02) 17:02	08:03 (WEA VB01) 06:37 21 08:24 (WEA VB01) 17:55	17:18 (WEA ZB11_EnBW) 06:25 10 17:28 (WEA ZB11_EnBW) 19:49	05:22 20:41	04:44 21:23
9 08:13 16:10	09:08 (WEA VB02) 07:34 28 09:36 (WEA VB02) 17:04	08:02 (WEA VB01) 06:35 23 08:25 (WEA VB01) 17:56	17:16 (WEA ZB11_EnBW) 06:22 14 17:30 (WEA ZB11_EnBW) 19:51	05:20 20:43	04:43 21:24
10 08:12 16:12	09:09 (WEA VB02) 07:32 28 09:37 (WEA VB02) 17:06	08:02 (WEA VB01) 06:33 23 08:25 (WEA VB01) 17:58	17:15 (WEA ZB11_EnBW) 06:20 18 17:33 (WEA ZB11_EnBW) 19:53	05:18 20:44	04:43 21:25
11 08:11 16:13	09:09 (WEA VB02) 07:30 28 09:37 (WEA VB02) 17:08	08:02 (WEA VB01) 06:30 23 08:25 (WEA VB01) 18:00	17:14 (WEA ZB11_EnBW) 06:18 20 17:34 (WEA ZB11_EnBW) 19:55	19:25 (WEA ZB05_wp0) 05:17 3 19:28 (WEA ZB05_wp0) 20:46	04:42 21:26
12 08:11 16:14	09:10 (WEA VB02) 07:28 27 09:37 (WEA VB02) 17:10	08:02 (WEA VB01) 06:28 23 08:25 (WEA VB01) 18:02	17:14 (WEA ZB11_EnBW) 06:16 20 17:34 (WEA ZB11_EnBW) 19:56	19:21 (WEA ZB05_wp0) 05:15 9 19:30 (WEA ZB05_wp0) 20:48	04:42 21:27
13 08:10 16:16	09:10 (WEA VB02) 07:26 27 09:38 (WEA VB02) 17:12	08:02 (WEA VB01) 06:26 22 08:25 (WEA VB01) 18:05	17:14 (WEA ZB11_EnBW) 06:13 20 17:34 (WEA ZB11_EnBW) 19:58	19:19 (WEA ZB05_wp0) 05:13 13 19:32 (WEA ZB05_wp0) 20:49	04:42 21:28
14 08:09 16:18	09:11 (WEA VB02) 07:24 27 09:38 (WEA VB02) 17:14	08:03 (WEA VB01) 06:23 22 08:25 (WEA VB01) 18:05	17:13 (WEA ZB11_EnBW) 06:11 20 17:33 (WEA ZB11_EnBW) 20:00	19:17 (WEA ZB05_wp0) 05:12 15 19:32 (WEA ZB05_wp0) 20:51	04:41 21:28
15 08:08 16:19	09:12 (WEA VB02) 07:22 27 09:38 (WEA VB02) 17:16	08:03 (WEA VB01) 06:21 21 08:24 (WEA VB01) 18:07	17:13 (WEA ZB11_EnBW) 06:09 20 17:33 (WEA ZB11_EnBW) 20:01	19:16 (WEA ZB05_wp0) 05:10 18 19:34 (WEA ZB05_wp0) 20:52	04:41 21:28
16 08:08 16:21	09:13 (WEA VB02) 07:20 24 09:37 (WEA VB02) 17:18	08:04 (WEA VB01) 06:19 20 08:24 (WEA VB01) 18:09	17:14 (WEA ZB11_EnBW) 06:07 18 17:32 (WEA ZB11_EnBW) 20:03	19:15 (WEA ZB05_wp0) 05:08 20 19:35 (WEA ZB05_wp0) 20:54	04:41 21:29
17 08:07 16:22	09:14 (WEA VB02) 07:18 23 09:37 (WEA VB02) 17:19	08:05 (WEA VB01) 06:16 17 08:22 (WEA VB01) 18:11	17:14 (WEA ZB11_EnBW) 06:04 16 17:30 (WEA ZB11_EnBW) 20:05	19:15 (WEA ZB05_wp0) 05:07 24 20:16 (WEA ZB03_wp0) 21:29	04:41 21:29
18 08:06 16:24	09:15 (WEA VB02) 07:16 22 09:37 (WEA VB02) 17:21	08:07 (WEA VB01) 06:14 14 08:21 (WEA VB01) 18:13	17:16 (WEA ZB11_EnBW) 06:02 13 17:29 (WEA ZB11_EnBW) 20:07	19:14 (WEA ZB05_wp0) 05:05 22 19:36 (WEA ZB05_wp0) 20:57	04:41 21:30
19 08:05 16:26	09:15 (WEA VB02) 07:14 21 09:36 (WEA VB02) 17:23	08:09 (WEA VB01) 06:12 10 08:19 (WEA VB01) 18:14	17:18 (WEA ZB11_EnBW) 06:00 7 17:25 (WEA ZB11_EnBW) 20:08	19:14 (WEA ZB05_wp0) 05:04 22 19:36 (WEA ZB05_wp0) 20:59	04:41 21:30
20 08:04 16:27	09:16 (WEA VB02) 07:12 21 09:36 (WEA VB02) 17:25	08:10 (WEA VB01) 06:11 18:16	17:19 (WEA ZB11_EnBW) 05:58 20 17:33 (WEA ZB11_EnBW) 20:09	19:13 (WEA ZB05_wp0) 05:02 21 19:34 (WEA ZB05_wp0) 20:58	04:41 21:30
21 08:02 16:29	09:18 (WEA VB02) 07:10 17 09:35 (WEA VB02) 17:27	08:11 (WEA VB01) 06:10 16:18	17:20 (WEA ZB11_EnBW) 05:56 20 17:34 (WEA ZB11_EnBW) 20:10	19:12 (WEA ZB05_wp0) 05:01 20 19:34 (WEA ZB05_wp0) 20:59	04:41 21:31
22 08:01 16:31	09:21 (WEA VB02) 07:08 13 09:34 (WEA VB02) 17:29	08:12 (WEA VB01) 06:09 15 08:20 (WEA VB01) 18:20	17:21 (WEA ZB11_EnBW) 05:54 19:14 (WEA ZB05_wp0) 05:00	19:11 (WEA ZB05_wp0) 05:00 22 19:36 (WEA ZB05_wp0) 20:57	04:41 21:31
23 08:00 16:33	09:23 (WEA VB02) 07:06 8 09:31 (WEA VB02) 17:31	08:13 (WEA VB01) 06:08 14:21	17:22 (WEA ZB11_EnBW) 05:52 19:15 (WEA ZB05_wp0) 05:00	19:10 (WEA ZB05_wp0) 05:00 17 19:32 (WEA ZB05_wp0) 20:54	04:41 21:31
24 07:59 16:34	09:25 (WEA VB02) 07:04 17:33	08:14 (WEA VB01) 06:07 13:23	17:23 (WEA ZB11_EnBW) 05:51 19:16 (WEA ZB05_wp0) 05:00	19:09 (WEA ZB05_wp0) 05:00 15 19:31 (WEA ZB05_wp0) 20:56	04:41 21:31
25 07:58 16:36	09:26 (WEA VB02) 07:02 17:34	08:15 (WEA VB01) 06:06 12:25	17:24 (WEA ZB11_EnBW) 05:50 19:17 (WEA ZB05_wp0) 05:00	19:08 (WEA ZB05_wp0) 05:00 12 19:29 (WEA ZB05_wp0) 20:55	04:41 21:31
26 07:56 16:38	09:27 (WEA VB02) 07:00 17:36	08:16 (WEA VB01) 06:05 11:25	17:25 (WEA ZB11_EnBW) 05:49 19:18 (WEA ZB05_wp0) 05:00	19:07 (WEA ZB05_wp0) 05:00 4 19:25 (WEA ZB05_wp0) 20:53	04:41 21:31
27 07:55 16:40	09:28 (WEA VB02) 06:58 17:37	08:17 (WEA VB01) 06:04 10:25	17:26 (WEA ZB11_EnBW) 05:48 19:19 (WEA ZB05_wp0) 05:00	19:06 (WEA ZB05_wp0) 05:00 17 20:13 (WEA ZB03_wp0) 04:44	04:41 21:31
28 07:53 16:42	09:29 (WEA VB02) 06:56 17:38	08:18 (WEA VB01) 06:03 9:25	17:27 (WEA ZB11_EnBW) 05:47 19:20 (WEA ZB05_wp0) 05:00	19:05 (WEA ZB05_wp0) 05:00 15 20:12 (WEA ZB03_wp0) 04:43	04:41 21:31
29 07:52 16:44	09:30 (WEA VB02) 06:54 17:40	08:19 (WEA VB01) 06:02 8:25	17:28 (WEA ZB11_EnBW) 05:46 19:21 (WEA ZB05_wp0) 05:00	19:04 (WEA ZB05_wp0) 05:00 13 20:11 (WEA ZB03_wp0) 04:43	04:41 21:31
30 07:50 16:45	09:31 (WEA VB02) 06:52 17:41	08:20 (WEA VB01) 06:01 7:25	17:29 (WEA ZB11_EnBW) 05:45 19:22 (WEA ZB05_wp0) 05:00	19:03 (WEA ZB05_wp0) 05:00 11 20:10 (WEA ZB03_wp0) 04:43	04:41 21:31
31 07:49 16:47	09:32 (WEA VB02) 06:50 17:42	08:21 (WEA VB01) 06:00 6:25	17:30 (WEA ZB11_EnBW) 05:44 19:23 (WEA ZB05_wp0) 05:00	19:02 (WEA ZB05_wp0) 05:00 9 20:09 (WEA ZB03_wp0) 04:43	04:41 21:31
Sonnenscheinstunden	256	276	367	417	502
astr.max.mögl.Beschattung	567	311	202	251	548

**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)	Schattende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-86 - SR-86, Neumühler Straße 9, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember					
1	04:45	05:22	20:03 (WEA Z803_wpd)	06:14	19:24 (WEA Z805_wpd)	07:04	17:52 (WEA Z811_EhW)	06:59	07:23 (WEA A801)	07:51	08:52 (WEA A802)
2	21:30	20:58	22 20:25 (WEA Z803_wpd)	19:54	3 19:27 (WEA Z805_wpd)	18:44	21 18:13 (WEA Z811_EhW)	16:36	23 07:55 (WEA A801)	15:55	28 09:20 (WEA A802)
3	04:47	05:24	20:02 (WEA Z803_wpd)	06:15	07:06	17:53 (WEA Z811_EhW)	07:01	07:32 (WEA A801)	07:52	08:53 (WEA A802)	
4	04:48	05:26	20:01 (WEA Z803_wpd)	06:17	07:07	17:53 (WEA Z811_EhW)	07:02	07:33 (WEA A801)	07:54	08:54 (WEA A802)	
5	04:49	05:29	20:04 (WEA Z803_wpd)	06:20	18:39	18:11 (WEA Z811_EhW)	16:33	21 07:54 (WEA A801)	15:54	28 09:20 (WEA A802)	
6	21:28	05:27	20:02 (WEA Z803_wpd)	06:19	07:09	17:54 (WEA Z811_EhW)	07:04	07:33 (WEA A801)	07:55	08:52 (WEA A802)	
7	04:50	05:32	20:03 (WEA Z803_wpd)	06:22	18:37	18:09 (WEA Z811_EhW)	16:31	20 07:53 (WEA A801)	15:53	28 09:20 (WEA A802)	
8	04:51	05:34	20:03 (WEA Z803_wpd)	06:25	07:11	17:54 (WEA Z811_EhW)	07:06	07:35 (WEA A801)	07:56	08:53 (WEA A802)	
9	21:27	05:35	20:04 (WEA Z803_wpd)	06:27	18:34	18:06 (WEA Z811_EhW)	16:29	17 07:52 (WEA A801)	15:52	28 09:21 (WEA A802)	
10	04:52	05:37	20:05 (WEA Z803_wpd)	06:29	07:12	17:55 (WEA Z811_EhW)	07:07	07:37 (WEA A801)	07:58	08:53 (WEA A802)	
11	04:53	05:38	20:06 (WEA Z803_wpd)	06:29	18:32	18:04 (WEA Z811_EhW)	16:27	14 07:51 (WEA A801)	15:52	29 09:22 (WEA A802)	
12	21:25	05:39	20:08 (WEA Z803_wpd)	06:30	07:14	17:56 (WEA Z811_EhW)	07:10	07:39 (WEA A801)	07:59	08:53 (WEA A802)	
13	04:54	05:40	20:09	06:31	18:30	18:02 (WEA Z811_EhW)	16:26	11 07:50 (WEA A801)	15:52	29 09:22 (WEA A802)	
14	04:55	05:41	20:10 (WEA Z803_wpd)	06:32	07:16	17:57 (WEA Z811_EhW)	07:12	07:41 (WEA A801)	08:00	08:54 (WEA A802)	
15	21:23	05:42	20:11 (WEA Z803_wpd)	06:33	18:28	18:01	16:25	6 07:47 (WEA A801)	15:51	29 09:23 (WEA A802)	
16	04:56	05:43	20:12 (WEA Z803_wpd)	06:34	07:18	17:58 (WEA Z811_EhW)	07:13	07:42 (WEA A801)	08:02	08:54 (WEA A802)	
17	21:21	05:44	20:13 (WEA Z803_wpd)	06:35	18:26	18:00	16:24	6 07:47 (WEA A801)	15:51	29 09:23 (WEA A802)	
18	04:57	05:45	20:14 (WEA Z803_wpd)	06:36	07:20	17:59 (WEA Z811_EhW)	07:14	07:43 (WEA A801)	08:03	08:54 (WEA A802)	
19	21:19	05:46	20:15 (WEA Z803_wpd)	06:37	18:24	17:58	16:23	07:43 (WEA A801)	15:51	29 09:24 (WEA A802)	
20	04:58	05:47	20:16 (WEA Z803_wpd)	06:38	07:22	17:59 (WEA Z811_EhW)	07:15	07:44 (WEA A801)	08:04	08:54 (WEA A802)	
21	21:17	05:48	20:17 (WEA Z803_wpd)	06:39	18:22	17:58	16:22	07:44 (WEA A801)	15:51	29 09:24 (WEA A802)	
22	04:59	05:49	20:18 (WEA Z803_wpd)	06:40	07:24	17:59 (WEA Z811_EhW)	07:16	07:45 (WEA A801)	08:05	08:54 (WEA A802)	
23	21:15	05:50	20:19 (WEA Z803_wpd)	06:41	18:20	17:57	16:21	07:45 (WEA A801)	15:51	29 09:24 (WEA A802)	
24	04:59	05:51	20:20 (WEA Z803_wpd)	06:42	07:26	17:59 (WEA Z811_EhW)	07:17	07:46 (WEA A801)	08:06	08:54 (WEA A802)	
25	21:13	05:52	20:21 (WEA Z803_wpd)	06:43	18:18	17:56	16:20	07:46 (WEA A801)	15:51	29 09:24 (WEA A802)	
26	04:59	05:53	20:22 (WEA Z803_wpd)	06:44	07:28	17:59 (WEA Z811_EhW)	07:18	07:47 (WEA A801)	08:07	08:54 (WEA A802)	
27	21:11	05:54	20:23 (WEA Z803_wpd)	06:45	18:16	17:55	16:19	07:47 (WEA A801)	15:51	29 09:24 (WEA A802)	
28	04:59	05:55	20:24 (WEA Z803_wpd)	06:46	07:30	17:59 (WEA Z811_EhW)	07:19	07:48 (WEA A801)	08:08	08:54 (WEA A802)	
29	21:09	05:56	20:25 (WEA Z803_wpd)	06:47	18:14	17:54	16:18	07:48 (WEA A801)	15:51	29 09:24 (WEA A802)	
30	04:59	05:57	20:26 (WEA Z803_wpd)	06:48	07:32	17:59 (WEA Z811_EhW)	07:20	07:49 (WEA A801)	08:09	08:54 (WEA A802)	
31	21:07	05:58	20:27 (WEA Z803_wpd)	06:49	18:12	17:53	16:17	07:49 (WEA A801)	15:51	29 09:24 (WEA A802)	
Sonnenscheinstunden	165	165	165	165	165	165	165	165	165	165	165
astr.mögl.Beschattung	393	417	411	381	273	264	390	280	273	264	390

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.636

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-87 - SR-87, Neumühler Straße 8, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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 08:15 16:00	09:04 (WEA V802) 07:47 09:32 (WEA V802) 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16
2 08:15 16:01	09:04 (WEA V802) 07:46 09:33 (WEA V802) 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:17
3 08:15 16:03	09:05 (WEA V802) 07:44 09:34 (WEA V802) 16:53	08:10 (WEA V801) 06:48 7 08:17 (WEA V801) 17:46	06:36 19:41	05:31 20:33	04:47 21:18
4 08:15 16:04	09:05 (WEA V802) 07:42 09:33 (WEA V802) 16:55	08:09 (WEA V801) 06:46 11 08:20 (WEA V801) 17:47	06:34 19:42	05:29 20:34	04:46 21:19
5 08:14 16:05	09:06 (WEA V802) 07:39 09:34 (WEA V802) 16:59	08:07 (WEA V801) 06:44 15 08:22 (WEA V801) 17:49	06:32 19:44	05:27 20:36	04:45 21:20
6 08:14 16:06	09:06 (WEA V802) 07:39 09:34 (WEA V802) 16:59	08:05 (WEA V801) 06:42 18 08:23 (WEA V801) 17:51	06:29 19:46	05:25 20:38	04:45 21:21
7 08:14 16:07	09:07 (WEA V802) 07:37 09:35 (WEA V802) 17:00	08:03 (WEA V801) 06:39 21 08:24 (WEA V801) 17:53	06:27 19:48	05:24 20:40	04:44 21:22
8 08:13 16:08	09:07 (WEA V802) 07:36 09:35 (WEA V802) 17:02	08:03 (WEA V801) 06:37 21 08:24 (WEA V801) 17:55	06:25 19:49	05:22 20:41	04:44 21:23
9 08:13 16:10	09:07 (WEA V802) 07:34 09:35 (WEA V802) 17:04	08:02 (WEA V801) 06:35 23 08:25 (WEA V801) 17:56	06:22 19:51	05:20 20:43	04:43 21:24
10 08:12 16:12	09:08 (WEA V802) 07:32 09:36 (WEA V802) 17:06	08:02 (WEA V801) 06:33 23 08:25 (WEA V801) 17:58	06:20 19:53	05:18 20:44	04:43 21:25
11 08:11 16:13	09:09 (WEA V802) 07:30 09:36 (WEA V802) 17:08	08:02 (WEA V801) 06:30 23 08:25 (WEA V801) 18:00	06:18 19:55	05:17 20:46	04:42 21:26
12 08:11 16:14	09:09 (WEA V802) 07:28 09:36 (WEA V802) 17:10	08:02 (WEA V801) 06:28 23 08:25 (WEA V801) 18:02	06:16 19:56	05:15 20:48	04:42 21:27
13 08:10 16:16	09:10 (WEA V802) 07:26 09:36 (WEA V802) 17:12	08:02 (WEA V801) 06:26 23 08:25 (WEA V801) 18:04	06:13 19:58	05:13 20:50	04:42 21:28
14 08:09 16:18	09:10 (WEA V802) 07:24 09:36 (WEA V802) 17:14	08:03 (WEA V801) 06:23 22 08:25 (WEA V801) 18:05	06:11 19:59	05:12 20:51	04:41 21:29
15 08:08 16:19	09:11 (WEA V802) 07:22 09:36 (WEA V802) 17:16	08:03 (WEA V801) 06:21 21 08:24 (WEA V801) 18:07	06:09 19:59	05:10 20:52	04:41 21:30
16 08:08 16:21	09:12 (WEA V802) 07:20 09:36 (WEA V802) 17:18	08:04 (WEA V801) 06:19 19 08:23 (WEA V801) 18:09	06:07 19:59	05:08 20:54	04:41 21:31
17 08:07 16:22	09:13 (WEA V802) 07:18 09:36 (WEA V802) 17:19	08:06 (WEA V801) 06:16 16 08:22 (WEA V801) 18:11	06:04 19:59	05:07 20:55	04:41 21:32
18 08:06 16:24	09:14 (WEA V802) 07:16 09:36 (WEA V802) 17:21	08:07 (WEA V801) 06:14 19 08:20 (WEA V801) 18:13	06:02 20:00	05:05 20:57	04:41 21:33
19 08:05 16:26	09:14 (WEA V802) 07:14 09:35 (WEA V802) 17:23	08:11 (WEA V801) 06:12 6 08:17 (WEA V801) 18:14	06:00 20:01	05:03 20:59	04:41 21:34
20 08:04 16:27	09:15 (WEA V802) 07:12 09:34 (WEA V802) 17:25	08:18 18:16	05:58 20:02	05:02 20:59	04:41 21:35
21 08:02 16:29	09:18 (WEA V802) 07:10 09:34 (WEA V802) 17:27	06:07 18:18	05:56 20:03	05:01 20:59	04:41 21:36
22 08:01 16:30	09:20 (WEA V802) 07:08 09:33 (WEA V802) 17:29	06:05 18:20	05:54 20:04	05:00 20:59	04:41 21:37
23 08:00 16:31	09:22 (WEA V802) 07:06 09:30 (WEA V802) 17:31	06:02 18:21	05:51 20:05	04:58 20:59	04:42 21:38
24 07:59 16:34	09:23 (WEA V802) 07:04 17:33	06:00 18:23	05:49 20:06	04:57 20:59	04:42 21:39
25 07:58 16:36	09:24 (WEA V802) 07:02 17:34	05:57 18:25	05:47 20:07	04:56 20:59	04:42 21:40
26 07:56 16:38	09:25 (WEA V802) 07:00 17:36	05:55 18:27	05:45 20:08	04:55 20:59	04:42 21:41
27 07:55 16:40	09:26 (WEA V802) 06:58 17:38	05:53 18:28	05:43 20:09	04:54 20:59	04:42 21:42
28 07:53 16:42	09:27 (WEA V802) 06:55 17:40	05:50 18:30	05:41 20:10	04:53 20:59	04:42 21:43
29 07:52 16:44	09:28 (WEA V802) 06:53 17:42	05:48 18:32	05:39 20:11	04:51 20:59	04:42 21:44
30 07:50 16:45	09:29 (WEA V802) 06:51 17:44	05:46 18:34	05:37 20:12	04:50 20:59	04:42 21:45
31 07:49 16:47	09:30 (WEA V802) 06:49 17:46	05:44 18:36	05:35 20:13	04:48 20:59	04:42 21:46
Sonnenscheinstunden	256	276	367	417	502
astr.max.mögl.Beschattung	558	305	205	257	555

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-87 - SR-87, Neumühler Straße 8, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:02 (WEA2002_wpd)	06:14	19:21 (WEA2005_wpd)	07:04
2	21:30	20:58	23 20:25 (WEA2003_wpd)	19:54	18:44	21 18:12 (WEA2011_EhW)
3	04:48	05:24	20:02 (WEA2002_wpd)	06:15	07:06	17:51 (WEA2011_EhW)
4	04:47	05:26	20:02 (WEA2002_wpd)	06:17	18:41	20 18:11 (WEA2011_EhW)
5	21:29	20:54	22 20:24 (WEA2003_wpd)	19:50	07:07	17:51 (WEA2011_EhW)
6	04:49	05:27	20:02 (WEA2002_wpd)	06:19	18:39	20 18:11 (WEA2011_EhW)
7	21:28	20:52	20 20:22 (WEA2003_wpd)	19:48	07:09	17:52 (WEA2011_EhW)
8	04:51	05:29	20:02 (WEA2002_wpd)	06:20	18:37	17 18:09 (WEA2011_EhW)
9	21:27	20:51	19 20:21 (WEA2003_wpd)	19:45	07:11	17:51 (WEA2011_EhW)
10	04:52	05:31	20:02 (WEA2002_wpd)	06:22	18:34	15 18:06 (WEA2011_EhW)
11	21:26	20:49	17 20:19 (WEA2003_wpd)	19:43	07:12	17:53 (WEA2011_EhW)
12	04:53	05:32	20:02 (WEA2002_wpd)	06:24	18:32	11 18:04 (WEA2011_EhW)
13	21:25	20:47	14 20:17 (WEA2003_wpd)	19:41	07:14	17:53 (WEA2011_EhW)
14	04:54	05:34	20:02 (WEA2002_wpd)	06:25	18:30	7 18:02 (WEA2011_EhW)
15	21:24	20:45	12 20:15 (WEA2003_wpd)	19:38	07:16	17:52 (WEA2011_EhW)
16	04:55	05:35	20:02 (WEA2002_wpd)	06:27	18:28	17:52 (WEA2011_EhW)
17	21:23	20:43	10 20:14 (WEA2003_wpd)	19:36	18:28	17:55 (WEA2011_EhW)
18	04:56	05:37	20:05 (WEA2002_wpd)	06:29	18:26	17:55 (WEA2011_EhW)
19	21:22	20:41	8 20:13 (WEA2003_wpd)	19:33	07:18	17:55 (WEA2011_EhW)
20	04:57	05:39	3 20:10 (WEA2003_wpd)	19:31	18:25	17:55 (WEA2011_EhW)
21	21:21	20:40	5 20:15 (WEA2003_wpd)	19:29	07:23	17:55 (WEA2011_EhW)
22	04:58	05:40	20:05 (WEA2002_wpd)	06:32	18:23	17:55 (WEA2011_EhW)
23	21:20	20:39	20:05 (WEA2002_wpd)	19:27	18:21	17:55 (WEA2011_EhW)
24	04:59	05:41	20:05 (WEA2002_wpd)	06:34	18:20	17:55 (WEA2011_EhW)
25	21:19	20:38	20:05 (WEA2002_wpd)	19:25	18:19	17:55 (WEA2011_EhW)
26	04:59	05:42	20:05 (WEA2002_wpd)	06:36	18:18	17:55 (WEA2011_EhW)
27	21:18	20:37	20:05 (WEA2002_wpd)	19:23	18:17	17:55 (WEA2011_EhW)
28	04:59	05:43	20:05 (WEA2002_wpd)	06:37	18:16	17:55 (WEA2011_EhW)
29	21:17	20:36	20:05 (WEA2002_wpd)	19:22	18:15	17:55 (WEA2011_EhW)
30	04:59	05:44	20:05 (WEA2002_wpd)	06:39	18:14	17:55 (WEA2011_EhW)
31	21:16	20:35	20:05 (WEA2002_wpd)	19:21	18:13	17:55 (WEA2011_EhW)
1	05:00	05:45	19:27 (WEA2005_wpd)	06:40	18:12	17:55 (WEA2011_EhW)
2	21:15	20:34	19 19:30 (WEA2005_wpd)	19:17	18:11	17:55 (WEA2011_EhW)
3	05:01	05:46	18 19:34 (WEA2005_wpd)	19:15	18:10	17:55 (WEA2011_EhW)
4	21:14	20:33	17 19:34 (WEA2005_wpd)	19:15	18:09	17:55 (WEA2011_EhW)
5	05:01	05:47	17 19:34 (WEA2005_wpd)	19:15	18:08	17:55 (WEA2011_EhW)
6	21:13	20:32	16 19:34 (WEA2005_wpd)	19:14	18:07	17:55 (WEA2011_EhW)
7	05:02	05:48	15 19:34 (WEA2005_wpd)	19:13	18:06	17:55 (WEA2011_EhW)
8	21:12	20:31	14 19:34 (WEA2005_wpd)	19:12	18:05	17:55 (WEA2011_EhW)
9	05:02	05:49	13 19:34 (WEA2005_wpd)	19:11	18:04	17:55 (WEA2011_EhW)
10	21:11	20:30	12 19:34 (WEA2005_wpd)	19:10	18:03	17:55 (WEA2011_EhW)
11	05:03	05:50	11 19:34 (WEA2005_wpd)	19:09	18:02	17:55 (WEA2011_EhW)
12	21:10	20:29	10 19:34 (WEA2005_wpd)	19:08	18:01	17:55 (WEA2011_EhW)
13	05:03	05:51	9 19:34 (WEA2005_wpd)	19:07	18:00	17:55 (WEA2011_EhW)
14	21:09	20:28	8 19:34 (WEA2005_wpd)	19:06	17:59	17:55 (WEA2011_EhW)
15	05:04	05:52	7 19:34 (WEA2005_wpd)	19:05	17:58	17:55 (WEA2011_EhW)
16	21:08	20:27	6 19:34 (WEA2005_wpd)	19:04	17:57	17:55 (WEA2011_EhW)
17	05:04	05:53	5 19:34 (WEA2005_wpd)	19:03	17:56	17:55 (WEA2011_EhW)
18	21:07	20:26	4 19:34 (WEA2005_wpd)	19:02	17:55	17:55 (WEA2011_EhW)
19	05:05	05:54	3 19:34 (WEA2005_wpd)	19:01	17:54	17:55 (WEA2011_EhW)
20	21:06	20:25	2 19:34 (WEA2005_wpd)	19:00	17:53	17:55 (WEA2011_EhW)
21	05:05	05:55	1 19:34 (WEA2005_wpd)	18:59	17:52	17:55 (WEA2011_EhW)
22	21:05	20:24	19:30 (WEA2005_wpd)	18:58	17:51	17:55 (WEA2011_EhW)
23	05:06	05:56	18:30 (WEA2005_wpd)	18:57	17:50	17:55 (WEA2011_EhW)
24	21:04	20:23	17:30 (WEA2005_wpd)	18:56	17:49	17:55 (WEA2011_EhW)
25	05:06	05:57	16:30 (WEA2005_wpd)	18:55	17:48	17:55 (WEA2011_EhW)
26	21:03	20:22	15:30 (WEA2005_wpd)	18:54	17:47	17:55 (WEA2011_EhW)
27	05:07	05:58	14:30 (WEA2005_wpd)	18:53	17:46	17:55 (WEA2011_EhW)
28	21:02	20:21	13:30 (WEA2005_wpd)	18:52	17:45	17:55 (WEA2011_EhW)
29	05:07	05:59	12:30 (WEA2005_wpd)	18:51	17:44	17:55 (WEA2011_EhW)
30	21:01	20:20	11:30 (WEA2005_wpd)	18:50	17:43	17:55 (WEA2011_EhW)
31	05:08	06:00	10:30 (WEA2005_wpd)	18:49	17:42	17:55 (WEA2011_EhW)
1	21:00	20:19	9:30 (WEA2005_wpd)	18:48	17:41	17:55 (WEA2011_EhW)
2	05:08	06:01	8:30 (WEA2005_wpd)	18:47	17:40	17:55 (WEA2011_EhW)
3	20:59	20:18	7:30 (WEA2005_wpd)	18:46	17:39	17:55 (WEA2011_EhW)
4	05:09	06:02	6:30 (WEA2005_wpd)	18:45	17:38	17:55 (WEA2011_EhW)
5	20:58	20:17	5:30 (WEA2005_wpd)	18:44	17:37	17:55 (WEA2011_EhW)
6	05:09	06:03	4:30 (WEA2005_wpd)	18:43	17:36	17:55 (WEA2011_EhW)
7	20:57	20:16	3:30 (WEA2005_wpd)	18:42	17:35	17:55 (WEA2011_EhW)
8	05:10	06:04	2:30 (WEA2005_wpd)	18:41	17:34	17:55 (WEA2011_EhW)
9	20:56	20:15	1:30 (WEA2005_wpd)	18:40	17:33	17:55 (WEA2011_EhW)
10	05:10	06:05	12:30 (WEA2005_wpd)	18:39	17:32	17:55 (WEA2011_EhW)
11	20:55	20:14	11:30 (WEA2005_wpd)	18:38	17:31	17:55 (WEA2011_EhW)
12	05:11	06:06	10:30 (WEA2005_wpd)	18:37	17:30	17:55 (WEA2011_EhW)
13	20:54	20:13	9:30 (WEA2005_wpd)	18:36	17:29	17:55 (WEA2011_EhW)
14	05:11	06:07	8:30 (WEA2005_wpd)	18:35	17:28	17:55 (WEA2011_EhW)
15	20:53	20:12	7:30 (WEA2005_wpd)	18:34	17:27	17:55 (WEA2011_EhW)
16	05:12	06:08	6:30 (WEA2005_wpd)	18:33	17:26	17:55 (WEA2011_EhW)
17	20:52	20:11	5:30 (WEA2005_wpd)	18:32	17:25	17:55 (WEA2011_EhW)
18	05:12	06:09	4:30 (WEA2005_wpd)	18:31	17:24	17:55 (WEA2011_EhW)
19	20:51	20:10	3:30 (WEA2005_wpd)	18:30	17:23	17:55 (WEA2011_EhW)
20	05:13	06:10	2:30 (WEA2005_wpd)	18:29	17:22	17:55 (WEA2011_EhW)
21	20:50	20:09	1:30 (WEA2005_wpd)	18:28	17:21	17:55 (WEA2011_EhW)
22	05:13	06:11	12:30 (WEA2005_wpd)	18:27	17:20	17:55 (WEA2011_EhW)
23	20:49	20:08	11:30 (WEA2005_wpd)	18:26	17:19	17:55 (WEA2011_EhW)
24	05:14	06:12	10:30 (WEA2005_wpd)	18:25	17:18	17:55 (WEA2011_EhW)
25	20:48	20:07	9:30 (WEA2005_wpd)	18:24	17:17	17:55 (WEA2011_EhW)
26	05:14	06:13	8:30 (WEA2005_wpd)	18:23	17:16	17:55 (WEA2011_EhW)
27	20:47	20:06	7:30 (WEA2005_wpd)	18:22	17:15	17:55 (WEA2011_EhW)
28	05:15	06:14	6:30 (WEA2005_wpd)	18:21	17:14	17:55 (WEA2011_EhW)
29	20:46	20:05	5:30 (WEA2005_wpd)	18:20	17:13	17:55 (WEA2011_EhW)
30	05:15	06:15	4:30 (WEA2005_wpd)	18:19	17:12	17:55 (WEA2011_EhW)
31	20:45	20:04	3:30 (WEA2005_wpd)	18:18	17:11	17:55 (WEA2011_EhW)
Sonnenscheinstunden	265	455		381	264	241
astronom.mögl.Beschattung	391	425	103	282	384	869

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	Schattenanfang (WEA mit erstem Schatten)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-88 - SR-88, Neumühler Straße 7, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:00 (WEA V02)	07:47	06:53	06:41	04:49
2	16:00	09:27 (WEA V02)	16:49	17:42	19:37	21:16
3	08:15	09:01 (WEA V02)	07:46	06:51	06:39	04:48
4	16:01	09:28 (WEA V02)	16:51	17:44	19:39	21:17
5	08:15	09:01 (WEA V02)	07:44	06:48	06:36	04:47
6	16:03	09:29 (WEA V02)	16:53	17:46	19:41	21:18
7	08:15	09:01 (WEA V02)	07:42	06:46	06:34	04:46
8	16:04	09:30 (WEA V02)	16:55	17:47	19:42	21:19
9	08:14	09:02 (WEA V02)	07:41	06:45	06:32	04:45
10	16:05	09:30 (WEA V02)	16:57	17:49	19:44	21:20
11	08:14	09:02 (WEA V02)	07:39	06:43	06:29	04:45
12	16:06	09:30 (WEA V02)	16:59	17:51	19:46	21:21
13	08:14	09:02 (WEA V02)	07:37	06:41	06:27	04:44
14	16:07	09:31 (WEA V02)	17:00	17:53	19:48	21:22
15	08:13	09:03 (WEA V02)	07:36	06:39	06:25	04:44
16	16:09	09:31 (WEA V02)	17:02	17:55	19:50	21:23
17	08:13	09:03 (WEA V02)	07:34	06:37	06:22	04:43
18	16:10	09:31 (WEA V02)	17:04	17:56	19:51	21:24
19	08:12	09:04 (WEA V02)	07:32	06:35	06:20	04:43
20	16:12	09:32 (WEA V02)	17:06	17:58	19:53	21:25
21	08:11	09:04 (WEA V02)	07:30	06:33	06:18	04:42
22	16:13	09:32 (WEA V02)	17:08	18:00	19:55	21:26
23	08:11	09:05 (WEA V02)	07:28	06:31	06:16	04:42
24	16:15	09:33 (WEA V02)	17:10	18:02	19:56	21:26
25	08:10	09:05 (WEA V02)	07:26	06:29	06:13	04:42
26	16:16	09:33 (WEA V02)	17:12	18:04	19:58	21:27
27	08:09	09:06 (WEA V02)	07:24	06:27	06:11	04:41
28	16:18	09:33 (WEA V02)	17:14	18:05	19:59	21:28
29	08:08	09:06 (WEA V02)	07:22	06:25	06:09	04:41
30	16:19	09:33 (WEA V02)	17:16	18:07	20:01	21:28
31	08:08	09:07 (WEA V02)	07:20	06:23	06:07	04:41
1	16:20	09:34 (WEA V02)	17:18	18:09	20:03	21:29
2	08:07	09:08 (WEA V02)	07:18	06:21	06:04	04:41
3	16:22	09:34 (WEA V02)	17:19	18:11	20:05	21:29
4	08:06	09:09 (WEA V02)	07:16	06:19	06:02	04:41
5	16:24	09:34 (WEA V02)	17:21	18:13	20:07	21:30
6	08:05	09:09 (WEA V02)	07:14	06:17	06:00	04:41
7	16:26	09:34 (WEA V02)	17:23	18:14	20:08	21:30
8	08:04	09:10 (WEA V02)	07:12	06:15	05:58	04:41
9	16:27	09:34 (WEA V02)	17:25	18:16	20:10	21:30
10	08:03	09:11 (WEA V02)	07:10	06:13	05:56	04:41
11	16:29	09:34 (WEA V02)	17:27	18:18	20:12	21:31
12	08:03	09:11 (WEA V02)	07:08	06:11	05:54	04:41
13	16:31	09:34 (WEA V02)	17:29	18:20	20:14	21:31
14	08:03	09:11 (WEA V02)	07:06	06:09	05:51	04:42
15	16:33	09:34 (WEA V02)	17:31	18:22	20:16	21:31
16	08:02	09:12 (WEA V02)	07:04	06:07	05:49	04:42
17	16:34	09:34 (WEA V02)	17:33	18:23	20:18	21:31
18	08:01	09:13 (WEA V02)	07:02	06:05	05:47	04:42
19	16:36	09:35 (WEA V02)	17:34	18:25	20:19	21:31
20	08:00	09:14 (WEA V02)	07:00	06:03	05:45	04:43
21	16:38	09:35 (WEA V02)	17:36	18:27	20:21	21:31
22	07:55	09:35 (WEA V02)	17:38	18:28	20:22	21:31
23	07:53	09:35 (WEA V02)	17:39	18:29	20:23	21:31
24	16:42	09:36 (WEA V02)	17:40	18:30	20:24	21:31
25	07:52	09:36 (WEA V02)	17:41	18:31	20:25	21:31
26	16:44	09:36 (WEA V02)	17:42	18:32	20:26	21:31
27	07:50	09:36 (WEA V02)	17:43	18:33	20:27	21:31
28	16:46	09:36 (WEA V02)	17:44	18:34	20:28	21:31
29	07:49	09:36 (WEA V02)	17:45	18:35	20:29	21:31
30	16:47	09:36 (WEA V02)	17:46	18:36	20:30	21:31
31	07:49	09:36 (WEA V02)	17:46	18:36	20:30	21:31
Sonnenscheinstunden	256	276	301	327	353	379
astr.mögl.Beschattung	608	294	361	266	188	52

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-88 - SR-88, Neumühler Straße 7, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Juli	August	September	Oktober	November	Dezember				
1	04:45	05:22	20:04 (WEA2802_wpd)	06:14	07:04	17:51 (WEA2811_ErWB)	08:59	07:20 (WEA4801)	07:51	08:46 (WEA4802)
2	21:30	20:58	22 20:26 (WEA2803_wpd)	19:54	18:44	21 18:12 (WEA2811_ErWB)	16:36	21 07:51 (WEA4801)	15:52	29 09:15 (WEA4802)
3	04:48	05:24	20:03 (WEA2802_wpd)	06:15	07:06	17:51 (WEA2811_ErWB)	07:01	07:30 (WEA4801)	07:52	08:46 (WEA4802)
4	04:47	05:26	20:04 (WEA2802_wpd)	06:17	18:41	21 18:12 (WEA2811_ErWB)	16:35	21 07:51 (WEA4801)	15:54	28 08:54 (WEA4802)
5	21:29	05:27	20:04 (WEA2802_wpd)	06:19	07:07	17:52 (WEA2811_ErWB)	07:02	07:31 (WEA4801)	07:54	08:47 (WEA4802)
6	04:49	05:29	20:04 (WEA2802_wpd)	06:20	18:39	19 18:11 (WEA2811_ErWB)	16:33	19 07:50 (WEA4801)	15:54	28 09:15 (WEA4802)
7	21:28	05:22	18 20:22 (WEA2803_wpd)	19:48	07:09	17:52 (WEA2811_ErWB)	07:04	07:33 (WEA4801)	07:55	08:47 (WEA4802)
8	04:51	05:24	20:04 (WEA2802_wpd)	06:20	18:37	17 18:09 (WEA2811_ErWB)	16:31	16 07:49 (WEA4801)	15:53	28 09:15 (WEA4802)
9	21:27	05:25	20:04 (WEA2802_wpd)	06:20	07:11	17:53 (WEA2811_ErWB)	07:06	07:35 (WEA4801)	07:57	08:48 (WEA4802)
10	04:52	05:21	17 20:21 (WEA2803_wpd)	19:45	18:34	13 18:06 (WEA2811_ErWB)	16:29	13 07:48 (WEA4801)	15:53	28 09:16 (WEA4802)
11	21:26	05:21	20:04 (WEA2802_wpd)	06:22	07:12	17:54 (WEA2811_ErWB)	07:07	07:37 (WEA4801)	07:58	08:48 (WEA4802)
12	04:50	05:23	20:04 (WEA2802_wpd)	06:24	18:32	10 18:04 (WEA2811_ErWB)	16:27	9 07:46 (WEA4801)	15:52	28 09:16 (WEA4802)
13	21:25	05:22	15 20:19 (WEA2803_wpd)	19:43	18:30	5 18:02 (WEA2811_ErWB)	16:26	4 07:43 (WEA4801)	15:52	28 09:16 (WEA4802)
14	04:51	05:24	20:04 (WEA2802_wpd)	06:25	07:16	17:57 (WEA2811_ErWB)	07:10	16:20	08:00	08:49 (WEA4802)
15	21:27	05:24	20:05 (WEA2802_wpd)	06:24	18:30	18:30	16:24	15:51	28 09:17 (WEA4802)	
16	04:52	05:25	20:07 (WEA2802_wpd)	06:27	07:18	18:23	16:23	15:51	28 09:17 (WEA4802)	
17	21:26	05:25	20:07 (WEA2802_wpd)	06:27	07:21	18:23	16:23	15:51	28 09:17 (WEA4802)	
18	04:53	05:26	20:10 (WEA2802_wpd)	06:29	07:19	18:23	16:23	15:51	28 09:17 (WEA4802)	
19	21:25	05:21	3 20:13 (WEA2802_wpd)	19:33	18:21	18:21	16:23	15:51	28 09:17 (WEA4802)	
20	04:54	05:27	19:31	06:30	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
21	21:25	05:22	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
22	04:55	05:28	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
23	21:24	05:29	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
24	04:56	05:30	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
25	21:23	05:31	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
26	04:57	05:32	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
27	21:22	05:33	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
28	04:59	05:34	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
29	21:21	05:35	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
30	05:00	05:36	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
31	21:20	05:37	19:31	06:32	07:23	18:23	16:23	15:51	28 09:17 (WEA4802)	
Sommerscheinstunden	155									
astronom.mög.Beschattung	488									

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender

**Berechnung:** WEA\_GB Schattenrezeptor:SR-89 - SR-89, Neumühler Straße 4a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:59 (WEA V02)	07:47		05:55	
2	16:00	09:26 (WEA V02)	16:49	06:41	20:29	04:49
3	08:15	09:00 (WEA V02)	07:46	19:37	05:53	18 20:19 (WEA Z03_wpd)
4	16:01	09:27 (WEA V02)	16:51	06:39	20:31	04:48
5	08:15	09:00 (WEA V02)	07:44	19:39	05:51	17 20:19 (WEA Z03_wpd)
6	16:03	09:28 (WEA V02)	16:53	06:36	20:33	04:47
7	08:15	09:00 (WEA V02)	07:42	19:41	05:50	16 20:18 (WEA Z03_wpd)
8	16:04	09:28 (WEA V02)	16:53	06:34	20:35	04:46
9	08:14	09:01 (WEA V02)	07:41	19:42	05:49	14 20:18 (WEA Z03_wpd)
10	16:05	09:29 (WEA V02)	16:57	06:32	20:36	04:45
11	08:14	09:01 (WEA V02)	07:39	19:44	05:48	13 20:17 (WEA Z03_wpd)
12	16:06	09:29 (WEA V02)	16:59	06:29	20:38	04:44
13	08:13	09:02 (WEA V02)	07:37	19:46	05:47	11 20:17 (WEA Z03_wpd)
14	16:07	09:30 (WEA V02)	17:00	06:27	20:39	10 20:17 (WEA Z03_wpd)
15	08:13	09:02 (WEA V02)	07:36	19:48	05:46	9 20:16 (WEA Z03_wpd)
16	16:09	09:31 (WEA V02)	17:02	06:25	20:41	8 20:16 (WEA Z03_wpd)
17	08:13	09:02 (WEA V02)	07:34	19:49	05:45	7 20:15 (WEA Z03_wpd)
18	16:10	09:31 (WEA V02)	17:04	06:22	20:42	6 20:15 (WEA Z03_wpd)
19	08:12	09:03 (WEA V02)	07:32	19:51	05:44	5 20:14 (WEA Z03_wpd)
20	16:11	09:32 (WEA V02)	17:06	06:21	20:44	
21	08:11	09:03 (WEA V02)	07:30	19:52	05:43	
22	16:13	09:32 (WEA V02)	17:08	06:18	20:46	
23	08:11	09:03 (WEA V02)	07:28	19:53	05:42	
24	16:15	09:32 (WEA V02)	17:10	06:16	20:48	
25	08:10	09:04 (WEA V02)	07:26	19:54	05:41	
26	16:16	09:33 (WEA V02)	17:12	06:13	20:49	
27	08:09	09:04 (WEA V02)	07:24	19:55	05:40	
28	16:18	09:33 (WEA V02)	17:14	06:11	20:51	
29	08:08	09:05 (WEA V02)	07:22	19:56	05:39	
30	16:19	09:33 (WEA V02)	17:16	06:09	20:52	
31	08:08	09:05 (WEA V02)	07:20	19:57	05:38	
1	16:20	09:34 (WEA V02)	17:18	06:07	20:53	
2	08:07	09:06 (WEA V02)	07:18	19:58	05:37	
3	16:22	09:34 (WEA V02)	17:19	06:06	20:54	
4	08:06	09:07 (WEA V02)	07:16	19:59	05:36	
5	16:24	09:34 (WEA V02)	17:21	06:04	20:55	
6	08:05	09:07 (WEA V02)	07:14	19:59	05:35	
7	16:25	09:35 (WEA V02)	17:23	06:03	20:56	
8	08:04	09:08 (WEA V02)	07:12	19:59	05:34	
9	16:27	09:35 (WEA V02)	17:25	06:01	20:57	
10	08:03	09:09 (WEA V02)	07:10	19:59	05:33	
11	16:29	09:35 (WEA V02)	17:27	06:00	20:58	
12	08:01	09:10 (WEA V02)	07:08	19:59	05:32	
13	16:31	09:36 (WEA V02)	17:29	05:59	20:59	
14	08:00	09:11 (WEA V02)	07:06	19:59	05:31	
15	16:33	09:36 (WEA V02)	17:31	05:57	21:00	
16	07:59	09:11 (WEA V02)	07:04	19:59	05:30	
17	16:34	09:36 (WEA V02)	17:33	05:56	21:01	
18	07:58	09:11 (WEA V02)	07:02	19:59	05:29	
19	16:35	09:37 (WEA V02)	17:34	05:55	21:02	
20	07:56	09:12 (WEA V02)	06:59	19:59	05:28	
21	16:38	09:37 (WEA V02)	17:36	05:54	21:03	
22	07:55	09:12 (WEA V02)	06:57	19:59	05:27	
23	16:40	09:38 (WEA V02)	17:38	05:53	21:04	
24	07:53	09:13 (WEA V02)	06:55	19:59	05:26	
25	16:42	09:38 (WEA V02)	17:40	05:52	21:05	
26	07:52	09:13 (WEA V02)	06:53	19:59	05:25	
27	16:44	09:39 (WEA V02)	17:42	05:51	21:06	
28	07:50	09:14 (WEA V02)	06:51	19:59	05:24	
29	16:46	09:39 (WEA V02)	17:44	05:50	21:07	
30	07:49	09:14 (WEA V02)	06:49	19:59	05:23	
31	16:47	09:40 (WEA V02)	17:46	05:49	21:08	
Sonnenscheinstunden	256	276	307	417	487	502
astr.max.mögl.Beschattung	662	299	210	259	352	111

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-89 - SR-89, Neumühler Straße 4a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember	
1	04:45	05:23	20:06 (WEA2802_wpd)	06:14	07:04	17:56 (WEA2801_ErhW)	
2	21:30	20:58	21	20:27 (WEA2803_wpd)	18:44	19	18:15 (WEA2811_ErhW)
3	04:47	05:26	20:06 (WEA2802_wpd)	06:15	07:06	17:56 (WEA2801_ErhW)	
4	04:48	05:27	20:07 (WEA2803_wpd)	06:17	18:41	18	18:14 (WEA2811_ErhW)
5	21:29	20:56	19	20:24 (WEA2803_wpd)	07:07	18	17:57 (WEA2811_ErhW)
6	04:49	05:28	20:07 (WEA2802_wpd)	06:19	18:39	14	18:11 (WEA2811_ErhW)
7	21:28	20:55	17	20:21 (WEA2802_wpd)	07:09	16	17:59 (WEA2811_ErhW)
8	04:51	05:30	20:08 (WEA2803_wpd)	06:20	18:37	10	18:09 (WEA2811_ErhW)
9	21:27	20:54	15	20:19 (WEA2802_wpd)	07:11	14	18:00 (WEA2811_ErhW)
10	04:52	05:31	20:08 (WEA2802_wpd)	06:22	18:34	6	18:06 (WEA2811_ErhW)
11	21:26	20:53	13	20:17 (WEA2802_wpd)	07:13	8	07:43 (WEA2801)
12	04:53	05:32	20:09 (WEA2803_wpd)	06:23	18:32		18:27
13	21:25	20:52	11	20:15 (WEA2802_wpd)	07:14		18:10
14	04:54	05:33	9	20:13 (WEA2802_wpd)	07:15		18:02
15	21:24	20:51	7	20:11 (WEA2802_wpd)	07:16		18:00
16	04:55	05:34	5	20:09 (WEA2802_wpd)	07:17		18:00
17	21:23	20:50	3	20:07 (WEA2802_wpd)	07:18		18:00
18	04:56	05:35	1	20:05 (WEA2802_wpd)	07:19		18:02
19	21:22	20:49		20:03 (WEA2802_wpd)	07:20		18:02
20	04:57	05:36		20:01 (WEA2802_wpd)	07:21		18:02
21	21:21	20:48		19:59 (WEA2802_wpd)	07:22		18:02
22	04:58	05:37		19:57 (WEA2802_wpd)	07:23		18:02
23	21:20	20:47		19:55 (WEA2802_wpd)	07:24		18:02
24	04:59	05:38		19:53 (WEA2802_wpd)	07:25		18:02
25	21:19	20:46		19:51 (WEA2802_wpd)	07:26		18:02
26	05:00	05:39		19:49 (WEA2802_wpd)	07:27		18:02
27	21:18	20:45		19:47 (WEA2802_wpd)	07:28		18:02
28	05:01	05:40		19:45 (WEA2802_wpd)	07:29		18:02
29	21:17	20:44		19:43 (WEA2802_wpd)	07:30		18:02
30	05:02	05:41		19:41 (WEA2802_wpd)	07:31		18:02
31	21:16	20:43		19:39 (WEA2802_wpd)	07:32		18:02
1	05:03	05:42		19:37 (WEA2802_wpd)	07:33		18:02
2	21:15	20:42		19:35 (WEA2802_wpd)	07:34		18:02
3	05:04	05:43		19:33 (WEA2802_wpd)	07:35		18:02
4	21:14	20:41		19:31 (WEA2802_wpd)	07:36		18:02
5	05:05	05:44		19:29 (WEA2802_wpd)	07:37		18:02
6	21:13	20:40		19:27 (WEA2802_wpd)	07:38		18:02
7	05:06	05:45		19:25 (WEA2802_wpd)	07:39		18:02
8	21:12	20:39		19:23 (WEA2802_wpd)	07:40		18:02
9	05:07	05:46		19:21 (WEA2802_wpd)	07:41		18:02
10	21:11	20:38		19:19 (WEA2802_wpd)	07:42		18:02
11	05:08	05:47		19:17 (WEA2802_wpd)	07:43		18:02
12	21:10	20:37		19:15 (WEA2802_wpd)	07:44		18:02
13	05:09	05:48		19:13 (WEA2802_wpd)	07:45		18:02
14	21:09	20:36		19:11 (WEA2802_wpd)	07:46		18:02
15	05:10	05:49		19:09 (WEA2802_wpd)	07:47		18:02
16	21:08	20:35		19:07 (WEA2802_wpd)	07:48		18:02
17	05:11	05:50		19:05 (WEA2802_wpd)	07:49		18:02
18	21:07	20:34		19:03 (WEA2802_wpd)	07:50		18:02
19	05:12	05:51		19:01 (WEA2802_wpd)	07:51		18:02
20	21:06	20:33		18:59 (WEA2802_wpd)	07:52		18:02
21	05:13	05:52		18:57 (WEA2802_wpd)	07:53		18:02
22	21:05	20:32		18:55 (WEA2802_wpd)	07:54		18:02
23	05:14	05:53		18:53 (WEA2802_wpd)	07:55		18:02
24	21:04	20:31		18:51 (WEA2802_wpd)	07:56		18:02
25	05:15	05:54		18:49 (WEA2802_wpd)	07:57		18:02
26	21:03	20:30		18:47 (WEA2802_wpd)	07:58		18:02
27	05:16	05:55		18:45 (WEA2802_wpd)	07:59		18:02
28	21:02	20:29		18:43 (WEA2802_wpd)	08:00		18:02
29	05:17	05:56		18:41 (WEA2802_wpd)	08:01		18:02
30	21:01	20:28		18:39 (WEA2802_wpd)	08:02		18:02
31	05:18	05:57		18:37 (WEA2802_wpd)	08:03		18:02
Sonnenscheinstunden	205	195	181	168	156	144	
astronom.mögl.Beschattung	558	376	144	297	429	834	

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-90 - SR-90, Neumühler Straße 4, 15518 Steinhöfel  
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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	08:15	08:56 (WEA V02)	07:47		05:35	10:27 (WEA Z05, wpt)	04:49	20:04 (WEA Z03, wpt)	
2	16:00	09:21 (WEA V02)	16:49		20:29	19:35 (WEA Z05, wpt)	21:16	20:26 (WEA Z03, wpt)	
3	08:15	08:52 (WEA V02)	07:46		05:33		04:48	20:04 (WEA Z03, wpt)	
4	16:01	09:23 (WEA V02)	16:51		20:31		21:17	20:26 (WEA Z03, wpt)	
5	08:15	08:57 (WEA V02)	07:44		05:31		04:47	20:04 (WEA Z03, wpt)	
6	16:03	09:23 (WEA V02)	16:53		20:33		21:18	20:25 (WEA Z03, wpt)	
7	08:15	08:57 (WEA V02)	07:42		05:29		04:46	20:05 (WEA Z03, wpt)	
8	16:04	09:22 (WEA V02)	16:55		20:34		21:19	20:26 (WEA Z03, wpt)	
9	08:14	08:57 (WEA V02)	07:41		05:27		04:45	20:06 (WEA Z03, wpt)	
10	16:05	09:24 (WEA V02)	16:57		20:36		21:20	20:25 (WEA Z03, wpt)	
11	08:14	08:57 (WEA V02)	07:39		05:25		04:45	20:07 (WEA Z03, wpt)	
12	16:06	09:24 (WEA V02)	16:59		20:38		21:21	20:26 (WEA Z03, wpt)	
13	08:14	08:57 (WEA V02)	07:37		05:24		04:44	20:07 (WEA Z03, wpt)	
14	16:07	09:25 (WEA V02)	17:00		20:39		21:22	20:25 (WEA Z03, wpt)	
15	08:13	08:58 (WEA V02)	07:36		05:22		04:44	20:08 (WEA Z03, wpt)	
16	16:09	09:26 (WEA V02)	17:02	7	20:41		21:23	20:25 (WEA Z03, wpt)	
17	08:13	08:57 (WEA V02)	07:34		05:20		04:43	20:08 (WEA Z03, wpt)	
18	16:10	09:26 (WEA V02)	17:04		20:43		21:24	20:25 (WEA Z03, wpt)	
19	08:12	08:58 (WEA V02)	07:32		05:18		04:43	20:08 (WEA Z03, wpt)	
20	16:11	09:27 (WEA V02)	17:06	16	20:44		21:25	20:25 (WEA Z03, wpt)	
21	08:11	08:59 (WEA V02)	07:30		05:17		04:43	20:09 (WEA Z03, wpt)	
22	16:13	09:28 (WEA V02)	17:08		20:46		21:26	20:25 (WEA Z03, wpt)	
23	08:11	08:59 (WEA V02)	07:28		05:15		04:42	20:09 (WEA Z03, wpt)	
24	16:15	09:28 (WEA V02)	17:10	21	20:48	5	20:16 (WEA Z03, wpt)	20:24 (WEA Z03, wpt)	
25	08:10	08:59 (WEA V02)	07:26		05:13		04:42	20:10 (WEA Z03, wpt)	
26	16:16	09:29 (WEA V02)	17:12	22	20:49	10	20:18 (WEA Z03, wpt)	21:27	20:24 (WEA Z03, wpt)
27	08:09	08:59 (WEA V02)	07:24		05:12		04:41	20:11 (WEA Z03, wpt)	
28	16:18	09:29 (WEA V02)	17:14	23	20:51	14	20:20 (WEA Z03, wpt)	21:28	20:24 (WEA Z03, wpt)
29	08:08	09:00 (WEA V02)	07:22		05:10		04:41	20:11 (WEA Z03, wpt)	
30	16:19	09:29 (WEA V02)	17:16	23	20:52	16	20:22 (WEA Z03, wpt)	21:28	20:24 (WEA Z03, wpt)
31	08:08	09:00 (WEA V02)	07:20		05:08		04:41	20:12 (WEA Z03, wpt)	
1	16:21	09:29 (WEA V02)	17:18	23	20:53	19	20:23 (WEA Z03, wpt)	21:29	20:24 (WEA Z03, wpt)
2	08:07	09:01 (WEA V02)	07:18		05:07		04:41	20:12 (WEA Z03, wpt)	
3	16:22	09:30 (WEA V02)	17:19	23	20:54	20	20:24 (WEA Z03, wpt)	21:29	20:24 (WEA Z03, wpt)
4	08:06	09:01 (WEA V02)	07:16		05:05		04:41	20:13 (WEA Z03, wpt)	
5	16:24	09:30 (WEA V02)	17:21	22	20:55	21	20:24 (WEA Z03, wpt)	21:30	20:24 (WEA Z03, wpt)
6	08:05	09:01 (WEA V02)	07:14		05:04		04:41	20:13 (WEA Z03, wpt)	
7	16:26	09:30 (WEA V02)	17:23	22	20:56	23	20:25 (WEA Z03, wpt)	21:30	20:24 (WEA Z03, wpt)
8	08:04	09:02 (WEA V02)	07:12		05:02		04:41	20:13 (WEA Z03, wpt)	
9	16:27	09:30 (WEA V02)	17:25	20	20:57	25	20:26 (WEA Z03, wpt)	21:30	20:24 (WEA Z03, wpt)
10	08:03	09:02 (WEA V02)	07:10		05:01		04:41	20:13 (WEA Z03, wpt)	
11	16:29	09:30 (WEA V02)	17:27	18	20:58	28	20:26 (WEA Z03, wpt)	21:31	20:24 (WEA Z03, wpt)
12	08:02	09:03 (WEA V02)	07:08		05:00		04:41	20:14 (WEA Z03, wpt)	
13	16:31	09:30 (WEA V02)	17:29	16	20:59	30	20:25 (WEA Z03, wpt)	21:31	20:25 (WEA Z03, wpt)
14	08:01	09:04 (WEA V02)	07:06		04:58		04:42	20:14 (WEA Z03, wpt)	
15	16:33	09:31 (WEA V02)	17:31	11	21:00	31	20:25 (WEA Z03, wpt)	21:31	20:25 (WEA Z03, wpt)
16	07:59	09:05 (WEA V02)	07:04		04:57		04:42	20:14 (WEA Z03, wpt)	
17	16:34	09:31 (WEA V02)	17:33	1	21:01	21	20:26 (WEA Z03, wpt)	21:31	20:25 (WEA Z03, wpt)
18	07:58	09:06 (WEA V02)	07:02		04:56		04:42	20:14 (WEA Z03, wpt)	
19	16:36	09:32 (WEA V02)	17:34		21:02		20:26 (WEA Z03, wpt)	21:31	20:25 (WEA Z03, wpt)
20	07:56	09:08 (WEA V02)	06:59		04:55		04:43	20:14 (WEA Z03, wpt)	
21	16:38	09:32 (WEA V02)	17:36		21:03		20:26 (WEA Z03, wpt)	21:31	20:26 (WEA Z03, wpt)
22	07:55	09:09 (WEA V02)	06:57		04:54		04:43	20:14 (WEA Z03, wpt)	
23	16:40	09:32 (WEA V02)	17:38		21:04		20:26 (WEA Z03, wpt)	21:31	20:26 (WEA Z03, wpt)
24	07:53	09:11 (WEA V02)	06:55		04:53		04:44	20:14 (WEA Z03, wpt)	
25	16:42	09:33 (WEA V02)	17:40		21:05		20:26 (WEA Z03, wpt)	21:31	20:27 (WEA Z03, wpt)
26	07:52	09:14 (WEA V02)			04:52		04:44	20:13 (WEA Z03, wpt)	
27	16:44	09:33 (WEA V02)			21:06		20:26 (WEA Z03, wpt)	21:31	20:27 (WEA Z03, wpt)
28	07:50				04:51		04:45	20:14 (WEA Z03, wpt)	
29	16:46				21:07		20:26 (WEA Z03, wpt)	21:31	20:28 (WEA Z03, wpt)
30	07:49				04:50		04:45	20:14 (WEA Z03, wpt)	
31	16:47				21:08		20:26 (WEA Z03, wpt)	21:31	20:28 (WEA Z03, wpt)
Sonnenscheinstunden					417		420		502
astr.mögl.Beschattung	743	299	215	262					

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-90 - SR-90, Neumühler Straße 4, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
2	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
3	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
4	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
5	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
6	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
7	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
8	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
9	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
10	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
11	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
12	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
13	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
14	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
15	04:45	20:14 (WEA Z803_wpd)	05:22	06:14	07:04	07:51
16	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
17	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
18	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
19	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
20	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
21	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
22	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
23	05:00	20:31 (WEA Z803_wpd)	05:39	06:31	07:21	08:08
24	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
25	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
26	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
27	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
28	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
29	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
30	05:11	20:43 (WEA Z803_wpd)	05:50	06:42	07:32	08:19
31	05:21	20:55 (WEA Z803_wpd)	06:01	06:53	07:43	08:30
Sommerscheinstunden	155	145	135	125	115	105
astr.mögl.Beschattung	633	274	190	303	477	762

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung: WEA\_GB Schattenrezeptor:SR-91 - SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel**  
**Annahmen für Schattenwurfberechnung**

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	08:15	08:59 (WEA V02)	07:47	06:53	06:41	05:35
2	16:00	09:27 (WEA V02)	16:49	17:42	19:37	20:29
3	08:15	09:10 (WEA V02)	07:46	06:51	06:39	05:33
4	16:01	09:27 (WEA V02)	16:51	17:44	19:39	20:31
5	08:15	09:10 (WEA V02)	07:44	06:48	06:36	05:31
6	16:03	09:28 (WEA V02)	16:53	17:46	19:41	20:33
7	08:15	09:10 (WEA V02)	07:42	06:46	06:34	05:29
8	16:04	09:28 (WEA V02)	16:55	17:47	19:42	20:34
9	08:14	09:11 (WEA V02)	07:41	06:44	06:32	05:27
10	16:05	09:29 (WEA V02)	16:57	17:49	19:44	20:36
11	08:14	09:10 (WEA V02)	07:39	06:42	06:29	05:25
12	16:06	09:29 (WEA V02)	16:59	17:51	19:46	20:38
13	08:14	09:11 (WEA V02)	07:37	06:39	06:27	05:24
14	16:07	09:31 (WEA V02)	17:00	17:53	19:48	20:39
15	08:13	09:11 (WEA V02)	07:36	06:37	06:25	05:22
16	16:09	09:31 (WEA V02)	17:02	17:55	19:49	20:41
17	08:13	09:11 (WEA V02)	07:34	06:35	06:22	05:20
18	16:10	09:31 (WEA V02)	17:04	17:56	19:51	20:43
19	08:12	09:12 (WEA V02)	07:32	06:33	06:20	05:18
20	16:12	09:32 (WEA V02)	17:06	17:58	19:53	20:44
21	08:11	09:12 (WEA V02)	07:30	06:30	06:18	05:17
22	16:13	09:32 (WEA V02)	17:08	18:00	19:55	20:46
23	08:11	09:12 (WEA V02)	07:28	06:28	06:16	05:15
24	16:15	09:33 (WEA V02)	17:10	18:02	19:56	20:48
25	08:10	09:13 (WEA V02)	07:26	06:26	06:13	05:13
26	16:16	09:33 (WEA V02)	17:12	18:04	19:58	20:49
27	08:09	09:13 (WEA V02)	07:24	06:23	06:11	05:12
28	16:18	09:33 (WEA V02)	17:14	18:05	19:59	20:51
29	08:08	09:14 (WEA V02)	07:22	06:21	06:09	05:10
30	16:19	09:34 (WEA V02)	17:16	18:07	20:01	20:52
31	08:08	09:14 (WEA V02)	07:20	06:19	06:07	05:08
1	16:21	09:34 (WEA V02)	17:18	18:09	20:03	20:54
2	08:07	09:15 (WEA V02)	07:18	06:16	06:04	05:07
3	16:22	09:34 (WEA V02)	17:19	18:11	20:05	20:56
4	08:06	09:15 (WEA V02)	07:16	06:14	06:02	05:05
5	16:24	09:35 (WEA V02)	17:21	18:13	20:07	20:57
6	08:05	09:15 (WEA V02)	07:14	06:12	06:00	05:04
7	16:26	09:34 (WEA V02)	17:23	18:14	20:08	20:59
8	08:04	09:16 (WEA V02)	07:12	06:09	05:58	05:02
9	16:27	09:34 (WEA V02)	17:25	18:16	20:10	21:00
10	08:03	09:17 (WEA V02)	07:10	06:07	05:56	05:01
11	16:29	09:34 (WEA V02)	17:27	18:18	20:12	21:02
12	08:03	09:17 (WEA V02)	07:08	06:05	05:54	05:00
13	16:31	09:34 (WEA V02)	17:29	18:20	20:14	21:03
14	08:03	09:18 (WEA V02)	07:06	06:02	05:51	05:01
15	16:33	09:33 (WEA V02)	17:31	18:21	20:15	21:04
16	07:59	09:19 (WEA V02)	07:04	06:00	05:49	04:57
17	16:34	09:33 (WEA V02)	17:33	18:23	20:17	21:06
18	07:58	09:11 (WEA V02)	07:02	05:57	05:47	04:56
19	16:36	09:33 (WEA V02)	17:34	18:25	20:19	21:07
20	07:56	09:13 (WEA V02)	06:59	05:55	05:45	04:55
21	16:38	09:31 (WEA V02)	17:36	18:27	20:21	21:09
22	07:55	09:14 (WEA V02)	06:57	05:53	05:43	04:54
23	16:40	09:29 (WEA V02)	17:38	18:28	20:22	21:10
24	07:53	09:16 (WEA V02)	06:55	05:50	05:41	04:53
25	16:42	09:27 (WEA V02)	17:40	18:30	20:24	21:11
26	07:52			06:48	05:39	04:51
27	16:44			19:32	20:26	21:13
28	07:50			06:46	05:37	04:50
29	16:46			19:34	20:27	21:14
30	07:49			06:43		04:50
31	16:47			19:35		21:15
1	256	276	307	417	487	592
Sonnenscheinstunden						
astr.max.mögl.Beschattung	747	314	201	251	426	294

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:45	20:16 (WEA Z803_wpd)	05:22	20:18 (WEA Z803_wpd)	06:14	07:04
2	21:30	9 20:25 (WEA Z803_wpd)	20:58	9 20:27 (WEA Z803_wpd)	19:54	18:44
3	04:46	20:25 (WEA Z803_wpd)	05:24	20:26	06:15	07:06
4	04:47	20:15 (WEA Z803_wpd)	05:26	20:17	06:17	07:07
5	21:30	11 20:26 (WEA Z803_wpd)	20:56	11 20:28	19:50	18:39
6	04:48	20:14 (WEA Z803_wpd)	05:27	20:19	06:19	07:09
7	21:29	13 20:27 (WEA Z803_wpd)	20:52	13 20:29	19:47	18:37
8	04:48	20:14 (WEA Z803_wpd)	05:29	20:20	06:20	07:11
9	21:29	14 20:28 (WEA Z803_wpd)	20:51	14 20:30	19:45	18:34
10	04:49	20:13 (WEA Z803_wpd)	05:31	20:21	06:22	07:12
11	21:28	15 20:28 (WEA Z803_wpd)	20:49	15 20:31	19:43	18:32
12	04:50	20:12 (WEA Z803_wpd)	05:32	20:22	06:24	07:14
13	21:28	16 20:29 (WEA Z803_wpd)	20:47	16 20:32	19:41	18:30
14	04:51	20:11 (WEA Z803_wpd)	05:34	20:23	06:25	07:16
15	21:27	17 20:30 (WEA Z803_wpd)	20:45	17 20:33	19:38	18:28
16	04:52	20:12 (WEA Z803_wpd)	05:35	20:24	06:27	07:18
17	21:26	18 20:31 (WEA Z803_wpd)	20:43	18 20:34	19:36	18:25
18	04:53	20:12 (WEA Z803_wpd)	05:37	20:25	06:29	07:19
19	21:25	19 20:31 (WEA Z803_wpd)	20:41	19 20:35	19:33	18:23
20	04:54	20:12 (WEA Z803_wpd)	05:39	20:26	06:30	07:21
21	21:25	20 20:32 (WEA Z803_wpd)	20:39	21 20:36	19:31	18:21
22	04:55	20:12 (WEA Z803_wpd)	05:40	20:27	06:32	07:23
23	21:24	20 20:32 (WEA Z803_wpd)	20:37	6 19:43 (WEA Z805_wpd)	19:29	18:18
24	04:56	20:11 (WEA Z803_wpd)	05:42	19:33 (WEA Z805_wpd)	06:34	07:25
25	21:23	21 20:32 (WEA Z803_wpd)	20:35	12 19:45 (WEA Z805_wpd)	19:26	18:16
26	04:57	20:11 (WEA Z803_wpd)	05:44	19:32 (WEA Z805_wpd)	06:35	07:26
27	21:22	22 20:32 (WEA Z803_wpd)	20:33	15 19:47 (WEA Z805_wpd)	19:24	18:14
28	04:59	20:11 (WEA Z803_wpd)	05:45	19:30 (WEA Z805_wpd)	06:37	07:28
29	21:21	22 20:33 (WEA Z803_wpd)	20:31	17 19:47 (WEA Z805_wpd)	19:22	18:12
30	05:00	20:12 (WEA Z803_wpd)	05:47	19:28 (WEA Z805_wpd)	06:38	07:30
31	21:20	23 20:34 (WEA Z803_wpd)	20:29	18 19:48 (WEA Z805_wpd)	19:19	18:09
1	05:01	20:13 (WEA Z803_wpd)	05:49	19:28 (WEA Z805_wpd)	06:40	07:32
2	21:19	23 20:34 (WEA Z803_wpd)	20:27	20 19:48 (WEA Z805_wpd)	19:17	18:07
3	05:02	20:14 (WEA Z803_wpd)	05:50	19:28 (WEA Z805_wpd)	06:42	07:33
4	21:18	23 20:34 (WEA Z803_wpd)	20:25	21 19:49 (WEA Z805_wpd)	19:15	18:05
5	05:04	20:14 (WEA Z803_wpd)	05:52	19:28 (WEA Z805_wpd)	06:44	07:35
6	21:17	23 20:34 (WEA Z803_wpd)	20:23	21 19:49 (WEA Z805_wpd)	19:12	18:03
7	05:05	20:14 (WEA Z803_wpd)	05:54	19:27 (WEA Z805_wpd)	06:45	07:37
8	21:15	23 20:34 (WEA Z803_wpd)	20:21	21 19:48 (WEA Z805_wpd)	19:10	18:01
9	05:06	20:14 (WEA Z803_wpd)	05:55	19:27 (WEA Z805_wpd)	06:47	07:39
10	21:14	24 20:35 (WEA Z803_wpd)	20:19	21 19:48 (WEA Z805_wpd)	19:07	17:59
11	05:08	20:14 (WEA Z803_wpd)	05:57	19:27 (WEA Z805_wpd)	06:49	07:41
12	21:13	24 20:35 (WEA Z803_wpd)	20:17	20 19:47 (WEA Z805_wpd)	19:05	17:57
13	05:09	20:14 (WEA Z803_wpd)	05:59	19:27 (WEA Z805_wpd)	06:50	07:43
14	21:12	23 20:34 (WEA Z803_wpd)	20:15	20 19:47 (WEA Z805_wpd)	19:03	17:54
15	05:11	20:14 (WEA Z803_wpd)	06:00	19:27 (WEA Z805_wpd)	06:52	07:44
16	21:10	23 20:35 (WEA Z803_wpd)	20:13	17 19:44 (WEA Z805_wpd)	19:00	17:52
17	05:12	20:14 (WEA Z803_wpd)	06:02	19:26 (WEA Z805_wpd)	06:54	07:46
18	21:09	24 20:34 (WEA Z803_wpd)	20:11	19:43 (WEA Z805_wpd)	18:58	17:50
19	05:14	20:14 (WEA Z803_wpd)	06:04	19:30 (WEA Z805_wpd)	06:55	07:48
20	21:07	22 20:34 (WEA Z803_wpd)	20:08	11 19:41 (WEA Z805_wpd)	18:56	17:48
21	05:15	20:15 (WEA Z803_wpd)	06:05	19:30 (WEA Z805_wpd)	06:57	07:49
22	21:06	21 20:34 (WEA Z803_wpd)	20:06	6 19:38 (WEA Z805_wpd)	18:53	17:46
23	05:17	20:15 (WEA Z803_wpd)	06:07	19:30 (WEA Z805_wpd)	06:59	07:51
24	21:04	20 20:33 (WEA Z803_wpd)	20:03	18:51	18:51	17:44
25	05:18	20:15 (WEA Z803_wpd)	06:09	19:30	07:00	07:52
26	21:03	20:15 (WEA Z803_wpd)	20:01	18:48	18:48	17:42
27	05:20	20:15 (WEA Z803_wpd)	06:10	19:30	07:02	07:55
28	21:01	15 20:35 (WEA Z803_wpd)	19:59	18:46	18:46	17:40
29	05:21	20:17 (WEA Z803_wpd)	06:12	19:30	07:05	07:58
30	20:59	1	1	1	1	1
31	20:59	1	1	1	1	1
Sonnenscheinstunden	195	187	181	181	176	164
astr.mögl.Beschattung	594	268	188	298	472	843

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-92 - SR-92, Neumühler Straße 2, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:06 (WEA V02)	07:47	08:31 (WEA V02)	06:53	06:41
2	16:00	09:36 (WEA V02)	16:49	08:47 (WEA V02)	17:42	19:37
3	08:15	09:06 (WEA V02)	07:46	08:32 (WEA V02)	06:51	06:39
4	16:01	09:27 (WEA V02)	16:51	08:46 (WEA V02)	17:44	19:39
5	08:15	09:07 (WEA V02)	07:44	08:34 (WEA V02)	06:48	06:36
6	16:03	09:38 (WEA V02)	16:53	08:44 (WEA V02)	17:46	19:41
7	08:15	09:07 (WEA V02)	07:42	08:37 (WEA V02)	06:46	06:34
8	16:04	09:39 (WEA V02)	16:55	08:42 (WEA V02)	17:47	19:42
9	08:14	09:08 (WEA V02)	07:41	08:39 (WEA V02)	06:44	06:32
10	16:05	09:39 (WEA V02)	16:57	08:41 (WEA V02)	17:49	19:44
11	08:14	09:07 (WEA V02)	07:39	08:06 (WEA V01)	06:42	06:29
12	16:06	09:39 (WEA V02)	16:59	08:13 (WEA V01)	17:51	19:46
13	08:14	09:08 (WEA V02)	07:37	08:03 (WEA V01)	06:39	06:27
14	16:07	09:40 (WEA V02)	17:00	08:16 (WEA V01)	17:53	19:48
15	08:13	09:08 (WEA V02)	07:36	08:01 (WEA V01)	06:37	06:25
16	16:09	09:40 (WEA V02)	17:02	08:18 (WEA V01)	17:55	19:49
17	08:13	09:08 (WEA V02)	07:34	08:00 (WEA V01)	06:35	06:23
18	16:10	09:41 (WEA V02)	17:04	08:19 (WEA V01)	17:56	19:51
19	08:13	09:08 (WEA V02)	07:32	07:59 (WEA V01)	06:33	06:21
20	16:11	09:41 (WEA V02)	17:06	08:20 (WEA V01)	17:58	19:53
21	08:11	09:10 (WEA V02)	07:30	07:58 (WEA V01)	06:30	06:18
22	16:13	09:41 (WEA V02)	17:08	08:21 (WEA V01)	18:00	19:55
23	08:11	09:10 (WEA V02)	07:28	07:58 (WEA V01)	06:28	06:16
24	16:15	09:42 (WEA V02)	17:10	08:22 (WEA V01)	18:02	19:56
25	08:10	09:11 (WEA V02)	07:26	07:58 (WEA V01)	06:26	06:14
26	16:16	09:42 (WEA V02)	17:12	08:22 (WEA V01)	18:04	19:58
27	08:09	09:11 (WEA V02)	07:24	07:57 (WEA V01)	06:23	06:11
28	16:18	09:42 (WEA V02)	17:14	08:23 (WEA V01)	18:05	19:59
29	08:08	09:12 (WEA V02)	07:22	07:57 (WEA V01)	06:21	06:09
30	16:19	09:42 (WEA V02)	17:16	08:22 (WEA V01)	18:07	19:59
31	08:08	09:12 (WEA V02)	07:20	07:58 (WEA V01)	06:19	06:07
1	16:21	09:42 (WEA V02)	17:18	08:23 (WEA V01)	18:09	19:59
2	08:07	09:13 (WEA V02)	07:18	07:58 (WEA V01)	06:16	06:04
3	16:22	09:42 (WEA V02)	17:19	08:22 (WEA V01)	18:11	19:59
4	08:06	09:13 (WEA V02)	07:16	07:58 (WEA V01)	06:14	06:02
5	16:24	09:42 (WEA V02)	17:21	08:22 (WEA V01)	18:13	19:59
6	08:05	09:13 (WEA V02)	07:14	07:59 (WEA V01)	06:12	06:00
7	16:25	09:42 (WEA V02)	17:23	08:21 (WEA V01)	18:14	19:59
8	08:04	09:13 (WEA V02)	07:12	08:00 (WEA V01)	06:09	05:58
9	16:27	09:42 (WEA V02)	17:25	08:20 (WEA V01)	18:16	19:59
10	08:02	09:13 (WEA V02)	07:10	08:00 (WEA V01)	06:07	05:56
11	16:29	09:42 (WEA V02)	17:27	08:18 (WEA V01)	18:18	19:59
12	08:01	09:13 (WEA V02)	07:08	08:02 (WEA V01)	06:05	05:54
13	16:31	09:41 (WEA V02)	17:29	08:16 (WEA V01)	18:20	19:59
14	08:00	09:13 (WEA V02)	07:06	08:05 (WEA V01)	06:02	05:51
15	16:33	09:41 (WEA V02)	17:31	08:13 (WEA V01)	18:21	19:59
16	07:59	09:13 (WEA V02)	07:04	08:00	06:00	05:49
17	16:34	09:41 (WEA V02)	17:33	08:13 (WEA V01)	18:23	19:59
18	07:57	09:13 (WEA V02)	07:02	07:57	05:57	05:47
19	16:36	09:41 (WEA V02)	17:34	08:25	18:25	19:59
20	07:56	09:13 (WEA V02)	06:59	05:55	05:45	05:35
21	16:38	09:41 (WEA V02)	17:36	08:27	18:27	19:59
22	07:55	09:13 (WEA V02)	06:57	05:53	05:43	05:33
23	16:40	09:41 (WEA V02)	17:38	08:28	18:28	19:59
24	07:53	09:13 (WEA V02)	06:55	05:50	05:40	05:30
25	16:42	09:41 (WEA V02)	17:40	08:30	18:30	19:59
26	07:52	09:13 (WEA V02)	06:53	05:48	05:38	05:28
27	16:44	09:41 (WEA V02)	17:42	08:31	18:31	19:59
28	07:50	09:13 (WEA V02)	06:51	05:46	05:36	05:26
29	16:46	09:41 (WEA V02)	17:44	08:32	18:32	19:59
30	07:49	09:13 (WEA V02)	06:49	05:43	05:33	05:23
31	16:47	09:41 (WEA V02)	17:46	08:33	18:33	19:59
Sonnenscheinstunden	256		267		277	
astr.max.mögl.Beschattung	974	276	397	487	623	731

**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)	Zeitpunkt (SS:MM)	Schattenanfang	Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

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Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:14 (WEA Z803_wpd)   06:14	07:04	18:10 (WEA Z811_ErWB)   06:59	07:29 (WEA V801)   07:51
2	04:46	05:23	20:15 (WEA Z803_wpd)   06:15	07:05	18:11 (WEA Z811_ErWB)   07:00	07:30 (WEA V801)   07:52
3	04:47	05:24	20:16 (WEA Z803_wpd)   06:16	07:06	18:12 (WEA Z811_ErWB)   07:01	07:31 (WEA V801)   07:53
4	04:48	05:25	20:17 (WEA Z803_wpd)   06:17	07:07	18:13 (WEA Z811_ErWB)   07:02	07:32 (WEA V801)   07:54
5	04:49	05:26	20:18 (WEA Z803_wpd)   06:18	07:08	18:14 (WEA Z811_ErWB)   07:03	07:33 (WEA V801)   07:55
6	04:50	05:27	20:19 (WEA Z803_wpd)   06:19	07:09	18:15 (WEA Z811_ErWB)   07:04	07:34 (WEA V801)   07:56
7	04:51	05:28	20:20 (WEA Z803_wpd)   06:20	07:10	18:16 (WEA Z811_ErWB)   07:05	07:35 (WEA V801)   07:57
8	04:52	05:29	20:21 (WEA Z803_wpd)   06:21	07:11	18:17 (WEA Z811_ErWB)   07:06	07:36 (WEA V801)   07:58
9	04:53	05:30	20:22 (WEA Z803_wpd)   06:22	07:12	18:18 (WEA Z811_ErWB)   07:07	07:37 (WEA V801)   07:59
10	04:54	05:31	20:23 (WEA Z803_wpd)   06:23	07:13	18:19 (WEA Z811_ErWB)   07:08	07:38 (WEA V801)   08:00
11	04:55	05:32	20:24 (WEA Z803_wpd)   06:24	07:14	18:20 (WEA Z811_ErWB)   07:09	07:39 (WEA V801)   08:01
12	04:56	05:33	20:25 (WEA Z803_wpd)   06:25	07:15	18:21 (WEA Z811_ErWB)   07:10	07:40 (WEA V801)   08:02
13	04:57	05:34	20:26 (WEA Z803_wpd)   06:26	07:16	18:22 (WEA Z811_ErWB)   07:11	07:41 (WEA V801)   08:03
14	04:58	05:35	20:27 (WEA Z803_wpd)   06:27	07:17	18:23 (WEA Z811_ErWB)   07:12	07:42 (WEA V801)   08:04
15	04:59	05:36	20:28 (WEA Z803_wpd)   06:28	07:18	18:24 (WEA Z811_ErWB)   07:13	07:43 (WEA V801)   08:05
16	05:00	05:37	20:29 (WEA Z803_wpd)   06:29	07:19	18:25 (WEA Z811_ErWB)   07:14	07:44 (WEA V801)   08:06
17	05:01	05:38	20:30 (WEA Z803_wpd)   06:30	07:20	18:26 (WEA Z811_ErWB)   07:15	07:45 (WEA V801)   08:07
18	05:02	05:39	20:31 (WEA Z803_wpd)   06:31	07:21	18:27 (WEA Z811_ErWB)   07:16	07:46 (WEA V801)   08:08
19	05:03	05:40	20:32 (WEA Z803_wpd)   06:32	07:22	18:28 (WEA Z811_ErWB)   07:17	07:47 (WEA V801)   08:09
20	05:04	05:41	20:33 (WEA Z803_wpd)   06:33	07:23	18:29 (WEA Z811_ErWB)   07:18	07:48 (WEA V801)   08:10
21	05:05	05:42	20:34 (WEA Z803_wpd)   06:34	07:24	18:30 (WEA Z811_ErWB)   07:19	07:49 (WEA V801)   08:11
22	05:06	05:43	20:35 (WEA Z803_wpd)   06:35	07:25	18:31 (WEA Z811_ErWB)   07:20	07:50 (WEA V801)   08:12
23	05:07	05:44	20:36 (WEA Z803_wpd)   06:36	07:26	18:32 (WEA Z811_ErWB)   07:21	07:51 (WEA V801)   08:13
24	05:08	05:45	20:37 (WEA Z803_wpd)   06:37	07:27	18:33 (WEA Z811_ErWB)   07:22	07:52 (WEA V801)   08:14
25	05:09	05:46	20:38 (WEA Z803_wpd)   06:38	07:28	18:34 (WEA Z811_ErWB)   07:23	07:53 (WEA V801)   08:15
26	05:10	05:47	20:39 (WEA Z803_wpd)   06:39	07:29	18:35 (WEA Z811_ErWB)   07:24	07:54 (WEA V801)   08:16
27	05:11	05:48	20:40 (WEA Z803_wpd)   06:40	07:30	18:36 (WEA Z811_ErWB)   07:25	07:55 (WEA V801)   08:17
28	05:12	05:49	20:41 (WEA Z803_wpd)   06:41	07:31	18:37 (WEA Z811_ErWB)   07:26	07:56 (WEA V801)   08:18
29	05:13	05:50	20:42 (WEA Z803_wpd)   06:42	07:32	18:38 (WEA Z811_ErWB)   07:27	07:57 (WEA V801)   08:19
30	05:14	05:51	20:43 (WEA Z803_wpd)   06:43	07:33	18:39 (WEA Z811_ErWB)   07:28	07:58 (WEA V801)   08:20
31	05:15	05:52	20:44 (WEA Z803_wpd)   06:44	07:34	18:40 (WEA Z811_ErWB)   07:29	07:59 (WEA V801)   08:21
Sonnenscheinstunden	155	157	159	161	163	165
stärkstmög. Beschattung	448	450	452	454	456	458

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-93 - SR-93, Neumühler Straße 1, 15518 Steinhöfel

**Annahmen für Schattenwurfberechnung**

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- 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 08:15	09:13 (WEA VB02) 07:47	08:37 (WEA VB03) 06:53	06:41	05:35	04:49
16:00	32 09:45 (WEA VB02) 16:49	13 08:50 (WEA VB01) 17:42	19:37	20:29	21:16
2 08:15	09:14 (WEA VB02) 07:46	08:39 (WEA VB03) 06:51	06:39	05:33	04:48
16:01	32 09:46 (WEA VB02) 16:51	8 08:47 (WEA VB03) 17:44	19:39	20:31	21:17
3 08:15	09:14 (WEA VB02) 07:44		06:36	05:31	04:47
16:03	33 09:47 (WEA VB02) 16:53		17:46	19:41	21:18
4 08:15	09:14 (WEA VB02) 07:42	08:11 (WEA VB01) 06:46	06:34	05:29	04:46
16:04	32 09:46 (WEA VB02) 16:55	7 08:18 (WEA VB01) 17:47	19:42	20:34	21:19
5 08:14	09:15 (WEA VB02) 07:39	08:06 (WEA VB01) 06:42	06:29	05:25	04:45
16:06	32 09:47 (WEA VB02) 16:59	16 08:22 (WEA VB01) 17:51	19:46	20:38	21:21
7 08:14	09:16 (WEA VB02) 07:37	08:05 (WEA VB01) 06:39	06:27	05:24	20:05 (WEA ZB03_wpd) 04:44
16:07	32 09:48 (WEA VB02) 17:00	19 08:24 (WEA VB01) 17:53	19:48	20:39	5 20:10 (WEA ZB03_wpd) 21:22
8 08:13	09:16 (WEA VB02) 07:36	08:04 (WEA VB01) 06:37	06:25	05:22	20:02 (WEA ZB03_wpd) 04:44
16:09	32 09:48 (WEA VB02) 17:02	21 08:25 (WEA VB01) 17:55	19:49	20:41	9 20:11 (WEA ZB03_wpd) 21:23
9 08:13	09:16 (WEA VB02) 07:34	08:03 (WEA VB01) 06:35	06:22	05:20	20:01 (WEA ZB03_wpd) 04:43
16:10	32 09:48 (WEA VB02) 17:04	23 08:26 (WEA VB01) 17:56	19:51	20:43	13 20:13 (WEA ZB03_wpd) 21:24
10 08:12	09:18 (WEA VB02) 07:32	08:02 (WEA VB01) 06:33	06:20	05:18	19:59 (WEA ZB03_wpd) 04:43
16:12	31 09:49 (WEA VB02) 17:06	24 08:26 (WEA VB01) 17:58	19:53	20:44	15 20:14 (WEA ZB03_wpd) 21:25
11 08:11	09:18 (WEA VB02) 07:30	08:02 (WEA VB01) 06:30	06:18	05:17	19:59 (WEA ZB03_wpd) 04:42
16:13	31 09:49 (WEA VB02) 17:08	25 08:27 (WEA VB01) 18:00	19:55	20:46	17 20:16 (WEA ZB03_wpd) 21:26
12 08:11	09:18 (WEA VB02) 07:28	08:02 (WEA VB01) 06:28	06:16	05:15	19:58 (WEA ZB03_wpd) 04:42
16:15	31 09:49 (WEA VB02) 17:10	25 08:27 (WEA VB01) 18:02	19:56	20:48	19 20:17 (WEA ZB03_wpd) 21:26
13 08:10	08:40 (WEA VB03) 07:26	08:01 (WEA VB01) 06:26	06:13	05:13	19:57 (WEA ZB03_wpd) 04:42
16:16	31 09:49 (WEA VB02) 17:12	26 08:27 (WEA VB01) 18:04	19:58	20:49	21 20:18 (WEA ZB03_wpd) 21:27
14 08:09	08:39 (WEA VB03) 07:24	08:02 (WEA VB01) 06:23	06:11	05:12	19:57 (WEA ZB03_wpd) 04:41
16:18	31 09:49 (WEA VB02) 17:14	25 08:27 (WEA VB01) 18:05	19:59	20:51	21 20:18 (WEA ZB03_wpd) 21:28
15 08:08	08:38 (WEA VB03) 07:22	08:02 (WEA VB01) 06:21	06:09	05:10	19:56 (WEA ZB03_wpd) 04:41
16:19	36 09:49 (WEA VB02) 17:16	25 08:27 (WEA VB01) 18:07	19:59	20:52	22 20:18 (WEA ZB03_wpd) 21:28
16 08:08	08:37 (WEA VB03) 07:20	08:02 (WEA VB01) 06:19	06:07	05:08	19:55 (WEA ZB03_wpd) 04:41
16:21	37 09:49 (WEA VB02) 17:18	25 08:27 (WEA VB01) 18:09	19:59	20:54	22 20:19 (WEA ZB03_wpd) 21:29
17 08:07	08:36 (WEA VB03) 07:18	08:03 (WEA VB01) 06:16	06:04	05:07	19:57 (WEA ZB03_wpd) 04:41
16:22	39 09:49 (WEA VB02) 17:19	23 08:26 (WEA VB01) 18:11	20:00	20:55	22 20:19 (WEA ZB03_wpd) 21:29
18 08:06	08:35 (WEA VB03) 07:16	08:04 (WEA VB01) 06:14	06:02	05:05	19:57 (WEA ZB03_wpd) 04:41
16:24	40 09:49 (WEA VB02) 17:21	21 08:25 (WEA VB01) 18:13	20:01	20:57	21 20:18 (WEA ZB03_wpd) 21:30
19 08:05	08:33 (WEA VB03) 07:14	08:05 (WEA VB01) 06:12	06:00	05:04	19:57 (WEA ZB03_wpd) 04:41
16:26	40 09:48 (WEA VB02) 17:23	19 08:24 (WEA VB01) 18:14	20:02	20:59	22 20:19 (WEA ZB03_wpd) 21:30
20 08:04	08:32 (WEA VB03) 07:12	08:06 (WEA VB01) 06:09	05:58	05:02	19:58 (WEA ZB03_wpd) 04:41
16:27	40 09:47 (WEA VB02) 17:25	17 08:23 (WEA VB01) 18:16	20:03	20:59	21 20:19 (WEA ZB03_wpd) 21:30
21 08:02	08:31 (WEA VB03) 07:10	08:07 (WEA VB01) 06:07	05:56	05:01	19:58 (WEA ZB03_wpd) 04:41
16:29	40 09:47 (WEA VB02) 17:27	13 08:20 (WEA VB01) 18:18	20:04	20:59	21 20:19 (WEA ZB03_wpd) 21:31
22 08:01	08:31 (WEA VB03) 07:08	08:11 (WEA VB01) 06:05	05:54	05:00	19:58 (WEA ZB03_wpd) 04:41
16:31	38 09:46 (WEA VB02) 17:29	5 08:16 (WEA VB01) 18:20	20:04	20:59	20 20:18 (WEA ZB03_wpd) 21:31
23 08:00	08:31 (WEA VB03) 07:06	06:02	05:51	05:04	19:58 (WEA ZB03_wpd) 04:42
16:33	35 09:44 (WEA VB02) 17:31	18:21	20:05	20:59	20 20:18 (WEA ZB03_wpd) 21:31
24 07:59	08:32 (WEA VB03) 07:04	06:00	05:49	05:03	19:59 (WEA ZB03_wpd) 04:42
16:34	30 09:42 (WEA VB02) 17:33	18:23	20:07	20:59	18 20:17 (WEA ZB03_wpd) 21:31
25 07:57	08:31 (WEA VB03) 07:02	05:57	05:47	05:02	19:59 (WEA ZB03_wpd) 04:42
16:36	21 08:52 (WEA VB03) 17:34	18:25	20:09	20:59	16 20:17 (WEA ZB03_wpd) 21:31
26 07:56	08:32 (WEA VB03) 06:59	05:55	05:45	05:01	19:59 (WEA ZB03_wpd) 04:43
16:38	21 08:53 (WEA VB03) 17:36	18:27	20:11	20:59	15 20:16 (WEA ZB03_wpd) 21:31
27 07:55	08:32 (WEA VB03) 06:57	05:53	05:43	05:02	19:59 (WEA ZB03_wpd) 04:43
16:40	20 08:52 (WEA VB03) 17:38	18:28	20:12	20:59	15 20:16 (WEA ZB03_wpd) 21:31
28 07:53	08:33 (WEA VB03) 06:55	05:50	05:41	05:03	19:58 (WEA ZB03_wpd) 04:44
16:42	20 08:53 (WEA VB03) 17:40	18:30	20:14	20:59	15 20:16 (WEA ZB03_wpd) 21:31
29 07:52	08:34 (WEA VB03)	06:48	05:39	05:04	20:04 (WEA ZB03_wpd) 04:44
16:43	18 08:52 (WEA VB03)	19:32	20:26	20:59	10 20:14 (WEA ZB03_wpd) 21:31
30 07:50	08:34 (WEA VB03)	06:46	05:37	05:03	20:05 (WEA ZB03_wpd) 04:45
16:45	17 08:51 (WEA VB03)	19:34	20:27	21:14	21:14
31 07:49	08:36 (WEA VB03)	06:43	05:37	05:04	20:05 (WEA ZB03_wpd) 04:45
16:47	15 08:51 (WEA VB03)	19:35	20:27	21:15	7 20:12 (WEA ZB03_wpd) 21:31
Sonnenscheinstunden	256	276	367	487	502
astr.max.mögl.Beschattung	953	393	175	417	210

**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) Schatteneende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	----------------------------------	---------------------------------	---------------------------	----------------------------



Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-93 - SR-93, Neumühler Straße 1, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:09 (WEA2803_wpd)	06:14	07:04	18:09 (WEA2811_ErWB)
2	21:30	20:58	18 20:27 (WEA2803_wpd)	19:54	18:44	7 18:16 (WEA2811_ErWB)
3	04:48	05:24	20:09 (WEA2803_wpd)	06:15	07:05	18:13 (WEA2811_ErWB)
4	04:47	05:26	20:10 (WEA2803_wpd)	06:17	18:41	1 18:44 (WEA2811_ErWB)
5	21:30	05:24	20:09 (WEA2803_wpd)	06:15	07:07	07:02
6	04:48	05:27	20:11 (WEA2803_wpd)	06:19	18:39	1 07:54 (WEA2803_wpd)
7	21:29	05:26	20:11 (WEA2803_wpd)	06:19	18:37	12 07:50 (WEA2803_wpd)
8	04:49	05:29	20:11 (WEA2803_wpd)	06:20	18:34	07:06
9	21:29	05:31	20:11 (WEA2803_wpd)	06:20	18:34	16 07:52 (WEA2803_wpd)
10	04:49	05:31	20:11 (WEA2803_wpd)	06:20	18:32	07:06
11	21:28	05:32	20:11 (WEA2803_wpd)	06:21	18:32	12 07:50 (WEA2803_wpd)
12	04:50	05:32	20:11 (WEA2803_wpd)	06:21	18:31	07:06
13	21:28	05:33	20:11 (WEA2803_wpd)	06:21	18:30	16 07:47 (WEA2803_wpd)
14	04:51	05:34	20:11 (WEA2803_wpd)	06:22	18:29	07:12
15	21:27	05:34	20:11 (WEA2803_wpd)	06:22	18:27	16:24
16	04:52	05:35	20:11 (WEA2803_wpd)	06:22	18:27	07:13
17	21:26	05:35	20:11 (WEA2803_wpd)	06:22	18:25	16:22
18	04:53	05:37	20:11 (WEA2803_wpd)	06:22	18:25	9 08:10 (WEA2803_wpd)
19	21:25	05:37	20:11 (WEA2803_wpd)	06:22	18:23	07:15
20	04:54	05:38	20:11 (WEA2803_wpd)	06:23	18:23	16 08:21 (WEA2803_wpd)
21	21:25	05:39	20:11 (WEA2803_wpd)	06:23	18:21	07:17
22	04:55	05:40	20:11 (WEA2803_wpd)	06:23	18:21	15 08:22 (WEA2803_wpd)
23	21:24	05:40	20:11 (WEA2803_wpd)	06:23	18:19	07:19
24	04:56	05:42	20:11 (WEA2803_wpd)	06:24	18:18	16 08:23 (WEA2803_wpd)
25	21:23	05:42	20:11 (WEA2803_wpd)	06:24	18:17	07:21
26	04:57	05:43	20:11 (WEA2803_wpd)	06:24	18:16	18 08:24 (WEA2803_wpd)
27	21:22	05:43	20:11 (WEA2803_wpd)	06:24	18:14	07:23
28	04:59	05:45	19:34 (WEA2805_wpd)	06:27	18:14	20 08:25 (WEA2803_wpd)
29	21:21	05:45	19:34 (WEA2805_wpd)	06:27	18:12	07:24
30	04:59	05:46	19:34 (WEA2805_wpd)	06:27	18:12	20 08:25 (WEA2803_wpd)
31	21:20	05:47	19:34 (WEA2805_wpd)	06:27	18:11	21 08:26 (WEA2803_wpd)
1	05:01	05:49	19:34 (WEA2805_wpd)	06:28	18:09	07:26
2	21:19	05:49	19:34 (WEA2805_wpd)	06:28	18:07	07:28
3	04:52	05:50	19:34 (WEA2805_wpd)	06:28	18:07	16 08:26 (WEA2803_wpd)
4	21:18	05:50	19:34 (WEA2805_wpd)	06:28	18:05	07:30
5	04:53	05:51	19:34 (WEA2805_wpd)	06:28	18:05	30 09:16 (WEA2803_wpd)
6	21:17	05:52	19:34 (WEA2805_wpd)	06:28	18:03	07:31
7	04:54	05:52	19:34 (WEA2805_wpd)	06:28	18:03	35 09:19 (WEA2803_wpd)
8	21:17	05:53	19:34 (WEA2805_wpd)	06:28	18:03	07:33
9	04:55	05:54	19:34 (WEA2805_wpd)	06:28	18:01	8 08:41 (WEA2803_wpd)
10	21:15	05:54	19:34 (WEA2805_wpd)	06:28	18:01	8 08:41 (WEA2803_wpd)
11	04:56	05:55	19:34 (WEA2805_wpd)	06:28	18:01	14 08:52 (WEA2803_wpd)
12	21:14	05:55	19:34 (WEA2805_wpd)	06:28	18:01	14 08:52 (WEA2803_wpd)
13	04:57	05:56	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
14	21:13	05:56	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
15	04:58	05:57	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
16	21:13	05:57	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
17	04:59	05:58	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
18	21:12	05:58	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
19	04:59	05:59	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
20	21:11	05:59	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
21	04:59	06:00	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
22	21:11	06:00	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
23	04:59	06:01	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
24	21:10	06:01	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
25	04:59	06:02	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
26	21:10	06:02	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
27	04:59	06:03	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
28	21:09	06:03	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
29	04:59	06:04	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
30	21:09	06:04	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
31	04:59	06:05	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
1	21:09	06:05	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
2	04:59	06:06	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
3	21:09	06:06	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
4	04:59	06:07	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
5	21:09	06:07	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
6	04:59	06:08	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
7	21:09	06:08	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
8	04:59	06:09	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
9	21:09	06:09	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
10	04:59	06:10	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
11	21:09	06:10	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
12	04:59	06:11	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
13	21:09	06:11	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
14	04:59	06:12	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
15	21:09	06:12	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
16	04:59	06:13	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
17	21:09	06:13	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
18	04:59	06:14	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
19	21:09	06:14	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
20	04:59	06:15	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
21	21:09	06:15	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
22	04:59	06:16	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
23	21:09	06:16	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
24	04:59	06:17	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
25	21:09	06:17	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
26	04:59	06:18	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
27	21:09	06:18	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
28	04:59	06:19	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
29	21:09	06:19	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
30	04:59	06:20	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
31	21:09	06:20	19:34 (WEA2805_wpd)	06:28	18:01	18 08:54 (WEA2803_wpd)
Sonnenscheinstunden	336	336	336	336	336	336
astronom.mög.Beschattung	336	285	167	265	745	990

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-94 - SR-94, Neumühler Straße 1b, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

- 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	08:15	09:21 (WEA V02)	07:47	08:16 (WEA V01)	06:53	06:41	
2	16:00	09:53 (WEA V02)	16:49	7 08:23 (WEA V01)	17:42	19:37	
3	08:15	09:22 (WEA V02)	07:46	08:13 (WEA V01)	06:51	06:39	
4	16:01	09:54 (WEA V02)	16:51	13 08:26 (WEA V01)	17:44	19:39	
5	08:15	09:23 (WEA V02)	07:44	08:11 (WEA V01)	06:48	06:36	
6	16:03	31 09:54 (WEA V02)	16:53	17 08:28 (WEA V01)	17:46	19:41	
7	08:15	09:23 (WEA V02)	07:42	08:11 (WEA V01)	06:46	06:34	
8	16:04	31 09:54 (WEA V02)	16:55	19 08:30 (WEA V01)	17:47	19:42	
9	08:14	09:24 (WEA V02)	07:41	08:10 (WEA V01)	06:44	06:32	
10	16:05	31 09:55 (WEA V02)	16:57	21 08:31 (WEA V01)	17:49	19:44	
11	08:14	09:24 (WEA V02)	07:39	08:09 (WEA V01)	06:42	06:29	
12	16:06	30 09:54 (WEA V02)	16:59	22 08:31 (WEA V01)	17:51	19:46	
13	08:14	09:24 (WEA V02)	07:37	08:08 (WEA V01)	06:39	06:27	
14	16:07	30 09:55 (WEA V02)	17:00	24 08:32 (WEA V01)	17:53	19:48	
15	08:13	09:25 (WEA V02)	07:36	08:08 (WEA V01)	06:37	06:25	
16	16:09	30 09:55 (WEA V02)	17:02	25 08:33 (WEA V01)	17:55	19:49	
17	08:13	09:25 (WEA V02)	07:34	08:07 (WEA V01)	06:35	06:22	
18	16:10	31 09:55 (WEA V02)	17:04	26 08:33 (WEA V01)	17:56	19:51	
19	08:12	09:26 (WEA V02)	07:32	08:07 (WEA V01)	06:33	06:20	
20	16:11	34 09:56 (WEA V02)	17:06	26 08:33 (WEA V01)	17:58	19:53	
21	08:11	09:26 (WEA V02)	07:30	08:07 (WEA V01)	06:30	06:18	
22	16:13	35 09:56 (WEA V02)	17:08	26 08:33 (WEA V01)	18:00	19:55	
23	08:11	09:26 (WEA V02)	07:28	08:07 (WEA V01)	06:28	06:16	
24	16:15	36 09:56 (WEA V02)	17:10	26 08:33 (WEA V01)	18:02	19:56	
25	08:10	09:26 (WEA V02)	07:26	08:08 (WEA V01)	06:26	06:13	
26	16:16	37 09:57 (WEA V02)	17:12	25 08:33 (WEA V01)	18:04	19:58	
27	08:09	09:27 (WEA V02)	07:24	08:08 (WEA V01)	06:23	06:11	
28	16:18	38 09:57 (WEA V02)	17:14	24 08:33 (WEA V01)	18:05	19:59	
29	08:08	09:28 (WEA V02)	07:22	08:09 (WEA V01)	06:21	06:09	
30	16:19	39 09:57 (WEA V02)	17:16	23 08:33 (WEA V01)	18:07	19:59	
31	08:08	09:27 (WEA V02)	07:20	08:10 (WEA V01)	06:19	06:07	
1	16:21	39 09:58 (WEA V02)	17:18	21 08:33 (WEA V01)	18:09	19:59	
2	08:07	09:28 (WEA V02)	07:18	08:11 (WEA V01)	06:16	06:04	
3	16:22	39 09:58 (WEA V02)	17:19	19 08:30 (WEA V01)	18:11	19:59	
4	08:06	09:28 (WEA V02)	07:16	08:11 (WEA V01)	06:14	06:02	
5	16:24	39 09:58 (WEA V02)	17:21	15 08:28 (WEA V01)	18:12	19:59	
6	08:05	09:28 (WEA V02)	07:14	08:12 (WEA V01)	06:12	06:00	
7	16:26	35 09:58 (WEA V02)	17:23	11 08:26 (WEA V01)	18:14	19:59	
8	08:04	09:28 (WEA V02)	07:12	08:12 (WEA V01)	06:10	05:58	
9	16:27	31 09:59 (WEA V02)	17:25	18:16	14 17:28 (WEA ZB1_ErBw)	20:10	19:57 (WEA ZB2_wpd)
10	08:03	09:28 (WEA V02)	07:10	08:13 (WEA V01)	06:07	05:56	
11	16:29	21 09:57 (WEA V02)	17:27	18:18	10 17:36 (WEA ZB1_ErBw)	20:12	19:58 (WEA ZB2_wpd)
12	08:01	09:28 (WEA V02)	07:08	08:13 (WEA V01)	06:05	05:54	
13	16:31	21 09:57 (WEA V02)	17:29	18:20	2 17:31 (WEA ZB1_ErBw)	20:14	19:59 (WEA ZB2_wpd)
14	08:00	09:28 (WEA V02)	07:06	08:14	16 17:39 (WEA ZB1_ErBw)	20:08	19:59 (WEA ZB2_wpd)
15	16:33	21 09:57 (WEA V02)	17:31	18:21	16 17:24 (WEA ZB1_ErBw)	20:09	19:59 (WEA ZB2_wpd)
16	07:59	08:37 (WEA V02)	07:04	08:14	14 17:28 (WEA ZB1_ErBw)	20:10	19:57 (WEA ZB2_wpd)
17	16:34	20 09:57 (WEA V02)	17:33	18:23	19 19:37 (WEA ZB2_wpd)	21:00	20:12 (WEA ZB3_wpd)
18	07:57	08:37 (WEA V02)	07:02	08:15	10 17:36 (WEA ZB1_ErBw)	20:12	19:58 (WEA ZB2_wpd)
19	16:36	20 09:57 (WEA V02)	17:34	18:25	18 19:18 (WEA ZB2_wpd)	20:59	20:13 (WEA ZB3_wpd)
20	07:56	08:38 (WEA V02)	06:59	08:15	16 17:39 (WEA ZB1_ErBw)	20:09	19:59 (WEA ZB2_wpd)
21	16:38	19 09:57 (WEA V02)	17:36	18:27	15 17:24 (WEA ZB1_ErBw)	20:08	19:59 (WEA ZB2_wpd)
22	07:55	08:38 (WEA V02)	06:57	08:15	14 17:28 (WEA ZB1_ErBw)	20:10	19:57 (WEA ZB2_wpd)
23	16:40	18 09:56 (WEA V02)	17:38	18:28	13 17:36 (WEA ZB1_ErBw)	20:12	19:58 (WEA ZB2_wpd)
24	07:53	08:38 (WEA V02)	06:55	08:16	12 17:32 (WEA ZB1_ErBw)	20:14	19:59 (WEA ZB2_wpd)
25	16:42	16 09:56 (WEA V02)	17:40	18:30	11 19:18 (WEA ZB2_wpd)	20:59	20:13 (WEA ZB3_wpd)
26	07:52	08:41 (WEA V02)	06:54	08:16	10 19:35 (WEA ZB2_wpd)	21:03	20:10 (WEA ZB3_wpd)
27	16:43	14 09:56 (WEA V02)	17:41	18:31	9 19:19 (WEA ZB2_wpd)	20:58	19:57 (WEA ZB2_wpd)
28	07:50	08:42 (WEA V02)	06:53	08:16	8 19:36 (WEA ZB2_wpd)	21:02	20:12 (WEA ZB3_wpd)
29	16:45	11 09:56 (WEA V02)	17:44	18:32	7 19:18 (WEA ZB2_wpd)	20:59	19:59 (WEA ZB2_wpd)
30	07:49	08:46 (WEA V02)	06:53	08:17	6 19:35 (WEA ZB2_wpd)	21:03	20:10 (WEA ZB3_wpd)
31	16:47	6 09:52 (WEA V02)	17:46	18:35	5 19:19 (WEA ZB2_wpd)	20:58	19:57 (WEA ZB2_wpd)
Sonnenscheinstunden	256	276	307	417	467	502	5
astr.mögl.Beschattung	807	390	162	198	359	5	

**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)	Schattenende (WEA mit letztem Schatten)
--------------	-----------------------	-------------------------	----------------------	-------------------	--	---

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-94 - SR-94, Neumühler Straße 1b, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:03 (WEA2803_wpd)	06:14	07:04	18:05 (WEA2811_ErW)
2	21:30	20:58	21 20:24 (WEA2803_wpd)	19:54	18:44	11 18:16 (WEA2811_ErW)
3	04:47	05:24	20:03 (WEA2803_wpd)	06:15	07:05	18:06 (WEA2811_ErW)
4	04:48	05:26	20:01 (WEA2803_wpd)	06:17	18:41	8 18:14 (WEA2811_ErW)
5	04:48	05:27	20:01 (WEA2803_wpd)	06:17	07:07	18:09 (WEA2811_ErW)
6	04:48	05:28	20:01 (WEA2803_wpd)	06:18	18:39	2 18:11 (WEA2811_ErW)
7	04:49	05:29	20:02 (WEA2803_wpd)	06:19	07:09	18:09
8	04:51	05:32	20:02 (WEA2803_wpd)	06:20	07:11	18:07
9	04:52	05:35	20:01 (WEA2803_wpd)	06:21	18:34	18:29
10	04:53	05:37	20:05 (WEA2803_wpd)	06:22	18:32	18:27
11	04:54	05:39	20:11 (WEA2803_wpd)	06:23	18:31	18:26
12	04:55	05:40	20:14 (WEA2803_wpd)	06:24	18:30	18:25
13	04:56	05:42	20:17 (WEA2803_wpd)	06:25	18:29	18:24
14	04:57	05:44	20:20 (WEA2803_wpd)	06:26	18:28	18:23
15	04:59	05:45	20:23 (WEA2803_wpd)	06:27	18:27	18:22
16	05:00	05:47	20:26 (WEA2803_wpd)	06:28	18:26	18:21
17	05:01	05:49	20:29 (WEA2803_wpd)	06:29	18:25	18:20
18	05:02	05:51	20:32 (WEA2803_wpd)	06:30	18:24	18:19
19	05:04	05:52	20:35 (WEA2803_wpd)	06:31	18:23	18:18
20	05:05	05:54	20:38 (WEA2803_wpd)	06:32	18:22	18:17
21	05:06	05:56	20:41 (WEA2803_wpd)	06:33	18:21	18:16
22	05:08	05:57	20:44 (WEA2803_wpd)	06:34	18:20	18:15
23	05:09	05:59	20:47 (WEA2803_wpd)	06:35	18:19	18:14
24	05:11	06:00	20:50 (WEA2803_wpd)	06:36	18:18	18:13
25	05:12	06:02	20:53 (WEA2803_wpd)	06:37	18:17	18:12
26	05:14	06:04	20:56 (WEA2803_wpd)	06:38	18:16	18:11
27	05:17	06:06	20:59 (WEA2803_wpd)	06:39	18:15	18:10
28	05:17	06:07	21:02 (WEA2803_wpd)	06:40	18:14	18:09
29	05:18	06:09	21:05 (WEA2803_wpd)	06:41	18:13	18:08
30	05:20	06:10	21:08 (WEA2803_wpd)	06:42	18:12	18:07
31	05:21	06:12	21:11 (WEA2803_wpd)	06:43	18:11	18:06
1	05:23	06:13	21:14 (WEA2803_wpd)	06:44	18:10	18:05
2	05:25	06:15	21:17 (WEA2803_wpd)	06:45	18:09	18:04
3	05:26	06:16	21:20 (WEA2803_wpd)	06:46	18:08	18:03
4	05:27	06:17	21:23 (WEA2803_wpd)	06:47	18:07	18:02
5	05:28	06:18	21:26 (WEA2803_wpd)	06:48	18:06	18:01
6	05:29	06:19	21:29 (WEA2803_wpd)	06:49	18:05	18:00
7	05:30	06:20	21:32 (WEA2803_wpd)	06:50	18:04	17:59
8	05:31	06:21	21:35 (WEA2803_wpd)	06:51	18:03	17:58
9	05:32	06:22	21:38 (WEA2803_wpd)	06:52	18:02	17:57
10	05:33	06:23	21:41 (WEA2803_wpd)	06:53	18:01	17:56
11	05:34	06:24	21:44 (WEA2803_wpd)	06:54	18:00	17:55
12	05:35	06:25	21:47 (WEA2803_wpd)	06:55	17:59	17:54
13	05:36	06:26	21:50 (WEA2803_wpd)	06:56	17:58	17:53
14	05:37	06:27	21:53 (WEA2803_wpd)	06:57	17:57	17:52
15	05:38	06:28	21:56 (WEA2803_wpd)	06:58	17:56	17:51
16	05:39	06:29	21:59 (WEA2803_wpd)	06:59	17:55	17:50
17	05:40	06:30	22:02 (WEA2803_wpd)	07:00	17:54	17:49
18	05:41	06:31	22:05 (WEA2803_wpd)	07:01	17:53	17:48
19	05:42	06:32	22:08 (WEA2803_wpd)	07:02	17:52	17:47
20	05:43	06:33	22:11 (WEA2803_wpd)	07:03	17:51	17:46
21	05:44	06:34	22:14 (WEA2803_wpd)	07:04	17:50	17:45
22	05:45	06:35	22:17 (WEA2803_wpd)	07:05	17:49	17:44
23	05:46	06:36	22:20 (WEA2803_wpd)	07:06	17:48	17:43
24	05:47	06:37	22:23 (WEA2803_wpd)	07:07	17:47	17:42
25	05:48	06:38	22:26 (WEA2803_wpd)	07:08	17:46	17:41
26	05:49	06:39	22:29 (WEA2803_wpd)	07:09	17:45	17:40
27	05:50	06:40	22:32 (WEA2803_wpd)	07:10	17:44	17:39
28	05:51	06:41	22:35 (WEA2803_wpd)	07:11	17:43	17:38
29	05:52	06:42	22:38 (WEA2803_wpd)	07:12	17:42	17:37
30	05:53	06:43	22:41 (WEA2803_wpd)	07:13	17:41	17:36
31	05:54	06:44	22:44 (WEA2803_wpd)	07:14	17:40	17:35
Sonnenscheinstunden	155	165	175	181	186	191
astr.mögl.Beschattung	225	335	443	543	643	743

**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)	Schattenende (WEA mit letztem Schatten)
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-95 - SR-95, Neumühler Straße 1a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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	08:15	09:18 (WEA VB02)	07:47	10	08:41 (WEA VB03)	06:53		06:41	05:35		04:49	
1	16:00	33 09:51 (WEA VB02)	16:49	10	08:51 (WEA VB01)	17:42		19:37	20:29		21:16	
2	08:15	09:19 (WEA VB02)	07:46		06:51			06:39	05:33		04:48	
1	16:01	33 09:52 (WEA VB02)	16:51		17:44			19:39	20:31		21:17	
3	08:15	09:20 (WEA VB02)	07:44		08:12 (WEA VB01)	06:48		06:36	05:31		04:47	
4	16:03	32 09:52 (WEA VB02)	16:53	8	08:20 (WEA VB01)	17:46		19:41	20:33		21:18	
4	08:15	09:19 (WEA VB02)	07:42		08:10 (WEA VB01)	06:46		06:34	05:29		04:46	
1	16:04	33 09:52 (WEA VB02)	16:55	13	08:23 (WEA VB01)	17:47		19:42	20:34		21:19	
5	08:14	09:20 (WEA VB02)	07:41		08:08 (WEA VB01)	06:44		06:32	05:27		04:45	
1	16:05	33 09:53 (WEA VB02)	16:57	17	08:25 (WEA VB01)	17:49		19:44	20:36		21:20	
6	08:14	09:20 (WEA VB02)	07:39		08:07 (WEA VB01)	06:42		06:29	05:25	20:04 (WEA ZB03_wpd)	04:45	
1	16:06	33 09:53 (WEA VB02)	16:59	19	08:26 (WEA VB01)	17:51		19:46	20:38	5 20:09 (WEA ZB03_wpd)	21:21	
7	08:14	09:21 (WEA VB02)	07:37		08:06 (WEA VB01)	06:39		06:27	05:24	20:01 (WEA ZB03_wpd)	04:44	
1	16:07	33 09:54 (WEA VB02)	17:00	21	08:27 (WEA VB01)	17:53		19:48	20:39	9 20:10 (WEA ZB03_wpd)	21:22	
8	08:13	09:22 (WEA VB02)	07:36		08:05 (WEA VB01)	06:37		06:25	05:22	20:00 (WEA ZB03_wpd)	04:44	
1	16:09	32 09:54 (WEA VB02)	17:02	23	08:28 (WEA VB01)	17:55		19:49	20:41	11 20:11 (WEA ZB03_wpd)	21:23	
9	08:13	09:22 (WEA VB02)	07:34		08:04 (WEA VB01)	06:35		06:22	05:20	19:59 (WEA ZB03_wpd)	04:43	
1	16:10	32 09:54 (WEA VB02)	17:04	25	08:29 (WEA VB01)	17:56		19:51	20:43	14 20:13 (WEA ZB03_wpd)	21:24	
10	08:12	09:23 (WEA VB02)	07:32		08:04 (WEA VB01)	06:33		06:20	05:18	19:58 (WEA ZB03_wpd)	04:43	
1	16:12	32 09:55 (WEA VB02)	17:06	25	08:29 (WEA VB01)	17:58		19:53	20:44	16 20:14 (WEA ZB03_wpd)	21:25	
11	08:11	08:42 (WEA VB03)	07:30		08:04 (WEA VB01)	06:30		06:18	05:17	19:58 (WEA ZB03_wpd)	04:42	
1	16:13	31 09:54 (WEA VB02)	17:08	26	08:30 (WEA VB01)	18:00		19:55	20:46	18 20:16 (WEA ZB03_wpd)	21:26	
12	08:11	08:41 (WEA VB03)	07:28		08:04 (WEA VB01)	06:28	17:34 (WEA ZB11_EnBW)	06:16	05:15	19:57 (WEA ZB03_wpd)	04:42	
1	16:15	34 09:54 (WEA VB02)	17:10	26	08:30 (WEA VB01)	18:02	2 17:36 (WEA ZB11_EnBW)	19:56	20:48	20 20:17 (WEA ZB03_wpd)	21:26	
13	08:10	08:40 (WEA VB03)	07:26		08:04 (WEA VB01)	06:26	17:31 (WEA ZB11_EnBW)	06:13	05:13	19:56 (WEA ZB03_wpd)	04:42	
1	16:16	36 09:54 (WEA VB02)	17:12	26	08:30 (WEA VB01)	18:04	7 17:38 (WEA ZB11_EnBW)	19:58	20:49	21 20:17 (WEA ZB03_wpd)	21:27	
14	08:09	08:39 (WEA VB03)	07:24		08:04 (WEA VB01)	06:23	10 17:39 (WEA ZB11_EnBW)	20:00	19:56 (WEA ZB03_wpd)	20:18 (WEA ZB03_wpd)	21:28	
1	16:18	37 09:54 (WEA VB02)	17:14	26	08:30 (WEA VB01)	18:05	14 17:42 (WEA ZB11_EnBW)	20:01	19:26 (WEA ZB05_wpd)	20:17 (WEA ZB03_wpd)	21:28	
15	08:08	08:38 (WEA VB03)	07:22		08:04 (WEA VB01)	06:21	17:28 (WEA ZB11_EnBW)	06:09	19:26 (WEA ZB05_wpd)	20:10 (WEA ZB03_wpd)	21:28	
1	16:19	39 09:54 (WEA VB02)	17:16	25	08:29 (WEA VB01)	18:07	14 17:42 (WEA ZB11_EnBW)	20:01	19:26 (WEA ZB05_wpd)	20:10 (WEA ZB03_wpd)	21:28	
16	08:08	08:37 (WEA VB03)	07:20		08:05 (WEA VB01)	06:19	17:27 (WEA ZB11_EnBW)	06:07	19:25 (WEA ZB05_wpd)	20:09 (WEA ZB03_wpd)	21:28	
1	16:21	40 09:54 (WEA VB02)	17:18	24	08:29 (WEA VB01)	18:09	17 17:44 (WEA ZB11_EnBW)	20:03	19:26 (WEA ZB05_wpd)	20:10 (WEA ZB03_wpd)	21:29	
17	08:07	08:36 (WEA VB03)	07:18		08:05 (WEA VB01)	06:16	17:26 (WEA ZB11_EnBW)	06:04	19:24 (WEA ZB05_wpd)	20:07 (WEA ZB03_wpd)	21:29	
1	16:22	40 09:54 (WEA VB02)	17:19	23	08:28 (WEA VB01)	18:11	19 17:45 (WEA ZB11_EnBW)	20:05	19:27 (WEA ZB05_wpd)	20:11 (WEA ZB03_wpd)	21:29	
18	08:06	08:35 (WEA VB03)	07:16		08:06 (WEA VB01)	06:14	17:26 (WEA ZB11_EnBW)	06:02	19:23 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:29	
1	16:24	40 09:55 (WEA VB02)	17:21	22	08:28 (WEA VB01)	18:12	17 17:45 (WEA ZB11_EnBW)	20:07	19:24 (WEA ZB05_wpd)	20:10 (WEA ZB03_wpd)	21:30	
19	08:05	08:33 (WEA VB03)	07:14		08:07 (WEA VB01)	06:12	17:25 (WEA ZB11_EnBW)	06:00	19:22 (WEA ZB05_wpd)	20:04 (WEA ZB03_wpd)	21:30	
20	08:04	09:52 (WEA VB02)	17:23	19	08:26 (WEA VB01)	18:14	19 17:44 (WEA ZB11_EnBW)	20:08	19:41 (WEA ZB05_wpd)	20:11 (WEA ZB03_wpd)	21:30	
21	08:04	08:33 (WEA VB03)	07:12		08:09 (WEA VB01)	06:09	17:26 (WEA ZB11_EnBW)	05:58	19:21 (WEA ZB05_wpd)	20:02 (WEA ZB03_wpd)	21:30	
1	16:29	39 09:51 (WEA VB02)	17:27	22	08:28 (WEA VB01)	18:18	16 17:43 (WEA ZB11_EnBW)	20:12	19:21 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:31	
22	08:01	08:34 (WEA VB03)	07:08		08:05 (WEA VB01)	06:10	17:27 (WEA ZB11_EnBW)	05:54	19:21 (WEA ZB05_wpd)	20:00 (WEA ZB03_wpd)	21:31	
23	08:00	08:33 (WEA VB03)	07:07		08:11 (WEA VB01)	06:07	17:27 (WEA ZB11_EnBW)	05:56	19:21 (WEA ZB05_wpd)	20:01 (WEA ZB03_wpd)	21:31	
1	16:31	37 09:45 (WEA VB02)	17:31	10	08:21 (WEA VB01)	18:21	16 17:43 (WEA ZB11_EnBW)	20:14	19:21 (WEA ZB05_wpd)	20:04 (WEA ZB03_wpd)	21:31	
24	07:59	08:34 (WEA VB03)	07:04		08:00		14 17:41 (WEA ZB11_EnBW)	20:14	19:40 (WEA ZB05_wpd)	20:13 (WEA ZB03_wpd)	21:31	
1	16:34	21 08:55 (WEA VB03)	17:33	18	08:20 (WEA VB01)	18:20	10 17:39 (WEA ZB11_EnBW)	20:15	19:22 (WEA ZB05_wpd)	20:00 (WEA ZB03_wpd)	21:31	
25	07:57	08:34 (WEA VB03)	07:02		08:05 (WEA VB01)	06:11	18:23		20:17	16 19:38 (WEA ZB05_wpd)	20:06 (WEA ZB03_wpd)	21:31
1	16:36	21 08:55 (WEA VB03)	17:34		08:05 (WEA VB01)	06:11	05:49		19:23 (WEA ZB05_wpd)	20:04 (WEA ZB03_wpd)	21:31	
26	07:56	08:35 (WEA VB03)	06:59		08:06 (WEA VB01)	06:14	20:17		19:24 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:31	
1	16:38	20 08:55 (WEA VB03)	17:36		08:07 (WEA VB01)	06:16	20:19		19:24 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:31	
27	07:55	08:35 (WEA VB03)	06:57		08:06 (WEA VB01)	06:14	05:45		19:24 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:31	
1	16:40	20 08:55 (WEA VB03)	17:38		08:07 (WEA VB01)	06:16	20:21		19:24 (WEA ZB05_wpd)	20:05 (WEA ZB03_wpd)	21:31	
28	07:53	08:36 (WEA VB03)	06:55		08:07 (WEA VB01)	06:16	05:43		19:26 (WEA ZB05_wpd)	20:04 (WEA ZB03_wpd)	21:31	
29	07:52	08:37 (WEA VB03)	06:54		08:08 (WEA VB01)	06:17	20:22	7 19:33 (WEA ZB05_wpd)	20:10 (WEA ZB03_wpd)	20:06 (WEA ZB03_wpd)	21:31	
1	16:43	17 08:54 (WEA VB03)	17:40		08:09 (WEA VB01)	06:18	05:41		19:33 (WEA ZB05_wpd)	20:11 (WEA ZB03_wpd)	21:31	
30	07:50	08:37 (WEA VB03)	06:46		08:10 (WEA VB01)	06:19	20:24		20:11	4 20:10 (WEA ZB03_wpd)	21:31	
1	16:45	16 08:53 (WEA VB03)	17:39		08:11 (WEA VB01)	06:20	05:39		04:51		04:44	
31	07:49	08:40 (WEA VB03)	06:43		08:12 (WEA VB01)	06:21	20:26		21:13		21:31	
1	16:47	13 08:53 (WEA VB03)	17:35		08:13 (WEA VB01)	06:22	05:37		04:50		04:45	
	Sonnenscheinstunden	256		276		367		417		487		502
	astr.max.mögl.Beschattung	948		404		164		198		366		

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender**

**Berechnung:** WEA\_GB Schattenrezeptor:SR-95 - SR-95, Neumühler Straße 1a, 15518 Steinhöfel  
**Annahmen für Schattenwurfberechnung**

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

	Jul	August	September	Oktober	November	Dezember
1	04:45	05:22	20:07 (WEA ZB03_wpd)	06:14	07:04	08:24 (WEA VB03)
2	04:48	05:28	20:07 (WEA ZB03_wpd)	06:14	18:44 4	07:59 (WEA VB01) 15:55 32
3	04:50	05:29	20:07 (WEA ZB03_wpd)	06:15	07:05	07:54 (WEA VB01) 15:52 32
4	04:52	05:30	20:06 (WEA ZB03_wpd)	06:17	07:07	07:55 (WEA VB01) 15:54 32
5	04:54	05:31	20:04 (WEA ZB03_wpd)	06:19	07:09	07:56 (WEA VB01) 15:54 32
6	04:56	05:32	20:02 (WEA ZB03_wpd)	06:21	07:11	07:57 (WEA VB01) 15:54 32
7	04:58	05:33	20:01 (WEA ZB03_wpd)	06:23	07:13	07:58 (WEA VB01) 15:54 32
8	04:59	05:34	20:00 (WEA ZB03_wpd)	06:25	07:15	07:59 (WEA VB01) 15:54 32
9	05:00	05:35	19:59 (WEA ZB03_wpd)	06:27	07:17	08:00 (WEA VB01) 15:54 32
10	05:01	05:36	19:58 (WEA ZB03_wpd)	06:29	07:19	08:01 (WEA VB01) 15:54 32
11	05:02	05:37	19:57 (WEA ZB03_wpd)	06:31	07:21	08:02 (WEA VB01) 15:54 32
12	05:03	05:38	19:56 (WEA ZB03_wpd)	06:33	07:23	08:03 (WEA VB01) 15:54 32
13	05:04	05:39	19:55 (WEA ZB03_wpd)	06:35	07:25	08:04 (WEA VB01) 15:54 32
14	05:05	05:40	19:54 (WEA ZB03_wpd)	06:37	07:27	08:05 (WEA VB01) 15:54 32
15	05:06	05:41	19:53 (WEA ZB03_wpd)	06:39	07:29	08:06 (WEA VB01) 15:54 32
16	05:07	05:42	19:52 (WEA ZB03_wpd)	06:41	07:31	08:07 (WEA VB01) 15:54 32
17	05:08	05:43	19:51 (WEA ZB03_wpd)	06:43	07:33	08:08 (WEA VB01) 15:54 32
18	05:09	05:44	19:50 (WEA ZB03_wpd)	06:45	07:35	08:09 (WEA VB01) 15:54 32
19	05:10	05:45	19:49 (WEA ZB03_wpd)	06:47	07:37	08:10 (WEA VB01) 15:54 32
20	05:11	05:46	19:48 (WEA ZB03_wpd)	06:49	07:39	08:11 (WEA VB01) 15:54 32
21	05:12	05:47	19:47 (WEA ZB03_wpd)	06:51	07:41	08:12 (WEA VB01) 15:54 32
22	05:13	05:48	19:46 (WEA ZB03_wpd)	06:53	07:43	08:13 (WEA VB01) 15:54 32
23	05:14	05:49	19:45 (WEA ZB03_wpd)	06:55	07:45	08:14 (WEA VB01) 15:54 32
24	05:15	05:50	19:44 (WEA ZB03_wpd)	06:57	07:47	08:15 (WEA VB01) 15:54 32
25	05:16	05:51	19:43 (WEA ZB03_wpd)	06:59	07:49	08:16 (WEA VB01) 15:54 32
26	05:17	05:52	19:42 (WEA ZB03_wpd)	07:01	07:51	08:17 (WEA VB01) 15:54 32
27	05:18	05:53	19:41 (WEA ZB03_wpd)	07:03	07:53	08:18 (WEA VB01) 15:54 32
28	05:19	05:54	19:40 (WEA ZB03_wpd)	07:05	07:55	08:19 (WEA VB01) 15:54 32
29	05:20	05:55	19:39 (WEA ZB03_wpd)	07:07	07:57	08:20 (WEA VB01) 15:54 32
30	05:21	05:56	19:38 (WEA ZB03_wpd)	07:09	07:59	08:21 (WEA VB01) 15:54 32
31	05:22	05:57	19:37 (WEA ZB03_wpd)	07:11	08:01	08:22 (WEA VB01) 15:54 32
Sonnenscheinstunden	155	157	159	161	163	165
str.max.mögl.Beschattung	282	286	286	286	286	286

**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)	Schattenende (WEA mit letztem Schatten)
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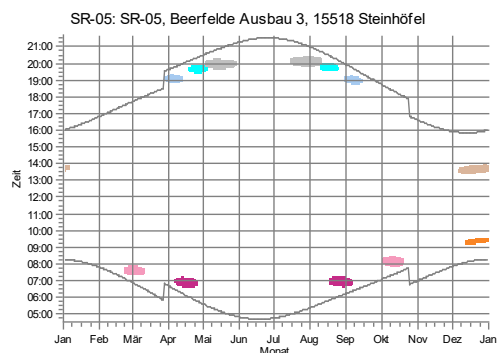
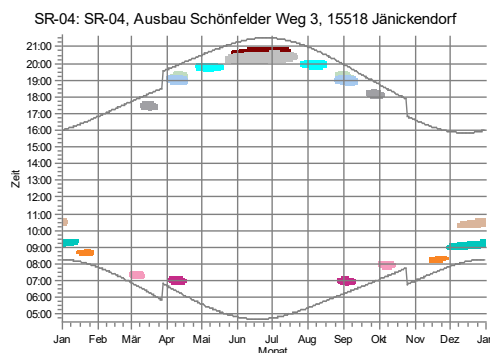
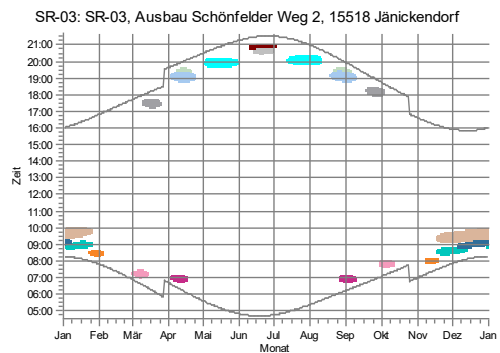
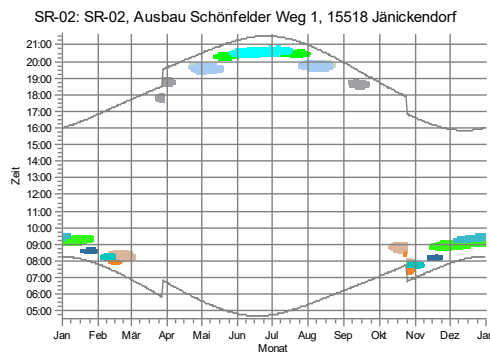
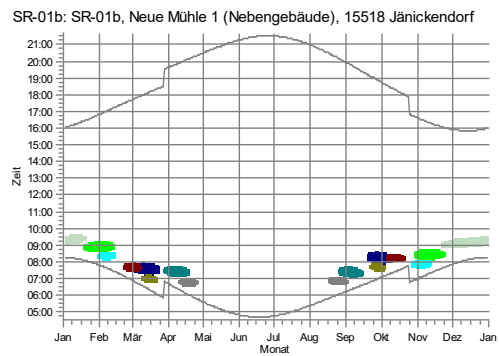
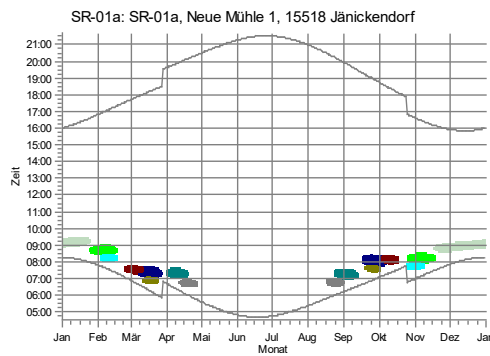
Anlage A4: SHADOW-Grafischer Kalender mit Darstellung der Schattenzeiten je Immissionsort durch die einzelnen WEA über das ganze Jahr

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



WEA	WEA 2804_npd: WEA 2804_npd, V162-6.2MW	WEA 2809_npd: WEA 2809_npd, V162-6.2MW	WEA 2814_EnBW: WEA 2814_EnBW, V162-6.2MW	WEA2: WEA2, Enron Wind EW 1.5.4	WEA7: WEA7, Enron Wind EW 1.5.4
	WEA 2805_npd: WEA 2805_npd, V162-6.2MW	WEA 2810_EnBW: WEA 2810_EnBW, V162-6.2MW	WEA 2815_EnBW: WEA 2815_EnBW, V162-6.2MW	WEA3: WEA3, Enron Wind EW 1.5.4	WEA802: WEA 802, SGE 2-170
	WEA 2807_npd: WEA 2807_npd, V162-6.2MW	WEA 2812_EnBW: WEA 2812_EnBW, V162-6.2MW	WEA 2816_EnBW: WEA 2816_EnBW, V162-6.2MW	WEA4: WEA4, Enron Wind EW 1.5.4	WEA904: WEA 904, SGE 2-170
	WEA 2808_npd: WEA 2808_npd, V162-6.2MW	WEA 2813_EnBW: WEA 2813_EnBW, V162-6.2MW	WEA1: WEA1, Enron Wind EW 1.5.4	WEA5: WEA5, Enron Wind EW 1.5.4	

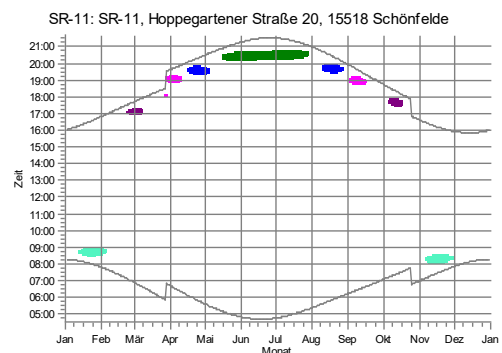
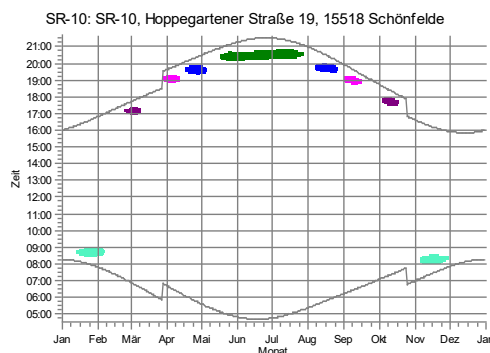
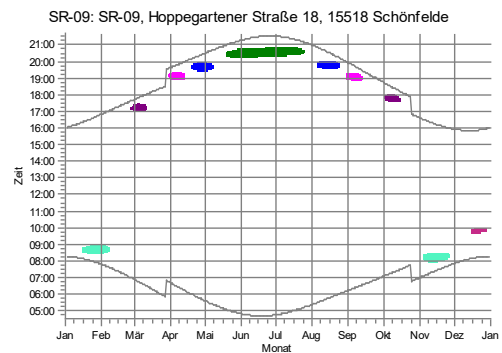
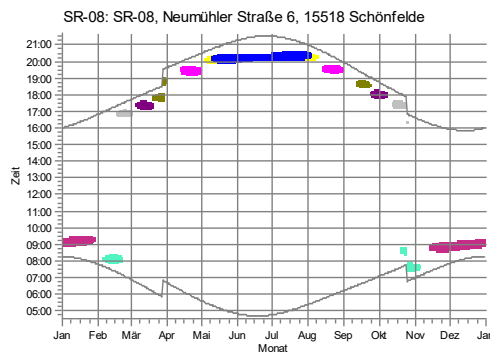
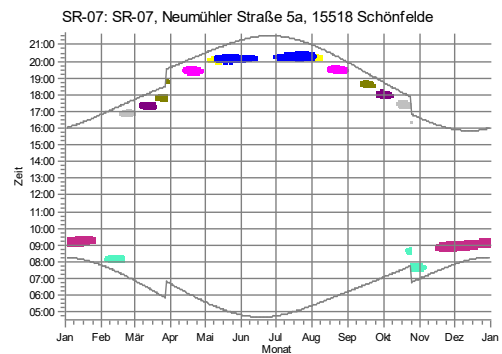
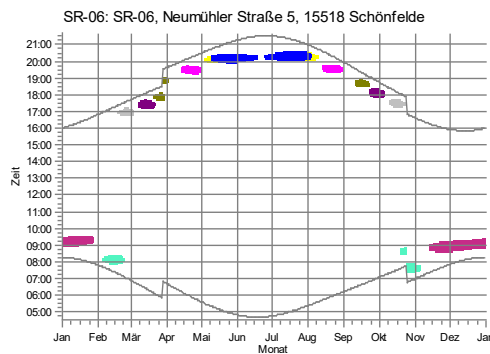


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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



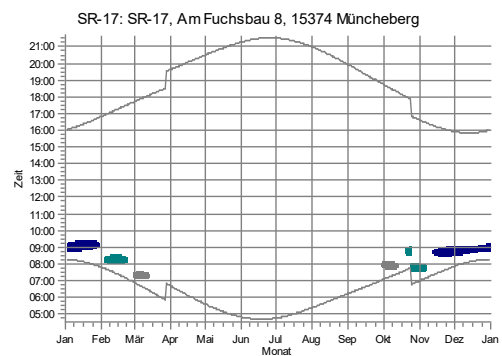
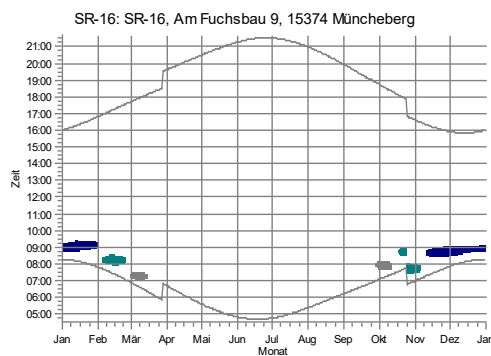
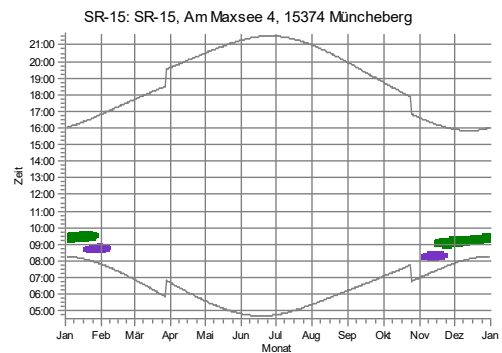
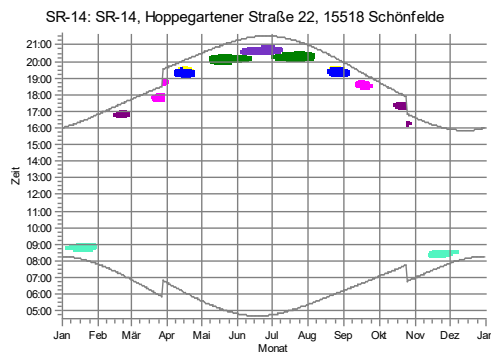
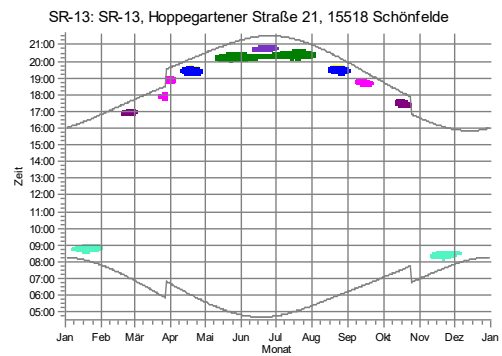
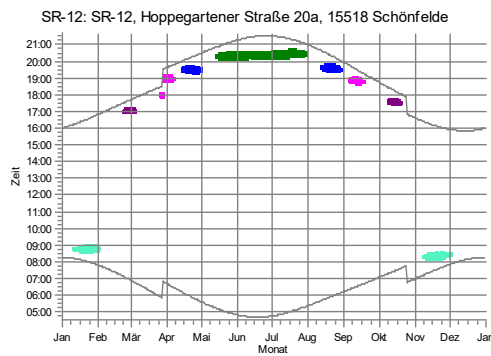
WEA  
■ WEA Z801\_0pd: WEA Z801\_0pd, V162-6-2MW  
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■ WEA Z810\_EnBW: WEA Z810\_EnBW, V162-6-2MW  
■ WEA Z812\_EnBW: WEA Z812\_EnBW, V162-6-2MW  
■ WEA V802: WEA V802, S56-2-170  
■ WEA Z802\_0pd: WEA Z802\_0pd, V162-6-2MW  
■ WEA Z805\_0pd: WEA Z805\_0pd, V162-6-2MW  
■ WEA Z811\_EnBW: WEA Z811\_EnBW, V162-6-2MW  
■ WEA V801: WEA V801, S56-2-170

Projekt:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Grafischer Kalender

Berechnung: WEA\_GB

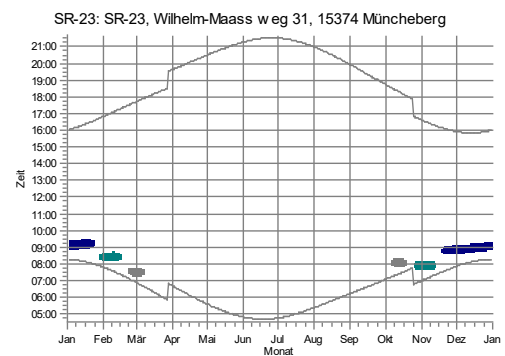
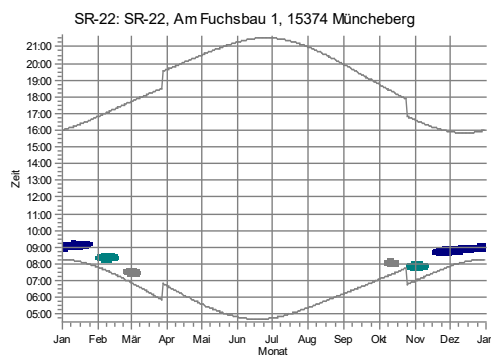
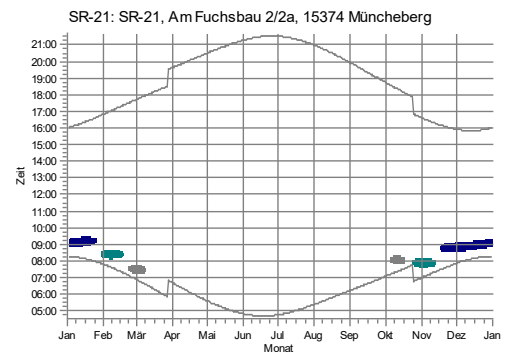
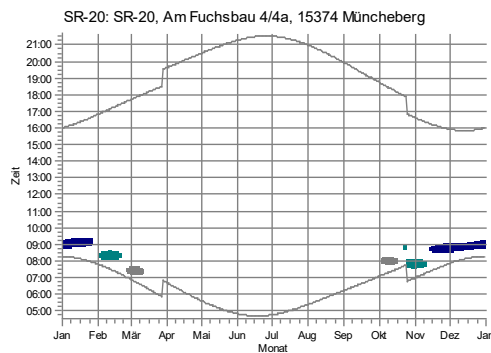
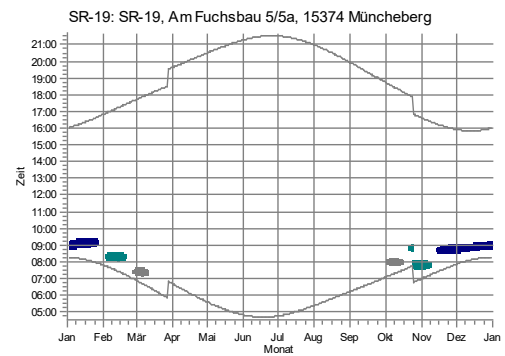
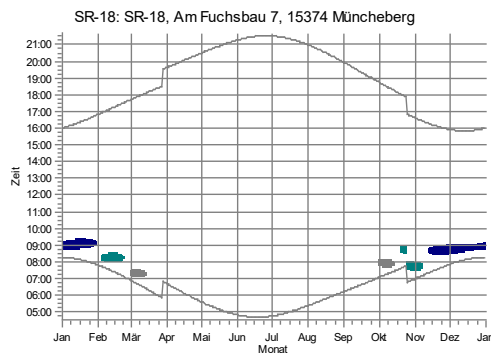


Projekt:  
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04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



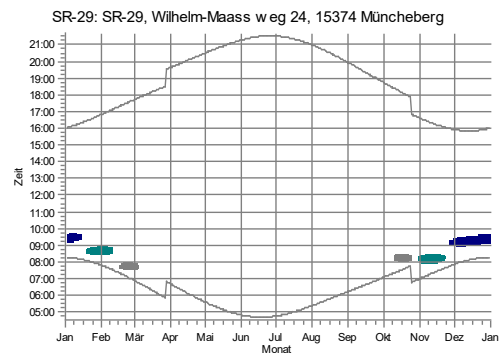
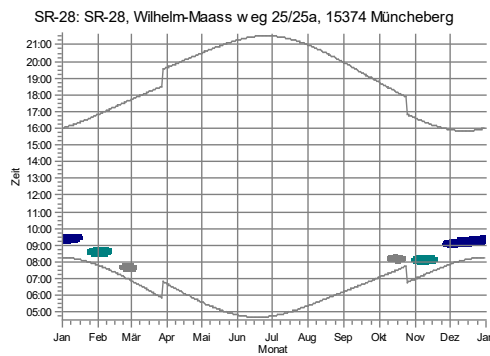
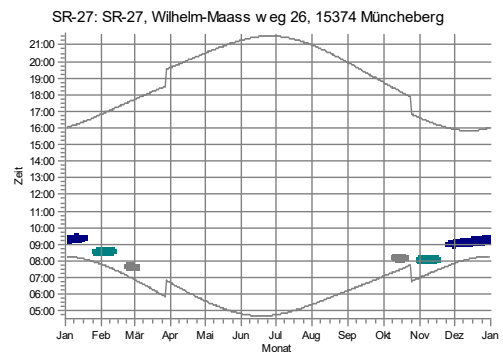
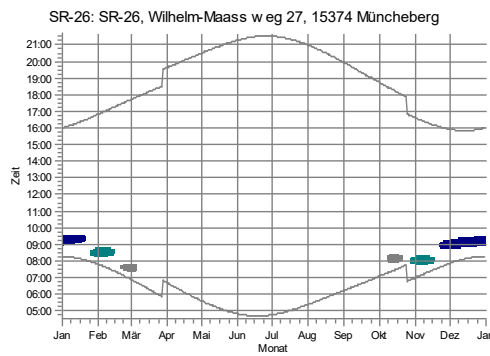
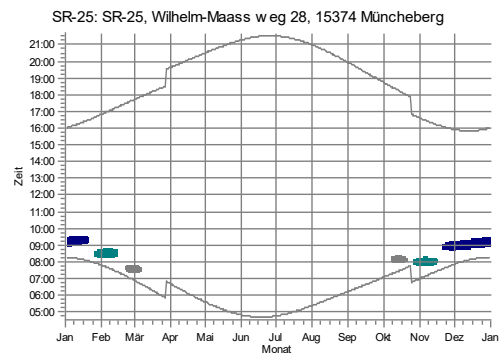
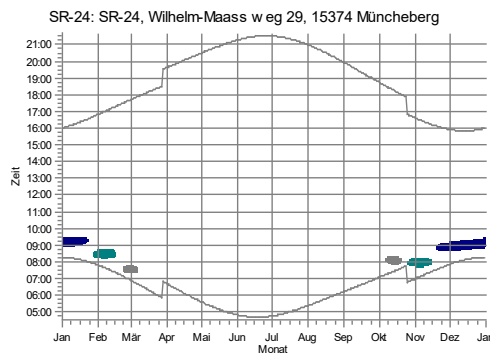
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Projekt:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



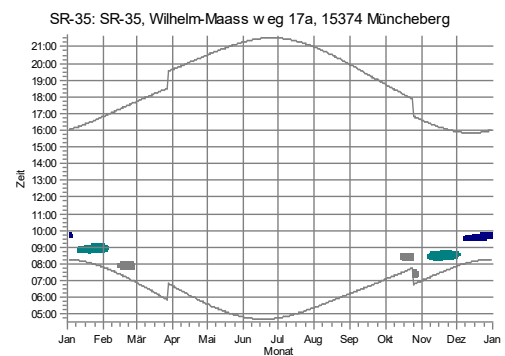
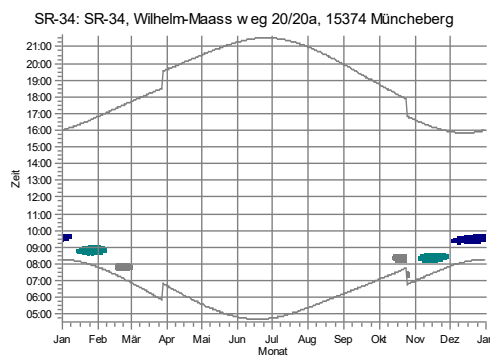
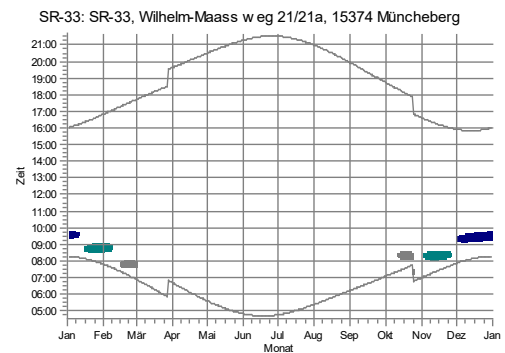
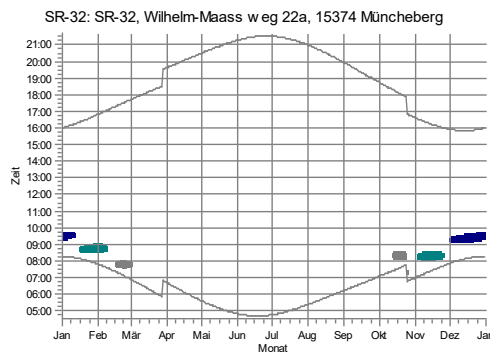
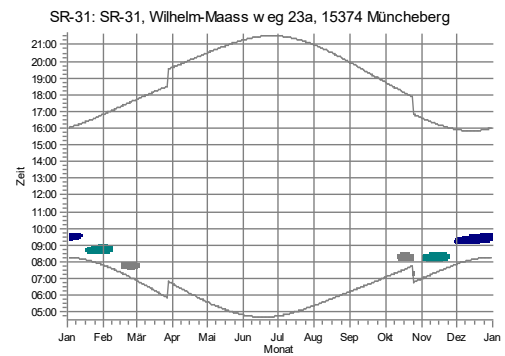
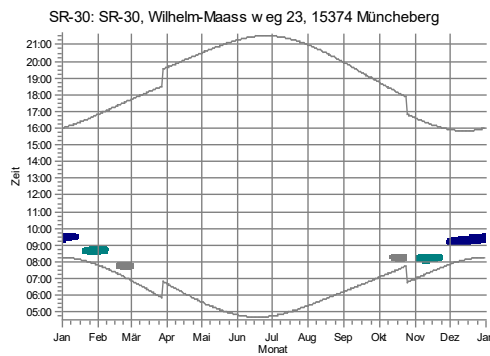
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Projekt:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



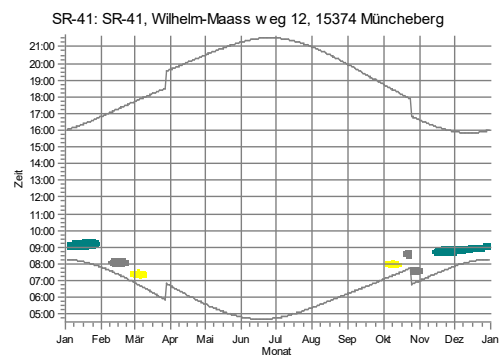
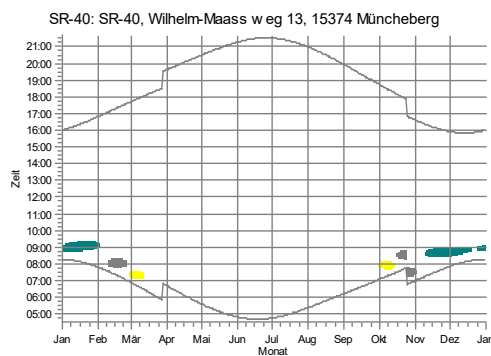
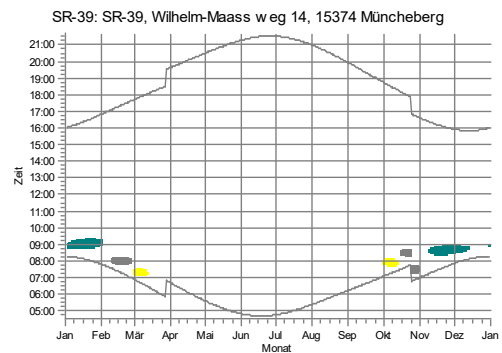
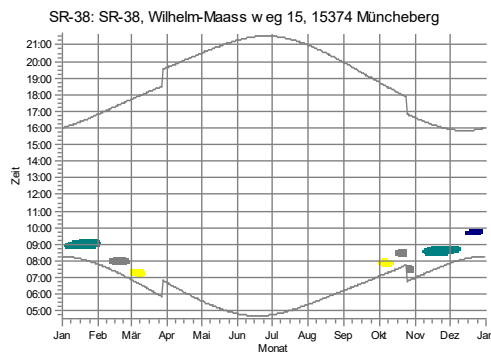
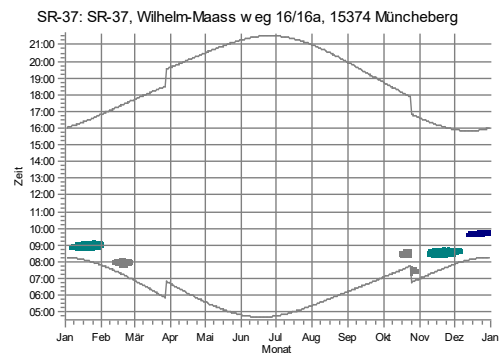
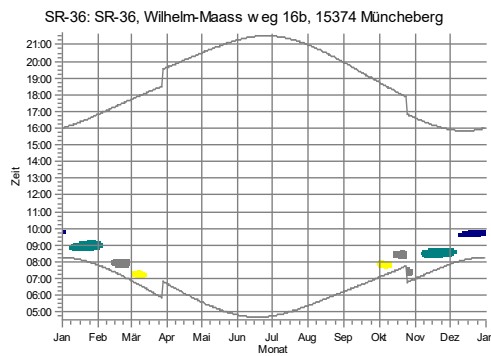
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 WEA 2806\_epd: WEA 2806\_epd\_V162-6.29M  
 WEA 2807\_epd: WEA 2807\_epd\_V162-6.29M

Projekt:  
**R-2-2023-0060**

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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



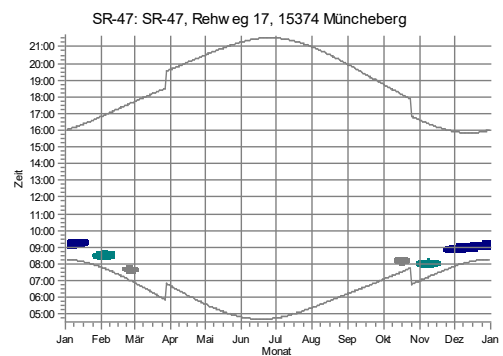
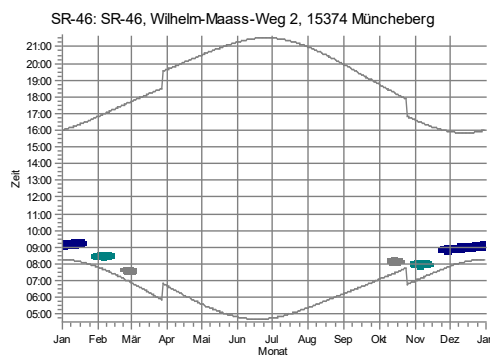
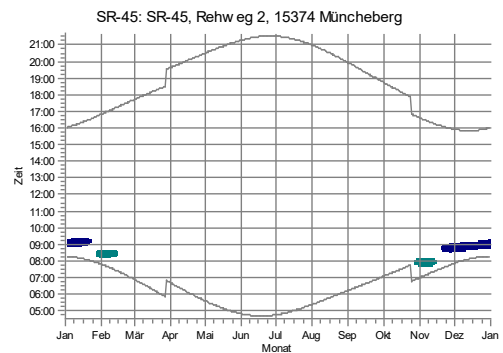
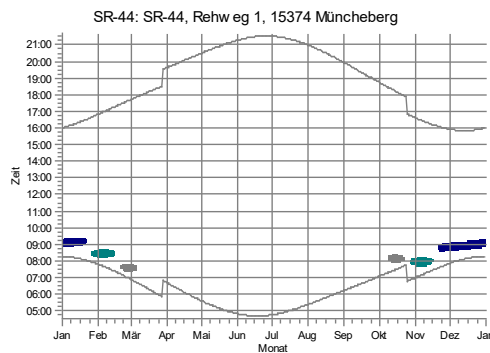
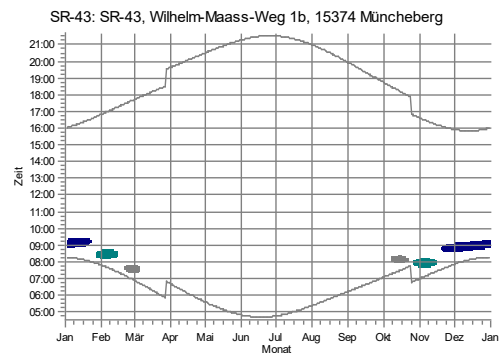
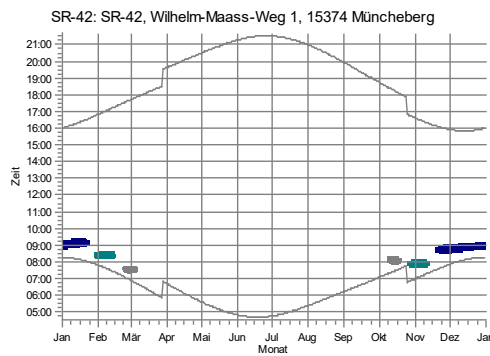
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■ WEA 2805\_npd: WEA 2805\_npd\_V162-6.2MW  
■ WEA 2807\_npd: WEA 2807\_npd\_V162-6.2MW

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**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



WEA  
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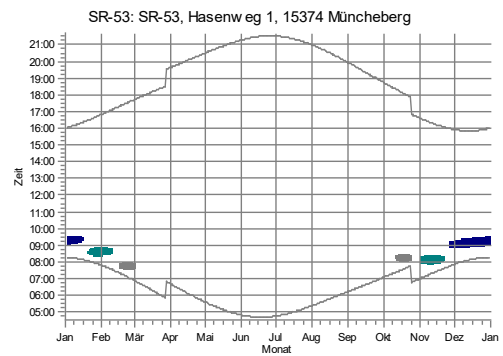
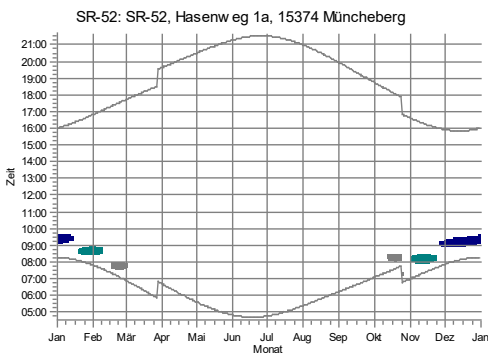
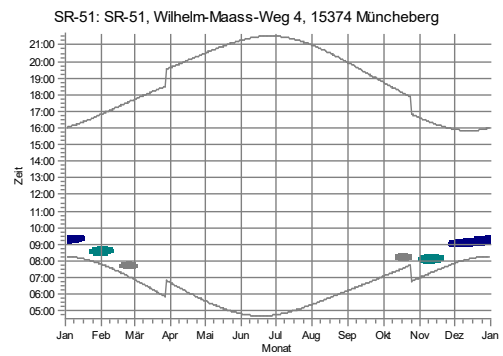
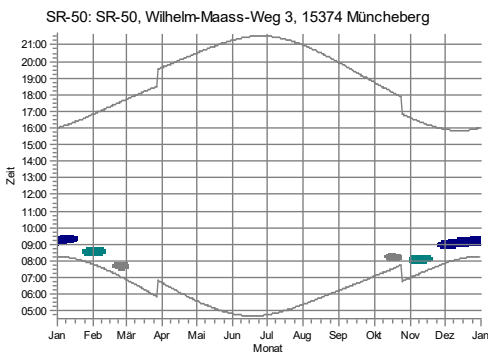
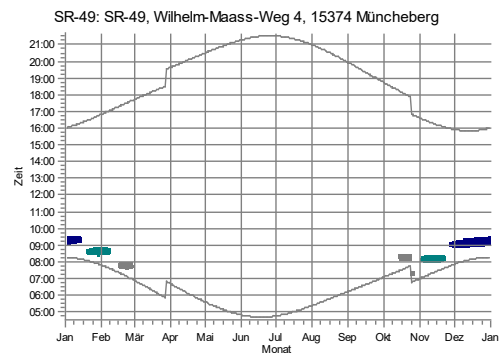
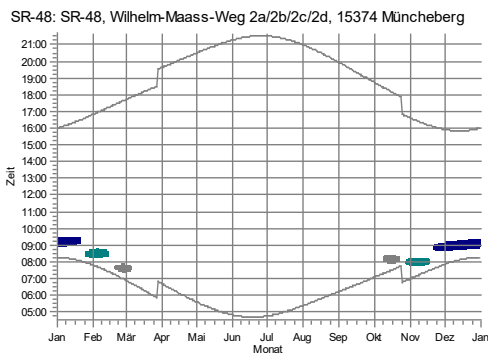


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**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



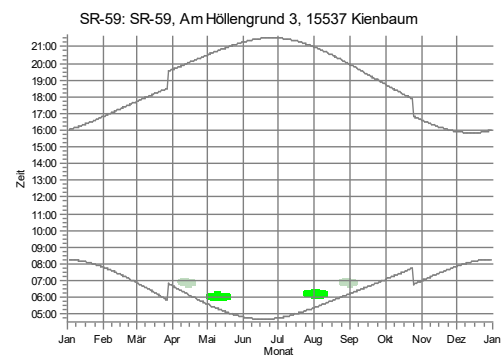
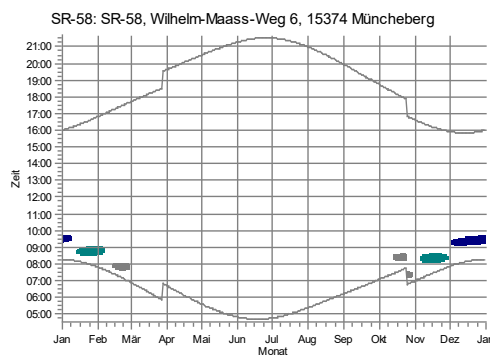
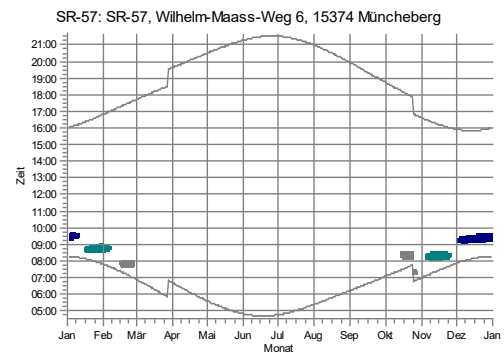
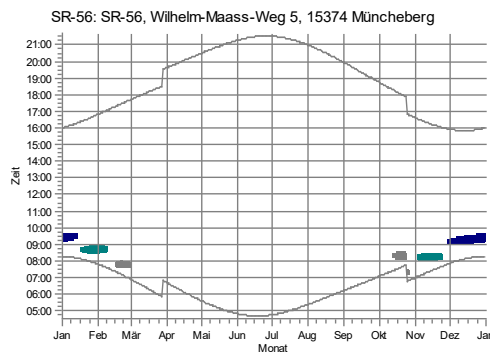
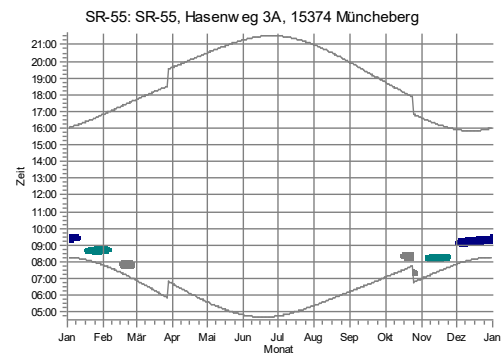
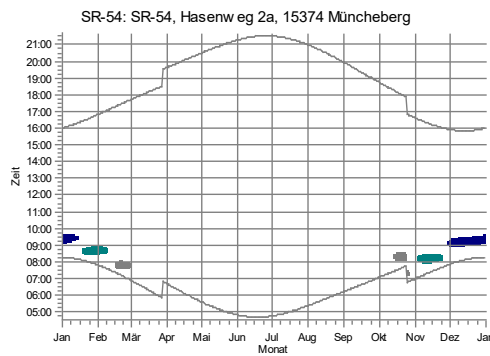
WEA  
 WEA 2804\_rpd: WEA 2804\_rpd\_V162-6.29W  
 WEA 2806\_rpd: WEA 2806\_rpd\_V162-6.29W  
 WEA 2807\_rpd: WEA 2807\_rpd\_V162-6.29W

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



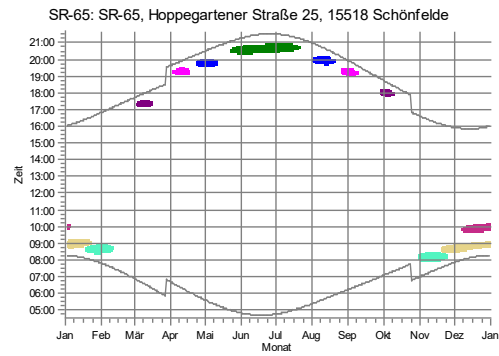
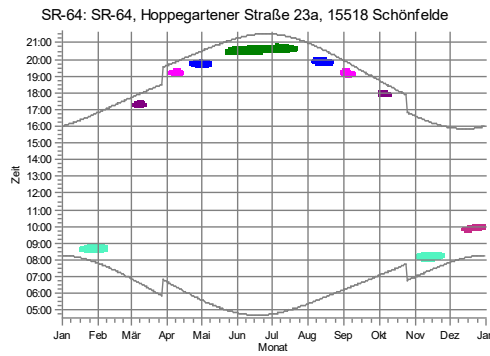
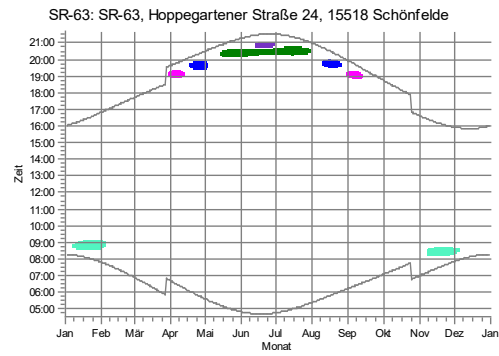
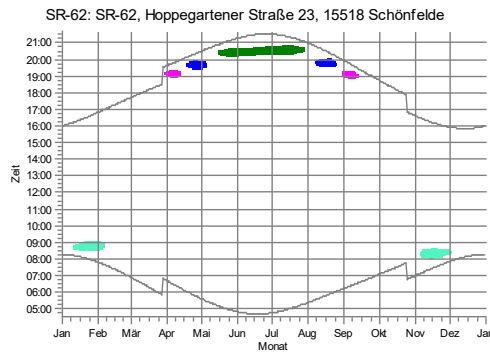
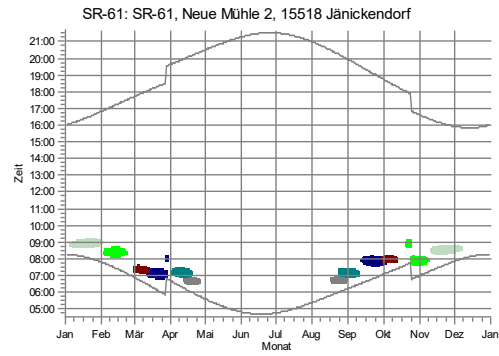
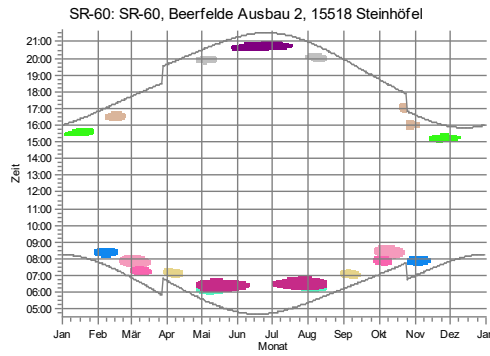
WEA  
 WEA 2804\_npd; WEA 2804\_npd; V162-6.2MW  
 WEA 2805\_npd; WEA 2805\_npd; V162-6.2MW  
 WEA 2807\_npd; WEA 2807\_npd; V162-6.2MW  
 WEA 2809\_npd; WEA 2809\_npd; V162-6.2MW  
 WEA 2814\_EnBW; WEA 2814\_EnBW; V162-6.2MW

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**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



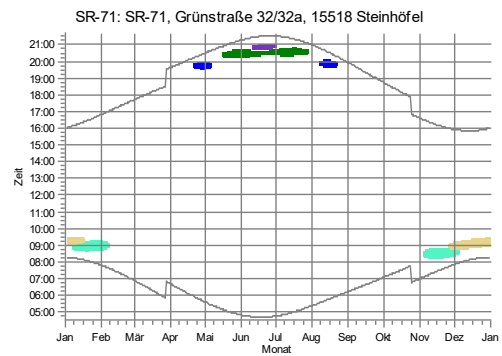
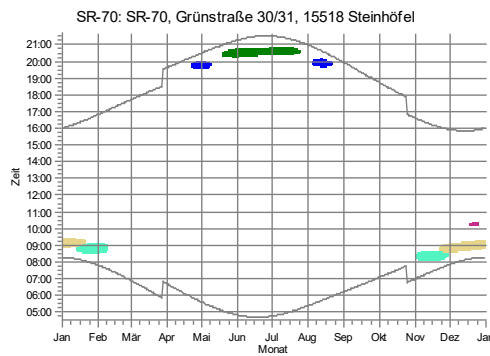
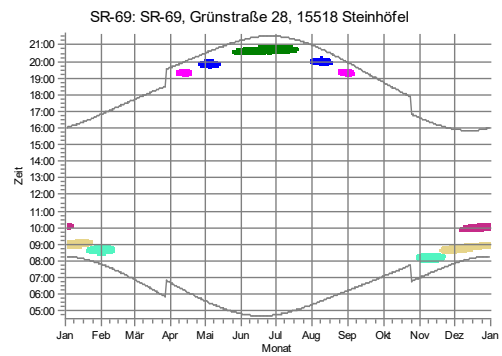
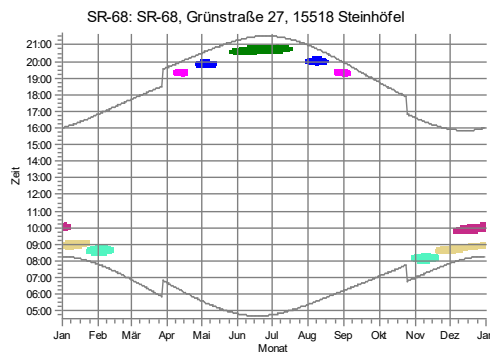
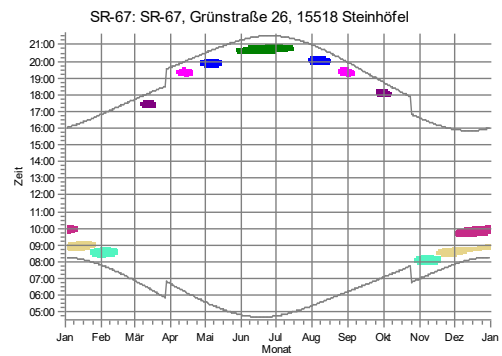
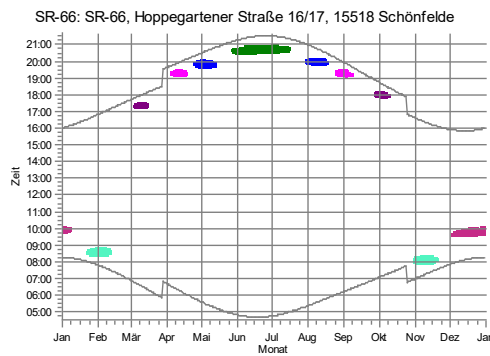
WEA	WEA 2801_npd: WEA 2801_npd, V162-6.2MW	WEA 2806_npd: WEA 2806_npd, V162-6.2MW	WEA 2811_EnBW: WEA 2811_EnBW, V162-6.2MW	WEA2: WEA2, Ennen Wind EW 1.5 #	WEA 9803: WEA 9803, S56-2-170
	WEA 2803_npd: WEA 2803_npd, V162-6.2MW	WEA 2807_npd: WEA 2807_npd, V162-6.2MW	WEA 2812_EnBW: WEA 2812_EnBW, V162-6.2MW	WEA 13: WEA 13, V162 5.6 (Gemeindef)	WEA 9804: WEA 9804, S56-2-170
	WEA 2804_npd: WEA 2804_npd, V162-6.2MW	WEA 2808_npd: WEA 2808_npd, V162-6.2MW	WEA 2814_EnBW: WEA 2814_EnBW, V162-6.2MW	WEA 9801: WEA 9801, S56-2-170	WEA 9805: WEA 9805, S56-2-170
	WEA 2805_npd: WEA 2805_npd, V162-6.2MW	WEA 2809_npd: WEA 2809_npd, V162-6.2MW	WEA1: WEA1, Ennen Wind EW 1.5 #	WEA 9802: WEA 9802, S56-2-170	WEA 9807: WEA 9807, S56-2-170

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB

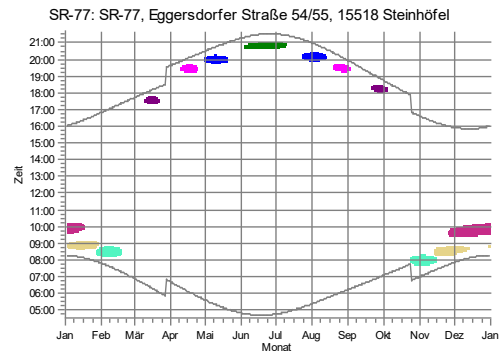
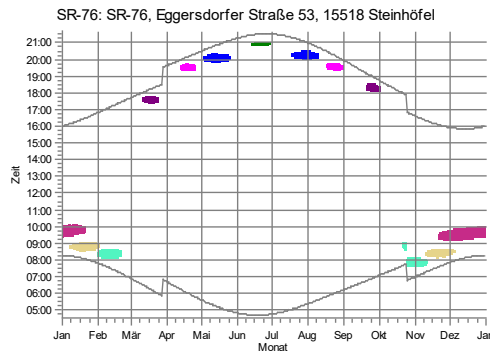
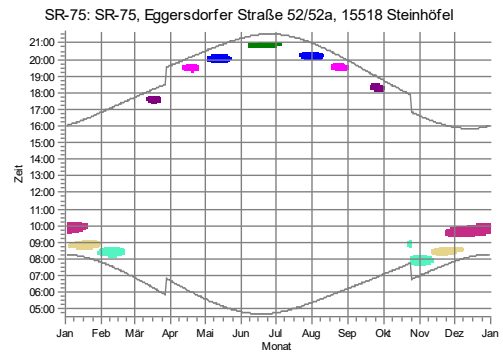
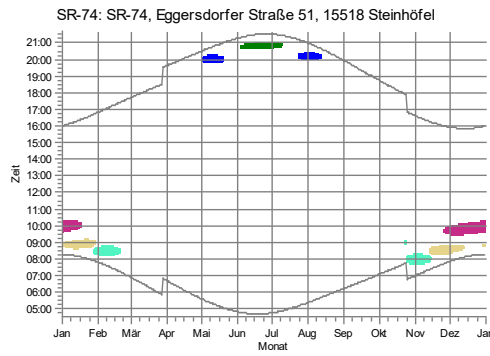
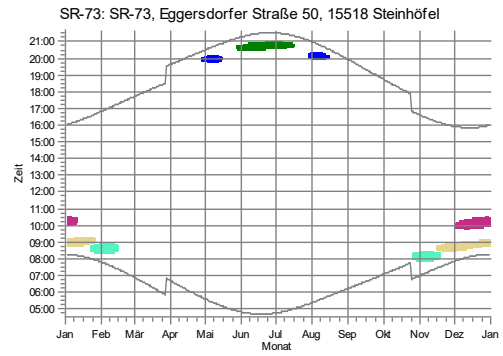
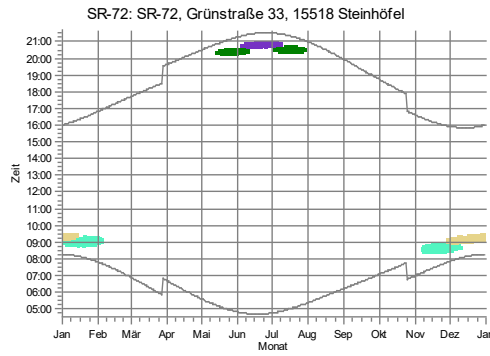


Projekt:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB

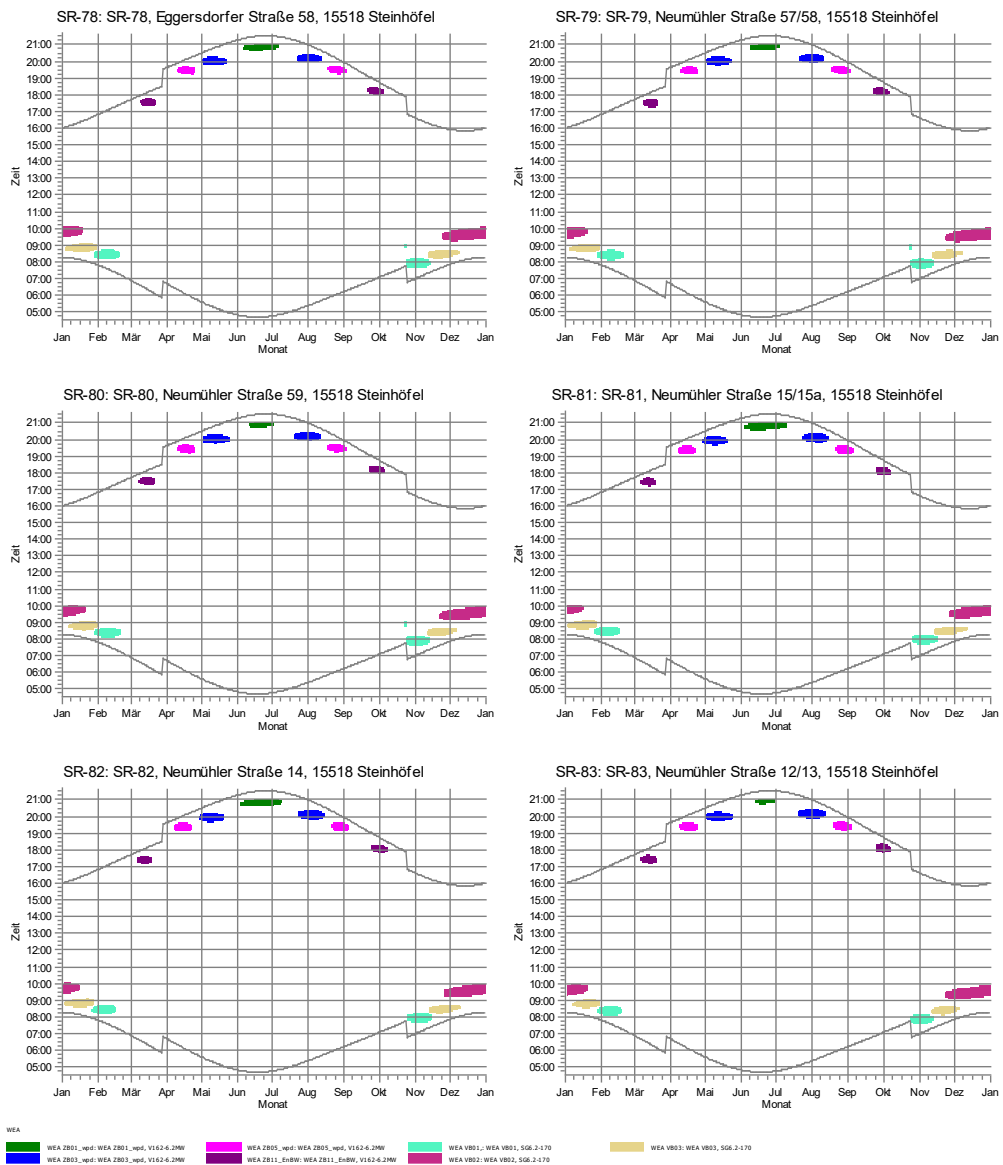


Projekt:  
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04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB

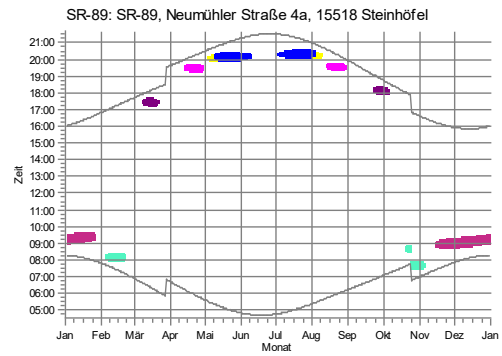
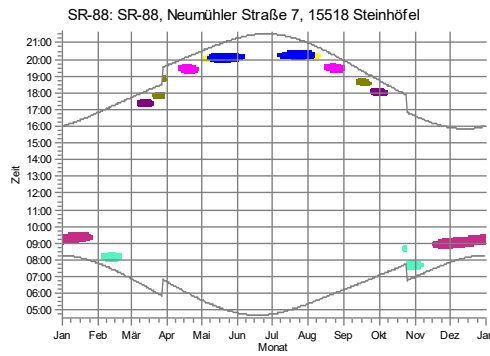
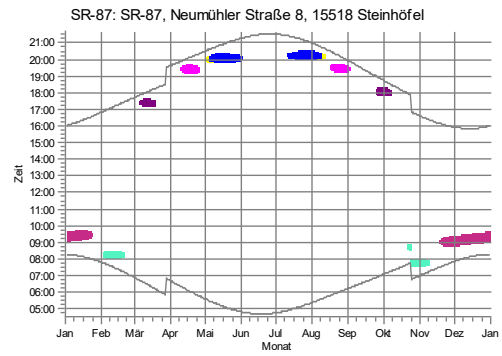
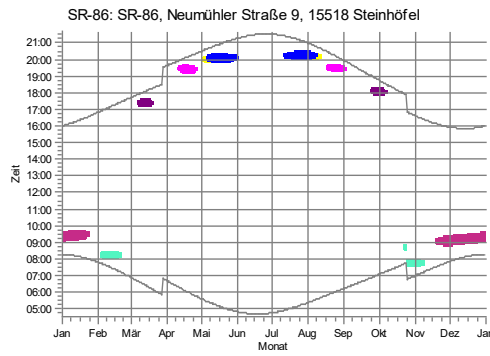
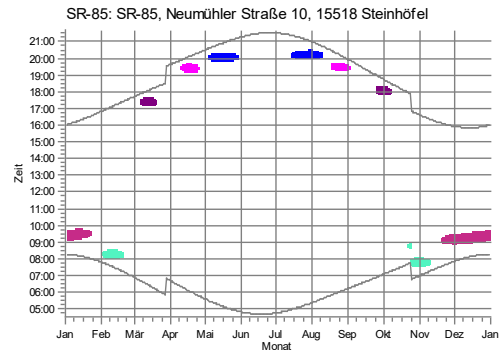
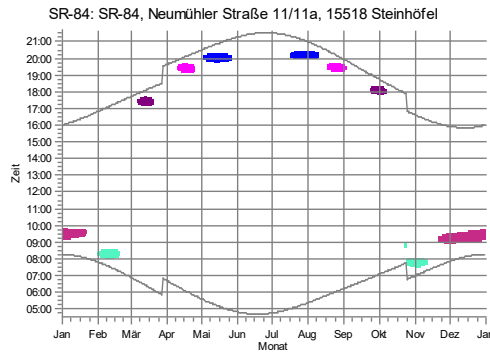


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Berechnet:  
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**SHADOW - Grafischer Kalender**

Berechnung: WEA\_GB



WEA  
■ WEA 2802\_0pd: WEA 2802\_0pd, V162-6.2MW  
■ WEA 2803\_0pd: WEA 2803\_0pd, V162-6.2MW  
■ WEA 2805\_0pd: WEA 2805\_0pd, V162-6.2MW  
■ WEA 2811\_EnBW: WEA 2811\_EnBW, V162-6.2MW  
■ WEA 9802: WEA 9802, S56.2-170  
■ WEA 2810\_EnBW: WEA 2810\_EnBW, V162-6.2MW  
■ WEA 9801: WEA 9801, S56.2-170

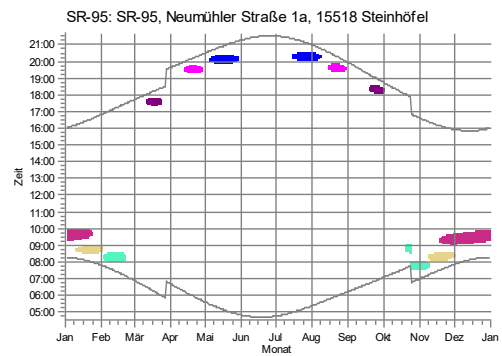
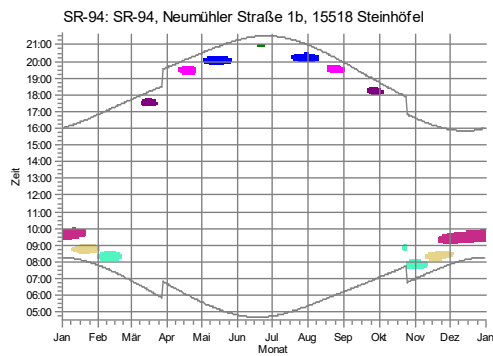
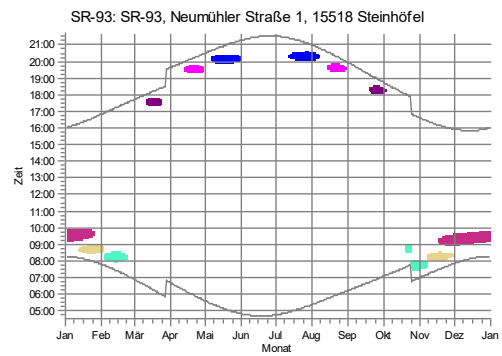
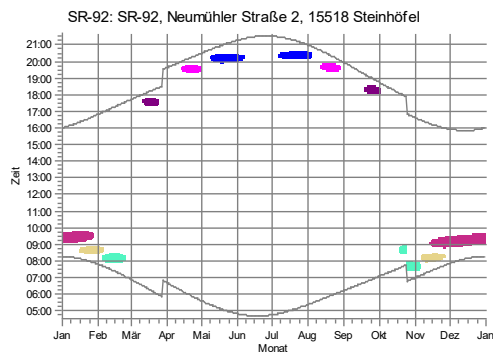
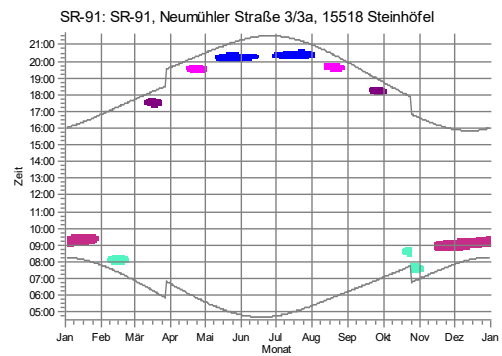
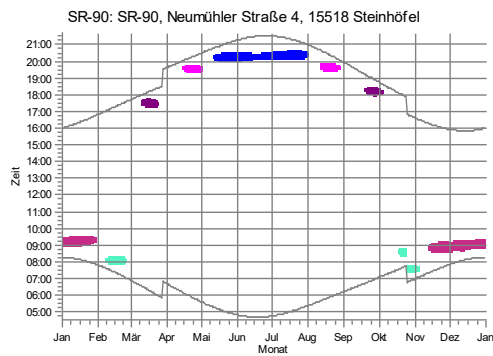


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### SHADOW - Grafischer Kalender

Berechnung: WEA\_GB



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

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB01\_wpd - WEA ZB01\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	08:15 09:08-09:34/26 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16
2	08:15 09:08-09:34/26 16:01	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:17
3	08:15 09:09-09:35/26 16:03	07:44 16:53	06:49 17:46	06:36 19:41	05:31 20:33	04:47 21:19
4	08:15 09:09-09:35/26 16:04	07:43 16:55	06:46 17:47	06:34 19:42	05:29 20:34	04:46 21:20
5	08:14 09:09-09:37/28 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:36	04:45 21:21
6	08:14 09:09-09:37/28 16:06	07:39 16:59	06:42 17:51	06:29 19:46	05:26 20:38	04:45 21:22
7	08:14 09:10-09:38/28 16:08	07:37 17:00	06:39 17:53	06:27 19:48	05:24 20:39	04:44 21:23
8	08:13 09:10-09:38/28 16:09	07:36 17:02	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23
9	08:13 09:11-09:39/28 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:24
10	08:12 09:11-09:39/28 16:12	07:32 17:06	06:33 17:58	06:20 19:53	05:18 20:44	04:43 21:25
11	08:12 09:11-09:40/29 16:13	07:30 17:08	06:30 18:00	06:18 19:55	05:17 20:46	04:42 21:26
12	08:11 09:11-09:40/29 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 20:48	04:42 21:27
13	08:10 09:11-09:40/29 16:16	07:26 17:12	06:26 18:04	06:13 19:58	05:13 20:49	04:42 21:27
14	08:09 09:12-09:41/29 16:18	07:24 17:14	06:23 18:05	06:11 20:00	05:12 20:51	04:41 21:28
15	08:09 09:12-09:41/29 16:19	07:22 17:16	06:21 18:07	06:09 20:02	05:10 20:53	04:41 21:28
16	08:08 09:13-09:41/28 16:21	07:20 17:18	06:19 18:09	06:07 20:03	05:08 20:54	04:41 21:29
17	08:07 09:13-09:42/29 16:22	07:18 17:19	06:16 18:11	06:05 20:05	05:07 20:56	04:41 21:29
18	08:06 09:14-09:42/28 16:24	07:16 17:21	06:14 18:13	06:02 20:07	05:05 20:57	04:41 21:30
19	08:05 09:15-09:42/27 16:26	07:14 17:23	06:12 18:14	06:00 20:09	05:04 20:59	04:41 21:30
20	08:04 09:15-09:41/26 16:27	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:31
21	08:03 09:16-09:41/25 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31
22	08:01 09:17-09:42/25 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:03	04:41 21:31
23	08:00 09:17-09:41/24 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:58 21:05	04:42 21:31
24	07:59 09:19-09:40/21 16:34	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:06	04:42 21:31
25	07:58 09:19-09:39/20 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:07	04:42 21:31
26	07:56 09:22-09:38/16 16:38	07:00 17:36	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:31
27	07:55 09:23-09:36/13 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 21:10	04:43 21:31
28	07:53 09:27-09:34/7 16:42	06:55 17:40	05:50 18:30	05:41 20:24	04:53 21:11	04:44 21:31
29	07:52 16:44	06:48 19:32	05:39 20:26	05:39 21:13	04:52 19:56-20:40/44	04:44 21:31
30	07:51 16:45	06:46 19:34	05:37 20:28	05:37 21:14	04:50 19:56-20:41/45	04:45 21:31
31	07:49 16:47	06:43 19:35	05:35 20:29	05:35 21:15	04:50 19:56-20:42/46	04:45 21:31
Sonnenscheinstunden 256 706 276 367 417 488 502						
Anzahl Minuten mit Schatten 256 706 276 367 417 488 502						

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB01\_wpd - WEA ZB01\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	October	November	Dezember
1	04:45 20:13-20:57/44	05:23 20:06-20:27/21	06:14 19:54	07:04 18:44	06:59 16:36	07:51 08:53-09:22/29
	21:31 20:58		19:54 18:44	18:44 16:36		15:55
2	04:46 20:11-20:56/45	05:24 20:07-20:25/18	06:15 19:52	07:06 18:41	07:01 16:35	07:52 08:54-09:23/29
	21:30 20:56		19:52 18:41	18:41 16:35		15:54
3	04:47 20:10-20:56/46	05:26 20:08-20:24/16	06:17 19:50	07:07 18:39	07:03 16:33	07:54 08:54-09:22/28
	21:30 20:54		19:50 18:39	18:39 16:33		15:54
4	04:48 20:09-20:56/47	05:27 20:09-20:22/13	06:19 19:48	07:09 18:37	07:04 16:31	07:55 08:55-09:23/28
	21:29 20:53		19:48 18:37	18:37 16:31		15:53
5	04:48 20:09-20:55/46	05:29 20:12-20:21/9	06:20 19:45	07:11 18:34	07:06 16:29	07:57 08:55-09:23/28
	21:29 20:51		19:45 18:34	18:34 16:29		15:53
6	04:49 20:07-20:54/47	05:31 20:49	06:22 19:43	07:12 18:32	07:08 16:27	07:58 08:55-09:23/28
	21:28 20:49		19:43 18:32	18:32 16:27		15:52
7	04:50 20:07-20:54/47	05:32 20:47	06:24 19:41	07:14 18:30	07:10 16:26	07:59 08:56-09:24/28
	21:28 20:47		19:41 18:30	18:30 16:26		15:52
8	04:51 20:07-20:53/46	05:34 20:45	06:25 19:38	07:16 18:28	07:12 16:24	08:00 08:57-09:24/27
	21:27 20:45		19:38 18:28	18:28 16:24		15:51
9	04:52 20:06-20:53/47	05:36 20:43	06:27 19:36	07:18 18:25	07:14 16:22	08:02 08:57-09:24/27
	21:26 20:43		19:36 18:25	18:25 16:22		15:51
10	04:53 20:06-20:52/46	05:37 20:41	06:29 19:34	07:19 18:23	07:15 16:21	08:03 08:57-09:24/27
	21:26 20:41		19:34 18:23	18:23 16:21		15:51
11	04:54 20:05-20:51/46	05:39 20:40	06:30 19:31	07:21 18:21	07:17 16:19	08:04 08:59-09:25/26
	21:25 20:40		19:31 18:21	18:21 16:19		15:51
12	04:55 20:05-20:51/46	05:40 20:38	06:32 19:29	07:23 18:18	07:19 16:17	08:05 08:59-09:25/26
	21:24 20:38		19:29 18:18	18:18 16:17		15:50
13	04:56 20:05-20:50/45	05:42 20:36	06:34 19:26	07:25 18:16	07:21 16:16	08:06 09:00-09:25/25
	21:23 20:36		19:26 18:16	18:16 16:16		15:50
14	04:58 20:04-20:49/45	05:44 20:34	06:35 19:24	07:26 18:14	07:23 16:14	08:07 09:01-09:25/24
	21:22 20:34		19:24 18:14	18:14 16:14		15:50
15	04:59 20:04-20:48/44	05:45 20:32	06:37 19:22	07:28 18:12	07:24 16:13	08:08 09:01-09:26/25
	21:21 20:32		19:22 18:12	18:12 16:13		15:50
16	05:00 20:04-20:48/44	05:47 20:29	06:39 19:19	07:30 18:10	07:26 16:11	08:09 09:01-09:25/24
	21:20 20:29		19:19 18:10	18:10 16:11		15:50
17	05:01 20:04-20:47/43	05:49 20:27	06:40 19:17	07:32 18:07	07:28 16:10	08:10 09:02-09:26/24
	21:19 20:27		19:17 18:07	18:07 16:10		15:51
18	05:02 20:04-20:45/41	05:50 20:25	06:42 19:15	07:33 18:05	07:30 16:09	08:10 09:03-09:26/23
	21:18 20:25		19:15 18:05	18:05 16:09		15:51
19	05:04 20:03-20:44/41	05:52 20:23	06:44 19:12	07:35 18:03	07:31 16:07	08:11 09:04-09:27/23
	21:17 20:23		19:12 18:03	18:03 16:07		15:51
20	05:05 20:03-20:43/40	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	08:12 09:03-09:27/24
	21:15 20:21		19:10 18:01	18:01 16:06		15:52
21	05:06 20:04-20:42/38	05:55 20:19	06:47 19:07	07:39 17:59	07:35 16:05	08:12 09:04-09:28/24
	21:14 20:19		19:07 17:59	17:59 16:05		15:52
22	05:08 20:03-20:41/38	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 09:04-09:28/24
	21:13 20:17		19:05 17:57	17:57 16:04		15:52
23	05:09 20:03-20:39/36	05:59 20:15	06:50 19:03	07:42 17:54	07:38 16:02	08:13 09:05-09:29/24
	21:12 20:15		19:03 17:54	17:54 16:02		15:53
24	05:11 20:04-20:39/35	06:00 20:12	06:52 19:00	07:44 17:52	07:40 16:01	08:14 09:05-09:29/24
	21:10 20:12		19:00 17:52	17:52 16:01		15:53
25	05:12 20:03-20:37/34	06:02 20:10	06:54 18:58	07:46 16:50	07:42 16:00	08:14 09:06-09:29/23
	21:09 20:10		18:58 16:50	16:50 16:00		15:54
26	05:14 20:03-20:35/32	06:04 20:08	06:55 18:56	07:48 16:48	07:43 15:59	08:14 09:07-09:31/24
	21:07 20:08		18:56 16:48	16:48 15:59		15:55
27	05:15 20:04-20:35/31	06:05 20:06	06:57 18:53	07:50 16:46	07:45 15:58	08:15 09:07-09:31/24
	21:06 20:06		18:53 16:46	16:46 15:58		15:56
28	05:17 20:04-20:33/29	06:07 20:04	06:59 18:51	07:52 16:44	07:46 15:57	08:15 09:07-09:32/25
	21:04 20:04		18:51 16:44	16:44 15:57		15:56
29	05:18 20:05-20:32/27	06:09 20:01	07:00 18:49	07:53 16:42	07:48 15:57	08:15 09:08-09:32/24
	21:03 20:01		18:49 16:42	16:42 15:57		15:57
30	05:20 20:05-20:30/25	06:10 19:59	07:02 18:46	07:55 16:40	07:50 15:56	08:15 09:08-09:33/25
	21:01 19:59		18:46 16:40	16:40 15:56		15:58
31	05:21 20:05-20:28/23	06:12 19:57		07:57 16:38		08:15 09:08-09:34/26
	20:59 19:57			16:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	1244	77	0	0	407	790

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB02\_wpd - WEA ZB02\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:53 07:17-07:30/13	06:41	05:35	04:49
	16:00	16:49	17:42	19:37	20:29	21:16
2	08:15	07:46	06:51 07:15-07:31/16	06:39	05:33 19:57-20:02/5	04:48
	16:02	16:51	17:44	19:39	20:31	21:17
3	08:15	07:44	06:49 07:12-07:31/19	06:36	05:31 19:55-20:04/9	04:47
	16:03	16:53	17:46	19:41	20:33	21:19
4	08:15	07:43	06:46 07:10-07:31/21	06:34	05:29 19:54-20:05/11	04:46
	16:04	16:55	17:47	19:42	20:34	21:20
5	08:14	07:41	06:44 07:08-07:32/24	06:32	05:27 19:53-20:06/13	04:46
	16:05	16:57	17:49	19:44	20:36	21:21
6	08:14	07:39	06:42 07:05-07:30/25	06:29	05:26 19:53-20:09/16	04:45
	16:06	16:59	17:51	19:46	20:38	21:22
7	08:14	07:37	06:40 07:05-07:30/25	06:27	05:24 19:52-20:10/18	04:44
	16:08	17:01	17:53	19:48	20:40	21:23
8	08:13	07:36	06:37 07:05-07:29/24	06:25	05:22 19:52-20:11/19	04:44
	16:09	17:02	17:55	19:49	20:41	21:23
9	08:13	07:34	06:35 07:04-07:27/23	06:23	05:20 19:52-20:13/21	04:43
	16:10	17:04	17:57	19:51	20:43	21:24
10	08:12	07:32	06:33 07:04-07:24/20	06:20 19:23-19:26/3	05:18 19:52-20:14/22	04:43
	16:12	17:06	17:58	19:53	20:45	21:25
11	08:12	07:30	06:30 07:05-07:22/17	06:18 19:21-19:28/7	05:17 19:52-20:16/24	04:42
	16:13	17:08	18:00	19:55	20:46	21:26
12	08:11	07:28	06:28 07:05-07:19/14	06:16 19:19-19:30/11	05:15 19:52-20:16/24	04:42
	16:15	17:10	18:02	19:56	20:48	21:27
13	08:10	07:26	06:26 07:08-07:17/9	06:13 19:18-19:32/14	05:13 19:52-20:16/24	04:42
	16:16	17:12	18:04	19:58	20:49	21:27
14	08:09	07:24	06:23	06:11 19:17-19:32/15	05:12 19:53-20:16/23	04:41
	16:18	17:14	18:06	20:00	20:51	21:28
15	08:09	07:22	06:21	06:09 19:16-19:34/18	05:10 19:55-20:16/21	04:41
	16:19	17:16	18:07	20:02	20:53	21:28
16	08:08	07:20	06:19	06:07 19:16-19:36/20	05:08 19:55-20:16/21	04:41
	16:21	17:18	18:09	20:03	20:54	21:29
17	08:07	07:18	06:16	06:05 19:16-19:38/22	05:07 19:56-20:16/20	04:41
	16:22	17:20	18:11	20:05	20:56	21:29
18	08:06	07:16	06:14	06:02 19:16-19:40/24	05:05 19:56-20:15/19	04:41
	16:24	17:21	18:13	20:07	20:57	21:30
19	08:05	07:14	06:12	06:00 19:17-19:41/24	05:04 19:57-20:15/18	04:41
	16:26	17:23	18:14	20:09	20:59	21:30
20	08:04	07:12	06:09	05:58 19:17-19:42/25	05:03 19:58-20:14/16	04:41
	16:27	17:25	18:16	20:10	21:00	21:31
21	08:03	07:10	06:07	05:56 19:18-19:44/26	05:01 19:59-20:14/15	04:41
	16:29	17:27	18:18	20:12	21:02	21:31
22	08:01	07:08	06:05	05:54 19:19-19:43/24	05:00 20:00-20:12/12	04:41
	16:31	17:29	18:20	20:14	21:03	21:31
23	08:00	07:06	06:02	05:52 19:22-19:43/21	04:59 20:01-20:11/10	04:42
	16:33	17:31	18:21	20:16	21:05	21:31
24	07:59	07:04	06:00	05:49 19:24-19:42/18	04:57 20:03-20:10/7	04:42
	16:34	17:33	18:23	20:17	21:06	21:31
25	07:58	07:02	05:58	05:47 19:26-19:41/15	04:56	04:42
	16:36	17:35	18:25	20:19	21:07	21:31
26	07:56	07:00	05:55	05:45 19:27-19:39/12	04:55	04:43
	16:38	17:36	18:27	20:21	21:09	21:31
27	07:55	06:57 07:21-07:27/6	05:53	05:43 19:29-19:37/8	04:54	04:43
	16:40	17:38	18:28	20:22	21:10	21:31
28	07:54	06:55 07:19-07:29/10	05:51	05:41	04:53	04:44
	16:42	17:40	18:30	20:24	21:11	21:31
29	07:52		06:48	05:39	04:52	04:44
	16:44		19:32	20:26	21:13	21:31
30	07:51		06:46	05:37	04:51	04:45
	16:45		19:34	20:28	21:14	21:31
31	07:49		06:43		04:50	
	16:47		19:35		21:15	
Sonnenscheinstunden	256	276	367	417	488	502
Anzahl Minuten mit Schatten	0	16	250	307	388	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB02\_wpd - WEA ZB02\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	July	August	September	Oktober	November	Dezember
1	04:45	05:23 20:03-20:27/24	06:14 19:20-19:27/7	07:04 07:46-07:58/12	06:59	07:51
	21:31	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24 20:02-20:25/23	06:15 19:22-19:25/3	07:06 07:43-07:59/16	07:01	07:52
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26 20:02-20:24/22	06:17	07:07 07:42-08:01/19	07:03	07:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48	05:27 20:02-20:22/20	06:19	07:09 07:42-08:04/22	07:04	07:55
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:48	05:29 20:02-20:21/19	06:20	07:11 07:42-08:05/23	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31 20:02-20:19/17	06:22	07:12 07:40-08:05/25	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32 20:03-20:17/14	06:24	07:14 07:41-08:06/25	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34 20:03-20:15/12	06:25	07:16 07:42-08:06/24	07:12	08:00
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36 20:04-20:14/10	06:27	07:18 07:44-08:07/23	07:14	08:02
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53	05:37 20:05-20:13/8	06:29	07:19 07:45-08:05/20	07:15	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54	05:39 20:07-20:10/3	06:30	07:21 07:47-08:05/18	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:40	06:32	07:23 07:49-08:04/15	07:19	08:05
	21:24	20:38	19:29	18:18	16:17	15:50
13	04:56	05:42	06:34	07:25 07:51-08:03/12	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44	06:35	07:26 07:53-08:01/8	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:45	06:37	07:28 07:55-07:58/3	07:24	08:08
	21:21	20:32	19:22	18:12	16:13	15:50
16	05:00	05:47 19:36-19:45/9	06:39	07:30	07:26	08:09
	21:20	20:30	19:19	18:10	16:11	15:51
17	05:01	05:49 19:34-19:46/12	06:40	07:32	07:28	08:10
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:03	05:50 19:32-19:48/16	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04 20:14-20:18/4	05:52 19:30-19:49/19	06:44	07:35	07:32	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05 20:11-20:20/9	05:54 19:28-19:48/20	06:45	07:37	07:33	08:12
	21:15	20:21	19:10	18:01	16:06	15:52
21	05:07 20:11-20:22/11	05:55 19:25-19:49/24	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08 20:09-20:23/14	05:57 19:22-19:48/26	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:52
23	05:09 20:08-20:24/16	05:59 19:21-19:47/26	06:50	07:42	07:38	08:13
	21:12	20:15	19:03	17:55	16:02	15:53
24	05:11 20:08-20:25/17	06:00 19:19-19:44/25	06:52	07:44	07:40	08:14
	21:10	20:12	19:00	17:52	16:01	15:54
25	05:12 20:07-20:25/18	06:02 19:19-19:42/23	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	17:50	16:00	15:54
26	05:14 20:06-20:25/19	06:04 19:19-19:41/22	06:55	07:48	07:43	08:15
	21:07	20:08	18:56	17:48	15:59	15:55
27	05:15 20:06-20:26/20	06:05 19:18-19:38/20	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	17:46	15:58	15:56
28	05:17 20:05-20:26/21	06:07 19:18-19:36/18	06:59	07:52	07:46	08:15
	21:04	20:04	18:51	17:44	15:57	15:56
29	05:18 20:05-20:27/22	06:09 19:18-19:33/15	07:01	07:53	07:48	08:15
	21:03	20:01	18:49	17:42	15:57	15:57
30	05:20 20:03-20:27/24	06:10 19:18-19:31/13	07:02 07:49-07:55/6	07:55	07:50	08:15
	21:01	19:59	18:46	17:40	15:56	15:58
31	05:21 20:03-20:27/24	06:12 19:19-19:30/11		07:57		08:15
	20:59	19:57		17:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	219	471	16	265	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB03\_wpd - WEA ZB03\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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

	Januar	Februar	März	April	Mai	Juni
1	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	19:25-20:01/36 21:16
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	19:27-20:02/35 21:17
3	08:15 16:03	07:44 16:53	06:49 17:46	06:36 19:41	05:31 20:33	19:29-20:04/35 21:19
4	08:15 16:04	07:43 16:55	06:46 17:47	06:34 19:42	05:29 20:34	19:30-20:05/35 21:20
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:36	19:32-20:06/34 21:21
6	08:14 16:06	07:39 16:59	06:42 17:51	06:29 19:46	05:26 20:38	19:35-20:09/34 21:22
7	08:14 16:08	07:37 17:01	06:39 17:53	06:27 19:48	05:24 20:39	19:37-20:10/33 21:23
8	08:13 16:09	07:36 17:02	06:37 17:55	06:25 19:49	05:22 20:41	19:14-19:23/9 21:23
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	19:11-19:24/13 21:24
10	08:12 16:12	07:32 17:06	06:33 17:58	06:20 19:53	05:18 20:44	19:09-19:26/17 21:25
11	08:12 16:13	07:30 17:08	06:30 18:00	06:18 19:55	05:17 20:46	19:08-19:28/20 21:26
12	08:11 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 20:48	19:07-19:30/23 21:27
13	08:10 16:16	07:26 17:12	06:26 18:04	06:13 19:58	05:13 20:49	19:06-19:32/26 21:27
14	08:09 16:18	07:24 17:14	06:23 18:05	06:11 20:00	05:12 20:51	19:05-19:32/27 21:28
15	08:09 16:19	07:22 17:16	06:21 18:07	06:09 20:02	05:10 20:53	19:05-19:34/29 21:28
16	08:08 16:21	07:20 17:18	06:19 18:09	06:07 20:03	05:08 20:54	19:48-20:23/35 21:29
17	08:07 16:22	07:18 17:20	06:16 18:11	06:05 20:05	05:07 20:56	19:49-20:24/35 21:29
18	08:06 16:24	07:16 17:21	06:14 18:13	06:02 20:07	05:05 20:57	19:50-20:24/34 21:30
19	08:05 16:26	07:14 17:23	06:12 18:14	06:00 20:09	05:04 20:59	19:51-20:25/34 21:30
20	08:04 16:27	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	19:52-20:25/33 21:31
21	08:03 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:02	19:52-20:26/34 21:31
22	08:01 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:03	19:52-20:25/33 21:31
23	08:00 16:33	07:06 17:31	06:02 18:21	05:52 20:15	04:58 21:05	19:53-20:26/33 21:31
24	07:59 16:34	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:06	19:53-20:26/33 21:31
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:07	19:54-20:26/32 21:31
26	07:56 16:38	07:00 17:36	05:55 18:27	05:45 20:21	04:55 21:09	19:55-20:26/31 21:31
27	07:55 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 21:10	19:56-20:26/30 21:31
28	07:53 16:42	06:55 17:40	05:50 18:30	05:41 20:24	04:53 21:11	19:56-20:26/30 21:31
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	19:56-20:26/30 21:31
30	07:51 16:45		06:46 19:34	05:37 20:28	04:51 21:14	19:57-20:26/29 21:31
31	07:49 16:47		06:43 19:35		04:50 21:15	19:57-20:26/29 21:31
Sonneneinstrahlung						
Anzahl Minuten mit Schatten						
	256	276	367	417	710	1029
						590

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB03\_wpd - WEA ZB03\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober	November	Dezember
1	04:45 20:09-20:29/20	05:23 19:53-20:27/34	06:14 19:07-19:27/20	07:04	06:59	07:51
	21:30	20:58	19:55	18:44	16:36	15:55
2	04:46 20:08-20:29/21	05:24 19:51-20:25/34	06:15 19:08-19:25/17	07:06	07:01	07:52
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47 20:08-20:30/22	05:26 19:50-20:24/34	06:17 19:09-19:22/13	07:07	07:03	07:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48 20:08-20:30/22	05:27 19:49-20:22/33	06:19 19:11-19:20/9	07:09	07:04	07:55
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:48 20:08-20:31/23	05:29 19:48-20:21/33	06:20	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49 20:07-20:31/24	05:31 19:46-20:19/33	06:22	07:12	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50 20:07-20:32/25	05:32 19:43-20:17/34	06:24	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51 20:07-20:32/25	05:34 19:41-20:15/34	06:25	07:16	07:12	08:00
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52 20:07-20:33/26	05:36 19:39-20:14/35	06:27	07:18	07:14	08:02
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53 20:06-20:33/27	05:37 19:37-20:13/36	06:29	07:19	07:15	08:03
	21:26	20:41	19:34	18:23	16:21	15:51
11	04:54 20:06-20:34/28	05:39 19:35-20:10/35	06:30	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55 20:06-20:34/28	05:40 19:34-20:09/35	06:32	07:23	07:19	08:05
	21:24	20:38	19:29	18:18	16:17	15:50
13	04:56 20:05-20:34/29	05:42 19:30-20:06/36	06:34	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58 20:05-20:34/29	05:44 19:28-20:05/37	06:35	07:26	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59 20:05-20:35/30	05:45 19:26-20:02/36	06:37	07:28	07:24	08:08
	21:21	20:32	19:22	18:12	16:13	15:50
16	05:00 20:05-20:36/31	05:47 19:24-20:01/37	06:39	07:30	07:26	08:09
	21:20	20:29	19:19	18:10	16:11	15:51
17	05:01 20:05-20:36/31	05:49 19:21-19:58/37	06:40	07:32	07:28	08:10
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:02 20:04-20:36/32	05:50 19:20-19:57/37	06:42	07:33	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04 20:03-20:36/33	05:52 19:17-19:55/38	06:44	07:35	07:31	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05 20:02-20:35/33	05:54 19:14-19:53/39	06:45	07:37	07:33	08:12
	21:15	20:21	19:10	18:01	16:06	15:52
21	05:06 20:03-20:36/33	05:55 19:12-19:51/39	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08 20:02-20:36/34	05:57 19:10-19:48/38	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:52
23	05:09 20:02-20:35/33	05:59 19:09-19:47/38	06:50	07:42	07:38	08:13
	21:12	20:15	19:03	17:54	16:02	15:53
24	05:11 20:02-20:36/34	06:00 19:08-19:44/36	06:52	07:44	07:40	08:14
	21:10	20:12	19:00	17:52	16:01	15:54
25	05:12 20:01-20:35/34	06:02 19:08-19:42/34	06:54	06:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14 20:00-20:34/34	06:04 19:07-19:41/34	06:55	06:48	07:43	08:14
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15 19:59-20:34/35	06:05 19:06-19:38/32	06:57	06:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17 19:57-20:33/36	06:07 19:06-19:36/30	06:59	06:52	07:46	08:15
	21:04	20:04	18:51	16:44	15:57	15:56
29	05:18 19:57-20:32/35	06:09 19:06-19:33/27	07:00	06:53	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20 19:56-20:30/34	06:10 19:06-19:31/25	07:02	06:55	07:49	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21 19:55-20:29/34	06:12 19:07-19:30/23		06:57		08:15
	20:59	19:57		16:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	915	1063	59	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA\_ZB04\_wpd - WEA\_ZB04\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:00	07:48 16:49	06:53 07:17-07:52/35 17:42	06:41 19:37	05:35 20:29	04:49 21:16
2	08:15 16:02	07:46 16:51	06:51 07:15-07:48/33 17:44	06:39 19:39	05:33 20:31	04:48 21:17
3	08:15 16:03	07:44 16:53	06:49 07:12-07:45/33 17:46	06:36 19:41	05:31 20:33	04:47 21:19
4	08:15 16:04	07:43 16:55	06:46 07:10-07:43/33 17:47	06:34 19:42	05:29 20:34	04:46 21:20
5	08:14 16:05	07:41 16:57	06:44 07:09-07:40/31 17:49	06:32 19:44	05:27 20:36	04:46 21:21
6	08:14 16:06	07:39 16:59	06:42 07:07-07:36/29 17:51	06:30 19:46	05:26 20:38	04:45 21:22
7	08:14 16:08	07:37 17:01	06:40 07:07-07:34/27 17:53	06:27 19:48	05:24 20:40	04:44 21:23
8	08:13 16:09	07:36 08:04-08:05/1 17:02	06:37 07:07-07:31/24 17:55	06:25 19:49	05:22 20:41	04:44 21:23
9	08:13 16:10	07:34 07:59-08:10/11 17:04	06:35 07:06-07:29/23 17:57	06:23 19:51	05:20 20:43	04:43 21:24
10	08:12 16:12	07:32 07:58-08:13/15 17:06	06:33 07:06-07:27/21 17:58	06:20 19:53	05:18 20:45	04:43 21:25
11	08:12 16:13	07:30 07:56-08:14/18 17:08	06:30 07:07-07:26/19 18:00	06:18 06:46-06:50/4 19:55	05:17 20:46	04:42 21:26
12	08:11 16:15	07:28 07:54-08:15/21 17:10	06:28 07:07-07:24/17 18:02	06:16 06:42-06:54/12 19:56	05:15 20:48	04:42 21:27
13	08:10 16:16	07:26 07:52-08:16/24 17:12	06:26 07:08-07:22/14 18:04	06:14 06:38-06:56/18 19:58	05:13 20:49	04:42 21:27
14	08:09 16:18	07:24 07:49-08:15/26 17:14	06:23 07:11-07:20/9 18:06	06:11 06:36-06:57/21 20:00	05:12 20:51	04:41 21:28
15	08:09 16:19	07:22 07:47-08:16/29 17:16	06:21 18:07	06:09 06:33-06:57/24 20:02	05:10 20:53	04:41 21:28
16	08:08 16:21	07:20 07:45-08:16/31 17:18	06:19 18:09	06:07 06:32-06:57/25 20:03	05:09 20:54	04:41 21:29
17	08:07 16:23	07:18 07:43-08:16/33 17:20	06:16 18:11	06:05 06:31-06:57/26 20:05	05:07 20:56	04:41 21:29
18	08:06 16:24	07:16 07:41-08:16/35 17:21	06:14 18:13	06:02 06:30-06:57/27 20:07	05:05 20:57	04:41 21:30
19	08:05 16:26	07:14 07:39-08:15/36 17:23	06:12 18:14	06:00 06:30-06:57/27 20:09	05:04 20:59	04:41 21:30
20	08:04 16:28	07:12 07:37-08:14/37 17:25	06:09 18:16	05:58 06:30-06:57/27 20:10	05:03 21:00	04:41 21:31
21	08:03 16:29	07:10 07:35-08:13/38 17:27	06:07 18:18	05:56 06:30-06:56/26 20:12	05:01 21:02	04:41 21:31
22	08:01 16:31	07:08 07:32-08:11/39 17:29	06:05 18:20	05:54 06:30-06:55/25 20:14	05:00 21:03	04:41 21:31
23	08:00 16:33	07:06 07:30-08:09/39 17:31	06:02 18:21	05:52 06:31-06:54/23 20:16	04:59 21:05	04:42 21:31
24	07:59 16:35	07:04 07:28-08:07/39 17:33	06:00 18:23	05:49 06:32-06:53/21 20:17	04:57 21:06	04:42 21:31
25	07:58 16:36	07:02 07:26-08:04/38 17:35	05:58 18:25	05:47 06:33-06:50/17 20:19	04:56 21:07	04:42 21:31
26	07:56 16:38	07:00 07:24-08:02/38 17:36	05:55 18:27	05:45 06:35-06:47/12 20:21	04:55 21:09	04:43 21:31
27	07:55 16:40	06:57 07:21-07:59/38 17:38	05:53 18:28	05:43 20:22	04:54 21:10	04:43 21:31
28	07:54 16:42	06:55 07:19-07:54/35 17:40	05:51 18:30	05:41 20:24	04:53 21:11	04:44 21:31
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31
30	07:51 16:45		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31
31	07:49 16:47		06:44 19:35		04:50 21:15	
Sonnenscheinstunden	256	276	367	417	488	502
Anzahl Minuten mit Schatten	0	621	348	335	0	0

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

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

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB04\_wpd - WEA ZB04\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
2	04:46 21:30	05:24 20:56	06:15 19:52	07:06 18:42	07:01 16:35	07:52 15:54	
3	04:47 21:30	05:26 20:54	06:17 19:50	07:07 18:39	07:04 16:33	07:54 15:54	
4	04:48 21:29	05:28 20:53	06:19 19:48	07:09 18:37	07:04 16:31	07:55 15:53	
5	04:48 21:29	05:29 20:51	06:20 19:45	07:11 18:35	07:04 16:29	07:57 15:53	
6	04:49 21:28	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:27	07:58 15:52	
7	04:50 21:28	05:32 20:47	06:24 19:41	07:14 18:30	07:10 16:26	07:59 15:52	
8	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:28	07:12 16:24	08:00 15:51	
9	04:52 21:26	05:36 20:43	06:27 19:36	07:18 18:25	07:14 16:22	08:02 15:51	
10	04:53 21:26	05:37 20:42	06:29 19:34	07:19 18:23	07:15 16:21	08:03 15:51	
11	04:54 21:25	05:39 20:40	06:30 19:31	07:21 18:21	07:17 16:19	08:04 15:51	
12	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:50	
13	04:56 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50	
14	04:58 21:22	05:44 20:34	06:35 19:24	07:26 18:14	07:23 16:14	08:07 15:50	
15	04:59 21:21	05:45 20:32	06:37 19:22	07:28 18:12	07:24 16:13	08:08 15:50	
16	05:00 21:20	05:47 20:30	06:39 19:19	07:30 18:10	07:26 16:11	08:09 15:51	
17	05:01 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:28 16:10	08:10 15:51	
18	05:03 21:18	05:50 20:25	06:42 19:15	07:34 18:05	08:00-08:39/39 16:09	08:10 15:51	
19	05:04 21:17	05:52 20:23	06:44 19:12	07:35 18:03	08:02-08:41/39 16:07	08:11 15:51	
20	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	08:04-08:43/39 16:06	08:12 15:52	
21	05:07 21:14	05:55 20:19	06:47 19:08	07:39 17:59	08:06-08:44/38 16:05	08:12 15:52	
22	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	08:08-08:45/37 16:04	08:13 15:52	
23	05:09 21:12	05:59 20:15	06:50 19:03	07:43 17:55	08:10-08:46/36 16:02	08:13 15:53	
24	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	08:12-08:46/34 16:01	08:14 15:54	
25	05:12 21:09	06:02 20:10	06:54 18:58	07:46 16:50	07:14-07:46/32 16:00	08:14 15:54	
26	05:14 21:07	06:04 20:08	06:55 18:56	07:48 16:48	07:16-07:46/30 16:00	08:15 15:55	
27	05:15 21:06	06:05 20:06	06:57 18:53	07:50 16:46	07:17-07:45/28 15:58	08:15 15:56	
28	05:17 21:04	06:07 20:04	06:59 18:51	07:52 16:44	07:19-07:45/26 15:57	08:15 15:56	
29	05:18 21:03	06:09 20:01	07:01 18:49	07:54 16:42	07:21-07:44/23 15:57	08:15 15:57	
30	05:20 21:01	06:10 19:59	07:02 18:46	07:56 16:40	07:23-07:44/21 15:56	08:15 15:58	
31	05:21 20:59	06:12 19:57	07:04 18:44	07:58 16:38	07:25-07:43/18 15:55	08:15 15:59	
	Sonnenscheinstunden	505	455	381	331	264	241
	Anzahl Minuten mit Schatten	0	333	24	940	24	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB05\_wpd - WEA ZB05\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
16:00	16:49	17:42	19:37	20:29	21:16	21:30	21:30	19:55	18:44	16:37	15:55	
2	08:15	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:06	07:01	07:52
16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:42	16:35	15:54	
3	08:15	07:44	06:49	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:03	07:54
16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:54	19:50	18:39	16:33	15:54	
4	08:15	07:43	06:46	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:04	07:55
16:04	16:55	17:47	19:42	20:34	21:20	21:29	20:53	19:48	18:37	16:31	15:53	
5	08:14	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:10	07:06	07:57
16:05	16:57	17:49	19:44	20:36	21:21	21:29	20:51	19:45	18:35	16:29	15:53	
6	08:14	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58
16:06	16:59	17:51	19:46	20:38	21:22	21:28	20:49	19:44	18:34	16:27	15:52	
7	08:14	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59
16:08	17:01	17:53	19:48	20:39	21:23	21:28	20:47	19:41	18:30	16:26	15:52	
8	08:13	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:15	07:12	08:00
16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	16:24	15:51	
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
16:10	17:04	17:57	19:51	20:43	21:24	21:28	20:43	19:36	18:26	16:22	15:51	
10	08:12	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:03
16:12	17:06	17:58	19:53	20:44	21:25	21:26	20:41	19:34	18:23	16:21	15:51	
11	08:12	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:04
16:13	17:08	18:00	19:55	20:46	21:26	21:25	20:40	19:31	18:21	16:19	15:51	
12	08:11	07:28	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19	08:05
16:15	17:10	18:02	19:56	20:48	21:27	21:24	20:38	19:29	18:18	16:17	15:50	
13	08:10	07:26	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:06
16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:36	19:27	18:16	16:16	15:50	
14	08:09	07:24	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:23	08:07
16:18	17:14	18:06	20:00	20:51	21:28	21:22	20:34	19:24	18:14	16:14	15:50	
15	08:09	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:08
16:19	17:16	18:07	20:02	20:53	21:28	21:21	20:32	19:22	18:12	16:13	15:50	
16	08:08	07:20	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:26	08:09
16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:10	16:11	15:51	
17	08:07	07:18	06:16	06:05	05:07	04:41	05:01	05:49	06:40	07:31	07:28	08:10
16:22	17:20	18:11	20:05	20:56	21:29	21:19	20:27	19:17	18:07	16:10	15:51	
18	08:06	07:16	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:30	08:10
16:24	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	16:09	15:51	
19	08:05	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	08:11
16:26	17:23	18:14	20:09	20:59	21:30	21:17	20:23	19:12	18:03	16:07	15:51	
20	08:04	07:12	06:09	06:00	05:03	04:41	05:05	05:54	06:46	07:37	07:33	08:12
16:28	17:25	18:16	20:10	21:00	21:31	21:15	20:21	19:10	18:01	16:06	15:52	
21	08:03	07:10	06:07	06:00	05:01	04:41	05:07	05:55	06:47	07:38	07:35	08:12
16:29	17:27	18:18	20:12	21:02	21:31	21:14	20:19	19:08	17:59	16:05	15:52	
22	08:01	07:08	06:05	06:00	05:00	04:41	05:08	05:57	06:49	07:40	07:37	08:13
16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	15:52	
23	08:00	07:06	06:02	06:00	05:00	04:42	05:09	05:59	06:50	07:42	07:38	08:13
16:33	17:31	18:21	20:15	21:05	21:31	21:12	20:15	19:03	17:55	16:02	15:53	
24	07:59	07:04	06:00	06:00	05:00	04:42	05:11	06:00	06:52	07:44	07:40	08:14
16:34	17:33	18:22	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:54	
25	07:58	07:02	06:00	06:00	05:00	04:42	05:12	06:01	06:53	07:45	07:42	08:14
16:36	17:35	18:25	20:19	21:07	21:31	21:09	20:10	18:58	16:50	16:00	15:54	
26	07:56	07:00	06:00	06:00	05:00	04:43	05:14	06:04	06:56	07:48	07:43	08:14
16:38	17:36	18:26	20:21	21:09	21:31	21:07	20:08	18:56	16:48	15:58	15:55	
27	07:55	06:57	06:00	06:00	05:00	04:43	05:15	06:05	06:57	07:49	07:45	08:15
16:40	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	16:46	15:58	15:56	
28	07:53	06:55	06:00	06:00	05:00	04:44	05:17	06:07	06:59	07:51	07:46	08:15
16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:04	18:51	16:44	15:57	15:56	
29	07:52	06:54	06:00	06:00	05:00	04:44	05:18	06:09	07:01	07:53	07:48	08:15
16:44	17:42	18:32	20:26	21:13	21:31	21:03	20:01	18:49	16:42	15:57	15:57	
30	07:51	06:53	06:00	06:00	05:00	04:45	05:20	06:10	07:02	07:54	07:50	08:15
16:45	17:44	18:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58	
31	07:49	06:51	06:00	06:00	05:00	04:45	05:21	06:12	07:03	07:55	07:51	08:15
16:47	17:47	18:37	20:30	21:15	21:31	21:00	19:57	18:44	16:38	15:55	15:59	
Sonnenscheinstunden	256	276	367	417	488	502	505	455	381	311	264	241
Anzahl Minuten mit Schatten	0	0	264	807	8	0	0	508	586	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB06\_wpd - WEA ZB06\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	08:15 08:51-09:10/19 16:01	07:48 08:14-09:08/54 16:49	06:53 17:42	06:41 07:15-07:38/23 19:37	05:35 20:29	04:49 21:16
2	08:15 08:51-09:11/20 16:02	07:46 08:14-09:07/53 16:51	06:51 17:44	06:39 07:12-07:39/27 19:39	05:33 20:31	04:48 21:17
3	08:15 08:51-09:12/21 16:03	07:44 08:13-09:05/52 16:53	06:49 17:46	06:37 07:07-07:39/32 19:41	05:31 20:33	04:47 21:19
4	08:15 08:50-09:13/23 16:04	07:43 08:11-09:01/50 16:55	06:46 17:48	06:34 07:04-07:40/36 19:42	05:29 20:34	04:46 21:20
5	08:14 08:50-09:14/24 16:05	07:41 08:09-08:58/49 16:57	06:44 17:49	06:32 07:03-07:40/37 19:44	05:27 20:36	04:46 21:21
6	08:14 08:49-09:15/26 16:06	07:39 08:07-08:55/48 16:59	06:42 17:51	06:30 07:01-07:41/40 19:46	05:26 20:38	04:45 21:22
7	08:14 08:48-09:15/27 16:08	07:37 08:06-08:52/46 17:01	06:40 17:53	06:27 06:59-07:40/41 19:48	05:24 20:40	04:44 21:23
8	08:13 08:47-09:16/29 16:09	07:36 08:05-08:49/44 17:03	06:37 17:55	06:25 06:59-07:40/41 19:49	05:22 20:41	04:44 21:23
9	08:13 08:47-09:17/30 16:10	07:34 08:04-08:47/43 17:04	06:35 17:57	06:23 06:58-07:40/42 19:51	05:20 20:43	04:43 21:24
10	08:12 08:46-09:18/32 16:12	07:32 08:04-08:46/42 17:06	06:33 17:58	06:20 06:57-07:38/41 19:53	05:18 20:45	04:43 21:25
11	08:12 08:45-09:18/33 16:13	07:30 08:03-08:43/40 17:08	06:30 18:00	06:18 06:57-07:38/41 19:55	05:17 20:46	04:42 21:26
12	08:11 08:44-09:19/35 16:15	07:28 08:03-08:40/37 17:10	06:28 18:02	06:16 06:57-07:37/40 19:56	05:15 20:48	04:42 21:27
13	08:10 08:43-09:19/36 16:16	07:26 08:02-08:37/35 17:12	06:26 18:04	06:14 06:57-07:36/39 19:58	05:13 20:49	04:42 21:27
14	08:09 08:40-09:19/39 16:18	07:24 08:01-08:34/33 17:14	06:23 18:06	06:11 06:58-07:35/37 20:00	05:12 20:51	04:41 21:28
15	08:09 08:39-09:20/41 16:19	07:22 08:01-08:31/30 17:16	06:21 18:07	06:09 06:57-07:32/35 20:02	05:10 20:53	04:41 21:29
16	08:08 08:38-09:20/42 16:21	07:20 08:01-08:29/28 17:18	06:19 18:09	06:07 06:58-07:30/32 20:03	05:09 20:54	04:41 21:29
17	08:07 08:37-09:21/44 16:23	07:18 08:01-08:27/26 17:20	06:16 18:11	06:05 06:59-07:28/29 20:05	05:07 20:56	04:41 21:30
18	08:06 08:35-09:21/46 16:24	07:16 08:02-08:26/24 17:21	06:14 18:13	06:02 07:01-07:22/21 20:07	05:06 20:57	04:41 21:30
19	08:05 08:34-09:22/48 16:26	07:14 08:03-08:25/22 17:23	06:12 18:14	06:00 07:04-07:12/8 20:09 07:13-07:18/5	05:04 20:59	04:41 21:30
20	08:04 08:32-09:21/49 16:28	07:12 08:04-08:24/20 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:31
21	08:03 08:31-09:21/50 16:29	07:10 08:05-08:23/18 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31
22	08:01 08:30-09:22/52 16:31	07:08 08:06-08:21/15 17:29	06:05 18:20	05:54 20:14	05:00 21:03	04:41 21:31
23	08:00 08:28-09:21/53 16:33	07:06 08:08-08:18/10 17:31	06:02 18:21	05:52 20:16	04:59 21:05	04:42 21:31
24	07:59 08:27-09:21/54 16:35	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:06	04:42 21:31
25	07:58 08:26-09:21/55 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:07	04:42 21:31
26	07:56 08:24-09:20/56 16:38	07:00 17:36	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:31
27	07:55 08:22-09:18/56 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 21:10	04:43 21:31
28	07:54 08:21-09:17/56 16:42	06:55 17:40	05:51 18:30	05:41 20:24	04:53 21:11	04:44 21:31
29	07:52 08:19-09:15/56 16:44		06:48 07:27-07:29/2 19:32	05:39 20:26	04:52 21:13	04:44 21:31
30	07:51 08:18-09:14/56 16:46		06:46 07:21-07:35/14 19:34	05:37 20:28	04:51 21:14	04:45 21:31
31	07:49 08:16-09:11/55 16:47		06:44 07:18-07:36/18 19:35		04:50 21:15	
Sonnenscheinstunden   256   276   367   417   488   502						
Anzahl Minuten mit Schatten   1263   819   34   647   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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB06\_wpd - WEA ZB06\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	04:45 21:31	05:23 20:58	06:14 06:56-07:37/41 19:55	07:04 18:44	06:59 07:33-08:14/41 16:37	07:51 08:27-09:00/33 15:55		
2	04:46 21:30	05:24 20:56	06:15 06:56-07:37/41 19:52	07:06 18:42	07:01 07:33-08:16/43 16:35	07:53 08:29-09:01/32 15:54		
3	04:47 21:30	05:26 20:54	06:17 06:56-07:38/42 19:50	07:07 18:39	07:03 07:34-08:19/45 16:33	07:54 08:30-09:00/30 15:54		
4	04:48 21:29	05:28 20:53	06:19 06:56-07:37/41 19:48	07:09 18:37	07:04 07:36-08:23/47 16:31	07:55 08:32-09:01/29 15:53		
5	04:48 21:29	05:29 20:51	06:20 06:57-07:37/40 19:45	07:11 18:35	07:06 07:37-08:25/48 16:29	07:57 08:33-09:01/28 15:53		
6	04:49 21:28	05:31 20:49	06:22 06:56-07:36/40 19:43	07:13 18:32	07:08 07:39-08:28/49 16:27	07:58 08:34-09:00/26 15:52		
7	04:50 21:28	05:32 20:47	06:24 06:58-07:35/37 19:41	07:14 18:30	07:10 07:41-08:31/50 16:26	07:59 08:36-09:01/25 15:52		
8	04:51 21:27	05:34 20:45	06:25 06:59-07:35/36 19:38	07:16 18:28	07:12 07:43-08:35/52 16:24	08:01 08:38-09:01/23 15:51		
9	04:52 21:26	05:36 20:43	06:27 07:01-07:33/32 19:36	07:18 18:25	07:14 07:44-08:38/54 16:22	08:02 08:39-09:01/22 15:51		
10	04:53 21:26	05:37 20:42	06:29 07:05-07:32/27 19:34	07:19 18:23	07:15 07:45-08:39/54 16:21	08:03 08:41-09:01/20 15:51		
11	04:54 21:25	05:39 20:40	06:30 07:06-07:30/24 19:31	07:21 18:21	07:17 07:47-08:42/55 16:19	08:04 08:42-09:01/19 15:51		
12	04:55 21:24	05:41 20:38	06:32 07:10-07:29/19 19:29	07:23 18:19	07:19 07:49-08:45/56 16:17	08:05 08:43-09:01/18 15:51		
13	04:56 21:23	05:42 20:36	06:34 07:12-07:26/14 19:27	07:25 18:16	07:21 07:51-08:47/56 16:16	08:06 08:44-09:01/17 15:50		
14	04:58 21:22	05:44 20:34	06:35 07:15-07:21/6 19:24	07:26 18:14	07:23 07:53-08:49/56 16:14	08:07 08:45-09:02/17 15:50		
15	04:59 21:21	05:46 20:32	06:37 19:22	07:28 18:12	07:25 07:55-08:51/56 16:13	08:08 08:46-09:02/16 15:50		
16	05:00 21:20	05:47 20:30	06:39 19:19	07:30 18:10	07:26 07:57-08:53/56 16:11	08:09 08:47-09:02/15 15:51		
17	05:01 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:28 07:59-08:54/55 16:10	08:10 08:47-09:02/15 15:51		
18	05:03 21:18	05:50 20:25	06:42 19:15	07:34 08:43-08:46/3 18:05	07:30 08:01-08:55/54 16:09	08:10 08:48-09:02/14 15:51		
19	05:04 21:17	05:52 20:23	06:44 19:12	07:35 08:39-08:51/12 18:03	07:32 08:03-08:56/53 16:07	08:11 08:49-09:03/14 15:51		
20	05:05 21:15	05:54 20:21	06:45 19:10	07:37 08:36-08:53/17 18:01	07:33 08:05-08:57/52 16:06	08:12 08:49-09:02/13 15:52		
21	05:07 21:14	05:55 20:19	06:47 19:08	07:39 08:35-08:54/19 17:59	07:35 08:07-08:57/50 16:05	08:12 08:50-09:03/13 15:52		
22	05:08 21:13	05:57 20:17	06:49 19:05	07:41 08:34-08:55/21 17:57	07:37 08:09-08:58/49 16:04	08:13 08:50-09:03/13 15:53		
23	05:09 21:12	05:59 20:15	06:50 19:03	07:43 08:33-08:56/23 17:55	07:38 08:10-08:58/48 16:03	08:13 08:51-09:04/13 15:53		
24	05:11 21:10	06:00 07:07-07:22/15 20:13	06:52 19:00	07:44 08:32-08:57/25 17:52	07:40 08:12-08:58/46 16:01	08:14 08:51-09:05/14 15:54		
25	05:12 21:09	06:02 07:04-07:25/21 20:10	06:54 18:58	06:46 07:32-07:58/26 16:50	07:42 08:15-08:59/44 16:00	08:14 08:51-09:05/14 15:54		
26	05:14 21:07	06:04 07:02-07:31/29 20:08	06:55 18:56	06:48 07:32-08:00/28 16:48	07:43 08:17-08:59/42 15:59	08:15 08:52-09:06/14 15:55		
27	05:15 21:06	06:05 07:00-07:32/32 20:06	06:57 18:53	06:50 07:31-08:01/30 16:46	07:45 08:18-08:59/41 15:58	08:15 08:52-09:07/15 15:56		
28	05:17 21:04	06:07 06:59-07:34/35 20:04	06:59 18:51	06:52 07:31-08:04/33 16:44	07:46 08:20-09:00/40 15:58	08:15 08:52-09:08/16 15:56		
29	05:18 21:03	06:09 06:59-07:36/37 20:01	07:01 18:49	06:53 07:31-08:06/35 16:42	07:48 08:24-09:00/36 15:57	08:15 08:52-09:08/16 15:57		
30	05:20 21:01	06:10 06:57-07:36/39 19:59	07:02 18:46	06:55 07:31-08:09/38 16:40	07:50 08:25-09:00/35 15:56	08:15 08:52-09:09/17 15:58		
31	05:21 20:59	06:12 06:57-07:37/40 19:57		06:57 07:32-08:12/40 16:38		08:15 08:52-09:10/18 15:59		
	Sonnenscheinstunden	505	455	381	331	264	1463	
	Anzahl Minuten mit Schatten	0	455	248	440	350	264	589

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB07\_wpd - WEA ZB07\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 08:49-09:48/59	07:48	06:53	06:41	05:35	04:49
	16:01	16:49	17:42	19:37	20:29	21:16
2	08:15 08:50-09:47/57	07:46	06:51	06:39	05:33	04:48
	16:02	16:51	17:44	19:39	20:31	21:17
3	08:15 08:50-09:46/56	07:44	06:49 07:30-07:42/12	06:37	05:31	04:47
	16:03	16:53	17:46	19:41	20:33	21:19
4	08:15 08:49-09:44/55	07:43	06:46 07:27-07:45/18	06:34	05:29	04:46
	16:04	16:55	17:48	19:42	20:34	21:20
5	08:14 08:50-09:43/53	07:41	06:44 07:25-07:48/23	06:32	05:28	04:46
	16:05	16:57	17:49	19:44	20:36	21:21
6	08:14 08:51-09:43/52	07:39	06:42 07:23-07:48/25	06:30	05:26	04:45
	16:06	16:59	17:51	19:46	20:38	21:22
7	08:14 08:50-09:42/52	07:37	06:40 07:19-07:50/31	06:27	05:24	04:44
	16:08	17:01	17:53	19:48	20:40	21:23
8	08:13 08:50-09:41/51	07:36	06:37 07:16-07:51/35	06:25	05:22	04:44
	16:09	17:03	17:55	19:49	20:41	21:23
9	08:13 08:51-09:40/49	07:34	06:35 07:13-07:51/38	06:23	05:20	04:43
	16:10	17:04	17:57	19:51	20:43	21:24
10	08:12 08:51-09:39/48	07:32	06:33 07:12-07:51/39	06:20	05:18	04:43
	16:12	17:06	17:58	19:53	20:45	21:25
11	08:12 08:51-09:37/46	07:30	06:30 07:11-07:52/41	06:18	05:17	04:42
	16:13	17:08	18:00	19:55	20:46	21:26
12	08:11 08:51-09:35/44	07:28	06:28 07:03-07:51/48	06:16	05:15	04:42
	16:15	17:10	18:02	19:56	20:48	21:27
13	08:10 08:51-09:33/42	07:26	06:26 07:00-07:51/51	06:14	05:13	04:42
	16:16	17:12	18:04	19:58	20:49	21:27
14	08:09 08:51-09:32/41	07:24	06:23 06:59-07:51/52	06:11	05:12	04:42
	16:18	17:14	18:06	20:00	20:51	21:28
15	08:09 08:51-09:32/41	07:22	06:21 06:56-07:50/54	06:09	05:10	04:41
	16:19	17:16	18:07	20:02	20:53	21:29
16	08:08 08:52-09:31/39	07:21	06:19 06:55-07:50/55	06:07	05:09	04:41
	16:21	17:18	18:09	20:03	20:54	21:29
17	08:07 08:52-09:28/36	07:19	06:16 06:53-07:49/56	06:05	05:07	04:41
	16:23	17:20	18:11	20:05	20:56	21:30
18	08:06 08:53-09:27/34	07:16	06:14 06:53-07:48/55	06:02	05:06	04:41
	16:24	17:22	18:13	20:07	20:57	21:30
19	08:05 08:53-09:25/32	07:14	06:12 06:53-07:47/54	06:00	05:04	04:41
	16:26	17:23	18:14	20:09	20:59	21:30
20	08:04 08:53-09:23/30	07:12	06:09 06:51-07:45/54	05:58	05:03	04:41
	16:28	17:25	18:16	20:10	21:00	21:31
21	08:03 08:54-09:21/27	07:10	06:07 06:51-07:44/53	05:56	05:01	04:41
	16:29	17:27	18:18	20:12	21:02	21:31
22	08:01 08:54-09:19/25	07:08	06:05 06:52-07:42/50	05:54	05:00	04:42
	16:31	17:29	18:20	20:14	21:03	21:31
23	08:00 08:54-09:19/25	07:06	06:02 06:51-07:39/48	05:52	04:59	04:42
	16:33	17:31	18:21	20:16	21:05	21:31
24	07:59 08:56-09:19/23	07:04	06:00 06:51-07:34/43	05:49	04:57	04:42
	16:35	17:33	18:23	20:17	21:06	21:31
25	07:58 08:57-09:19/22	07:02	05:58 06:52-07:30/38	05:47	04:56	04:42
	16:36	17:35	18:25	20:19	21:07	21:31
26	07:56 08:57-09:18/21	07:00	05:55 06:52-07:27/35	05:45	04:55	04:43
	16:38	17:36	18:27	20:21	21:09	21:31
27	07:55 08:58-09:17/19	06:57	05:53 06:53-07:15/22	05:43	04:54	04:43
	16:40	17:38	18:29 07:18-07:21/3	20:22	21:10	21:31
28	07:54 09:00-09:17/17	06:55	05:51 06:54-07:13/19	05:41	04:53	04:44
	16:42	17:40	18:30	20:24	21:11	21:31
29	07:52 09:01-09:15/14		06:48 07:56-08:10/14	05:39	04:52	04:44
	16:44		19:32	20:26	21:13	21:31
30	07:51 09:05-09:13/8		06:46 08:01-08:06/5	05:37	04:51	04:45
	16:46		19:34	20:28	21:14	21:31
31	07:49		06:44		04:50	
	16:47		19:35		21:15	
Sonnenscheinstunden	256	276	367	417	487	502
Anzahl Minuten mit Schatten	1118	0	1071	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:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA ZB07\_wpd - WEA ZB07\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	07:42-08:31/49 16:37	06:59 15:55
2	04:46 21:30	05:24 20:56	06:15 19:52	07:06 18:42	07:46-08:30/44 16:35	07:01 15:54
3	04:47 21:30	05:26 20:54	06:17 19:50	07:07 18:39	07:49-08:29/40 16:33	07:03 15:54
4	04:48 21:29	05:28 20:53	06:19 19:48	07:09 18:37	07:50-08:29/39 16:31	07:04 15:53
5	04:49 21:29	05:29 20:51	06:20 19:45	07:11 18:35	07:52-08:28/36 16:29	07:06 15:53
6	04:49 21:28	05:31 20:49	06:22 19:43	07:13 18:32	07:53-08:26/33 16:27	07:08 15:52
7	04:50 21:28	05:32 20:47	06:24 19:41	07:14 18:30	07:57-08:25/28 16:26	07:10 15:52
8	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:28	07:59-08:24/25 16:24	07:12 15:51
9	04:52 21:26	05:36 20:43	06:27 19:36	07:18 18:25	08:01-08:22/21 16:22	07:14 15:51
10	04:53 21:26	05:37 20:42	06:29 19:34	07:19 18:23	08:03-08:18/15 16:21	07:15 15:51
11	04:54 21:25	05:39 20:40	06:30 19:31	07:21 18:21	08:07-08:13/6 16:19	07:17 15:51
12	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	08:35-08:44/9 16:17	08:05 15:51
13	04:57 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:54-07:56/2 16:16	08:06 15:50
14	04:58 21:22	05:44 20:34	06:35 19:24	07:26 18:14	07:47-08:00/13 16:14	08:07 15:50
15	04:59 21:21	05:46 20:32	06:37 19:22	07:28 18:12	07:45-08:03/18 16:13	08:08 15:51
16	05:00 21:20	05:47 20:30	06:39 19:19	07:30 18:10	07:42-08:04/22 16:11	08:09 15:51
17	05:01 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:41-08:14/33 16:10	08:10 15:51
18	05:03 21:18	05:50 20:25	06:42 19:15	07:34 18:05	08:30-08:53/23 16:09	08:10 15:51
19	05:04 21:17	05:52 20:23	06:44 19:12	07:35 18:03	08:29-08:54/25 16:07	08:11 15:51
20	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	08:29-08:54/25 16:06	08:12 15:52
21	05:07 21:14	05:55 20:19	06:47 19:08	07:39 17:59	07:37-08:27/50 16:05	08:12 15:52
22	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	08:30-09:00/30 16:04	08:13 15:53
23	05:09 21:12	05:59 20:15	06:50 19:03	07:43 17:55	08:29-09:01/32 16:03	08:13 15:53
24	05:11 21:10	06:00 20:13	06:52 19:00	07:44 17:53	08:30-09:04/34 16:01	08:14 15:54
25	05:12 21:09	06:02 20:10	06:54 18:58	07:46 16:50	08:30-09:06/36 16:00	08:14 15:54
26	05:14 21:07	06:04 20:08	06:56 18:56	07:48 16:48	08:31-09:10/39 15:59	08:15 15:55
27	05:15 21:06	06:05 20:06	06:57 18:53	07:50 16:46	08:30-09:11/41 15:58	08:15 15:56
28	05:17 21:04	06:07 20:04	06:59 18:51	07:52 16:44	08:31-09:12/41 15:57	08:15 15:57
29	05:18 21:03	06:09 20:01	07:01 18:49	07:54 16:42	08:32-09:14/42 15:57	08:15 15:57
30	05:20 21:01	06:10 19:59	07:02 18:46	07:56 16:40	08:32-09:16/44 15:56	08:15 15:58
31	05:21 20:59	06:12 19:57	07:03 18:44	07:57 16:38	08:32-09:16/44 15:56	08:15 15:59
Sonnenscheinstunden						
Anzahl Minuten mit Schatten						
	505	455	381	331	264	241
	0	0	745	336	541	1781

**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:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB08\_wpd - WEA ZB08\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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

	Januar	Februar	März	April	Mai	Juni	
1	08:15 16:01	07:47 16:49	06:53 07:19-07:52/33 17:42	06:41 19:37	05:35 20:29	04:49 20:29-20:43/14 21:16	
2	08:15 16:02	07:46 16:51	06:51 07:17-07:52/35 17:44	06:39 19:39	05:33 20:31	04:48 20:28-20:44/16 21:17	
3	08:15 16:03	07:44 16:53	06:49 07:14-07:50/36 17:46	06:37 19:41	05:31 20:33	04:47 20:27-20:45/18 21:19	
4	08:15 16:04	07:43 16:55	06:46 07:13-07:50/37 17:47	06:34 19:42	05:29 20:34	04:46 20:28-20:46/18 21:20	
5	08:14 16:05	07:41 16:57	06:44 07:13-07:49/36 17:49	06:32 19:44	05:27 20:36	04:46 20:27-20:47/20 21:21	
6	08:14 16:06	07:39 16:59	06:42 07:11-07:47/36 17:51	06:30 19:46	05:26 20:38	04:45 20:28-20:48/20 21:22	
7	08:14 16:08	07:37 17:01	06:40 07:11-07:45/34 17:53	06:27 19:48	05:24 20:40	04:44 20:27-20:48/21 21:23	
8	08:13 16:09	07:36 17:02	06:37 07:11-07:41/30 17:55	06:25 19:49	05:22 20:41	04:44 20:28-20:49/21 21:23	
9	08:13 16:10	07:34 17:04	06:35 07:11-07:38/27 17:57	06:23 19:51	05:20 20:43	04:43 20:27-20:48/21 21:24	
10	08:12 16:12	07:32 17:06	06:33 07:11-07:35/24 17:58	06:20 19:53	05:18 20:44	04:43 20:28-20:49/21 21:25	
11	08:12 16:13	07:30 17:08	06:30 07:12-07:29/17 18:00	06:18 19:55	05:17 20:46	04:42 20:28-20:51/23 21:26	
12	08:11 16:15	07:28 17:10	06:28 07:13-07:26/13 18:02	06:16 19:56	05:15 20:48	04:42 20:27-20:52/25 21:27	
13	08:10 16:16	07:26 17:12	06:26 07:15-07:24/9 18:04	06:14 19:58	05:13 20:49	04:42 20:28-20:53/25 21:27	
14	08:09 16:18	07:24 17:14	06:23 18:06	06:11 20:00	05:12 20:51	04:42 20:28-20:54/26 21:28	
15	08:09 16:19	07:22 17:16	06:21 18:07	06:09 20:02	05:10 20:53	04:41 20:28-20:54/26 21:28	
16	08:08 16:21	07:20 17:18	06:19 18:09	06:07 20:03	05:09 20:54	04:41 20:28-20:55/27 21:29	
17	08:07 16:23	07:18 17:20	06:16 18:11	06:05 20:05	05:07 20:56	04:41 20:29-20:55/26 21:29	
18	08:06 16:24	07:16 17:21	06:14 18:13	06:02 20:07	05:06 20:57	04:41 20:29-20:56/27 21:30	
19	08:05 16:26	07:14 17:23	06:12 18:14	06:00 20:09	05:04 20:59	04:41 20:29-20:56/27 21:30	
20	08:04 16:28	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 20:29-20:56/27 21:31	
21	08:03 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 20:29-20:56/27 21:31	
22	08:01 16:31	07:08 07:36-07:45/9 17:29	06:05 18:20	05:54 20:14	05:00 21:03	04:41 20:30-20:57/27 21:31	
23	08:00 16:33	07:06 07:34-07:48/14 17:31	06:02 18:21	05:52 20:16	04:59 21:05	04:42 20:30-20:57/27 21:31	
24	07:59 16:35	07:04 07:32-07:49/17 17:33	06:00 18:23	05:49 20:17	04:57 21:06	04:42 20:30-20:57/27 21:31	
25	07:58 16:36	07:02 07:29-07:51/22 17:35	05:58 18:25	05:47 20:19	04:56 21:07	04:42 20:31-20:57/26 21:31	
26	07:56 16:38	07:00 07:27-07:51/24 17:36	05:55 18:27	05:45 20:21	04:55 21:09	04:43 20:31-20:57/26 21:31	
27	07:55 16:40	06:57 07:25-07:51/26 17:38	05:53 18:28	05:43 20:22	04:54 20:34-20:38/4 21:10	04:43 20:31-20:57/26 21:31	
28	07:54 16:42	06:55 07:24-07:51/27 17:40	05:51 18:30	05:41 20:24	04:53 20:32-20:39/7 21:11	04:44 20:31-20:57/26 21:31	
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 20:30-20:40/10 21:13	04:44 20:32-20:57/25 21:31	
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 20:29-20:41/12 21:14	04:45 20:31-20:56/25 21:31	
31	07:49 16:47		06:44 19:35		04:50 20:29-20:43/14 21:15		
	Sonnenscheinstunden	256	276	367	417	487	502
	Anzahl Minuten mit Schatten	0	139	367	0	47	711

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB08\_wpd - WEA ZB08\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	04:45 20:32-20:56/24	05:23 19:57	06:14 19:55	07:04 07:54-08:06/12	06:59 16:37	07:51 15:55
	21:30	20:58	19:55	18:44	16:37	15:55
2	04:46 20:32-20:53/21	05:24 19:52	06:15 19:52	07:06 07:51-08:06/15	07:01 16:35	07:52 15:54
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47 20:32-20:54/22	05:26 19:50	06:17 19:50	07:07 07:50-08:07/17	07:03 16:33	07:54 15:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48 20:33-20:54/21	05:28 19:48	06:19 19:48	07:09 07:49-08:15/26	07:04 16:31	07:55 15:53
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:48 20:33-20:54/21	05:29 19:45	06:20 19:45	07:11 07:48-08:17/29	07:06 16:29	07:57 15:53
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49 20:34-20:54/20	05:31 19:43	06:22 19:43	07:13 07:47-08:20/33	07:08 16:27	07:58 15:52
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50 20:34-20:53/19	05:32 19:41	06:24 19:41	07:14 07:47-08:22/35	07:10 16:26	07:59 15:52
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51 20:34-20:53/19	05:34 19:38	06:25 19:38	07:16 07:47-08:23/36	07:12 16:24	08:00 15:51
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52 20:35-20:53/18	05:36 19:36	06:27 19:36	07:18 07:48-08:24/36	07:14 16:22	08:02 15:51
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53 20:35-20:52/17	05:37 19:34	06:29 19:34	07:19 07:48-08:24/36	07:15 16:21	08:03 15:51
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54 20:36-20:51/15	05:39 19:31	06:30 19:31	07:21 07:49-08:25/36	07:17 16:19	08:04 15:51
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55 20:37-20:50/13	05:41 19:29	06:32 19:29	07:23 07:51-08:25/34	07:19 16:17	08:05 15:51
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:56 20:37-20:50/13	05:42 19:27	06:34 19:27	07:25 07:57-08:25/28	07:21 16:16	08:06 15:50
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58 20:38-20:49/11	05:44 19:24	06:35 19:24	07:26 07:57-08:24/27	07:23 16:14	08:07 15:50
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59 20:40-20:49/9	05:46 19:22	06:37 19:22	07:28 07:58-08:24/26	07:24 16:13	08:08 15:50
	21:21	20:32	19:22	18:12	16:13	15:50
16	05:00 20:42-20:48/6	05:47 19:19	06:39 19:19	07:30 07:59-08:22/23	07:26 16:11	08:09 15:51
	21:20	20:30	19:19	18:10	16:11	15:51
17	05:01	05:49 19:17	06:40 19:17	07:32 08:02-08:21/19	07:28 16:10	08:10 15:51
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:03	05:50 19:15	06:42 19:15	07:34 08:04-08:20/16	07:30 16:09	08:10 15:51
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52 19:12	06:44 19:12	07:35 08:06-08:18/12	07:32 16:07	08:11 15:51
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54 19:10	06:45 19:10	07:37 08:09-08:15/6	07:33 16:06	08:12 15:52
	21:15	20:21	19:10	18:01	16:06	15:52
21	05:07	05:55 19:08	06:47 19:08	07:39	07:35 16:05	08:12 15:52
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57 19:05	06:49 19:05	07:41	07:37 16:04	08:13 15:53
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59 19:03	06:50 19:03	07:43	07:38 16:03	08:13 15:53
	21:12	20:15	19:03	17:55	16:03	15:53
24	05:11	06:00 19:00	06:52 19:00	07:44	07:40 16:01	08:14 15:54
	21:10	20:12	19:00	17:52	16:01	15:54
25	05:12	06:02 18:58	06:54 18:58	06:46	07:42 16:00	08:14 15:54
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14	06:04 18:56	06:55 18:56	06:48	07:43 16:00	08:14 15:54
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15	06:05 18:53	06:57 18:53	06:50	07:45 16:00	08:15 15:55
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17	06:07 18:51	06:59 18:51	06:52	07:46 16:00	08:15 15:56
	21:04	20:04	18:51	16:44	15:58	15:56
29	05:18	06:09 18:49	07:01 18:49	06:53	07:48 16:00	08:15 15:57
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20	06:10 18:46	07:02 18:46	06:55	07:50 16:00	08:15 15:58
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21	06:12		06:57		08:15 15:59
	20:59	19:57		16:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	269	0	5	502	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA ZB09\_wpd - WEA ZB09\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni
1	08:15 16:01	07:48 08:29-09:08/39 16:49	06:53 17:42	06:41 19:37	05:35 06:01-06:05/4 20:29	04:49 20:14-20:25/11 21:16
2	08:15 16:02	07:46 08:29-09:08/39 16:51	06:51 17:44	06:39 19:39	05:33 05:58-06:08/10 20:31	04:48 20:15-20:24/9 21:17
3	08:15 16:03	07:44 08:21-08:26/5 16:53 08:29-09:09/40	06:49 17:46	06:37 19:41	05:31 05:56-06:09/13 20:33	04:47 20:16-20:22/6 21:19
4	08:15 16:04	07:43 08:17-09:09/52 16:55	06:46 17:48	06:34 19:42	05:29 05:55-06:11/16 20:34	04:46 20:19-20:20/1 21:20
5	08:14 16:05	07:41 08:15-09:08/53 16:57	06:44 17:49	06:32 19:44	05:28 05:53-06:12/19 20:36	04:46 21:21
6	08:14 16:06	07:39 08:14-09:08/54 16:59	06:42 17:51	06:30 19:46	05:26 05:52-06:12/20 20:38	04:45 21:22
7	08:14 16:08	07:37 08:13-09:07/54 17:01	06:40 17:53	06:27 19:48	05:24 05:52-06:12/20 20:40	04:44 21:23
8	08:13 16:09	07:36 08:12-09:06/54 17:03	06:37 17:55	06:25 19:49	05:22 05:52-06:13/21 20:41	04:44 21:23
9	08:13 16:10	07:34 08:11-09:05/54 17:04	06:35 17:57	06:23 19:51	05:20 05:51-06:13/22 20:43	04:43 21:24
10	08:12 16:12	07:32 08:12-09:05/53 17:06	06:33 17:58	06:20 19:53	05:18 05:51-06:12/21 20:45	04:43 21:25
11	08:12 16:13	07:30 08:12-09:03/51 17:08	06:30 18:00	06:18 19:55	05:17 05:51-06:13/22 20:46	04:42 21:26
12	08:11 16:15	07:28 08:11-09:00/49 17:10	06:28 18:02	06:16 19:56	05:15 05:51-06:12/21 20:48 20:14-20:17/3	04:42 21:27
13	08:10 16:16	07:26 08:11-08:54/43 17:12	06:26 18:04	06:14 19:58	05:13 05:52-06:12/20 20:49 20:12-20:19/7	04:42 21:27
14	08:09 16:18	07:24 08:10-08:52/42 17:14	06:23 18:06	06:11 20:00	05:12 05:52-06:11/19 20:51 20:11-20:20/9	04:42 21:28
15	08:09 16:19	07:22 08:11-08:50/39 17:16	06:21 18:07	06:09 20:02	05:10 05:53-06:11/18 20:53 20:10-20:22/12	04:41 21:28
16	08:08 16:21	07:20 08:11-08:36/25 17:18 08:40-08:46/6	06:19 18:09	06:07 20:03	05:09 05:53-06:10/17 20:54 20:09-20:23/14	04:41 21:29
17	08:07 16:23	07:18 08:12-08:36/24 17:20	06:16 18:11	06:05 20:05	05:07 05:54-06:10/16 20:56 20:09-20:25/16	04:41 21:29
18	08:06 16:24	07:16 08:13-08:35/22 17:22	06:14 18:13	06:02 20:07	05:06 05:55-06:09/14 20:57 20:08-20:26/18	04:41 21:30
19	08:05 08:47-08:54/7 16:26	07:14 08:14-08:34/20 17:23	06:12 18:14	06:00 20:09	05:04 05:56-06:07/11 20:59 20:08-20:27/19	04:41 21:30
20	08:04 08:44-08:57/13 16:28	07:12 08:15-08:32/17 17:25	06:09 18:16	05:58 20:10	05:03 05:58-06:06/8 21:00 20:08-20:28/20	04:41 21:31
21	08:03 08:43-08:59/16 16:29	07:10 08:18-08:30/12 17:27	06:07 18:18	05:56 20:12	05:01 20:09-20:28/19 21:02	04:41 21:31
22	08:01 08:43-09:01/18 16:31	07:08 08:21-08:25/4 17:29	06:05 18:20	05:54 20:14	05:00 20:08-20:27/19 21:03	04:42 21:31
23	08:00 08:41-09:02/21 16:33	07:06 17:31	06:02 18:21	05:52 20:16	04:59 20:08-20:27/19 21:05	04:42 21:31
24	07:59 08:41-09:03/22 16:35	07:04 17:33	06:00 18:23	05:50 20:17	04:57 20:09-20:27/18 21:06	04:42 21:31
25	07:58 08:37-09:04/27 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 20:09-20:27/18 21:07	04:42 21:31
26	07:56 08:35-09:05/30 16:38	07:00 17:36	05:55 18:27	05:45 20:21	04:55 20:10-20:27/17 21:09	04:43 21:31
27	07:55 08:33-09:06/33 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 20:10-20:27/17 21:10	04:43 21:31
28	07:54 08:32-09:07/35 16:42	06:55 17:40	05:51 18:30	05:41 20:24	04:53 20:11-20:26/15 21:11	04:44 21:31
29	07:52 08:31-09:07/36 16:44		06:48 19:32	05:39 20:26	04:52 20:11-20:26/15 21:13	04:44 21:31
30	07:51 08:31-09:08/37 16:46		06:46 19:34	05:37 20:28	04:51 20:12-20:25/13 21:14	04:45 21:31
31	07:49 08:30-09:08/38 16:47		06:44 19:35		04:50 20:13-20:26/13 21:15	
Sonnenscheinstunden	256	276	367	417	487	502
Anzahl Minuten mit Schatten	333	851	0	0	633	27

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB09\_wpd - WEA ZB09\_wpd, V 162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	04:46	05:23 06:01-06:23/22	06:14	07:04	06:59 07:41-08:34/53	07:51
	21:31	20:58 20:25-20:27/2	19:55	18:44	16:37	15:55
2	04:46	05:24 06:02-06:23/21	06:15	07:06	07:01 07:41-08:35/54	07:52
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26 06:01-06:23/22	06:17	07:07	07:03 07:42-08:36/54	07:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48	05:28 06:02-06:23/21	06:19	07:09	07:04 07:43-08:37/54	07:55
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:49	05:29 06:01-06:22/21	06:20	07:11	07:06 07:44-08:37/53	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31 06:02-06:22/20	06:22	07:13	07:08 07:45-08:38/53	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32 06:02-06:21/19	06:24	07:14	07:10 07:48-08:38/50	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34 06:03-06:21/18	06:25	07:16	07:12 07:52-07:55/3	08:00
	21:27	20:45	19:38	18:28	16:24 07:59-08:39/40	15:51
9	04:52 20:24-20:29/5	05:36 06:04-06:19/15	06:27 07:18		07:14 08:00-08:39/39	08:02
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53 20:23-20:31/8	05:37 06:06-06:18/12	06:29 07:19		07:15 08:00-08:39/39	08:03
	21:26	20:42	19:34	18:23	16:21	15:51
11	04:54 20:22-20:32/10	05:39 06:07-06:16/9	06:30 07:21		07:17 08:01-08:39/38	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55 20:21-20:33/12	05:41	06:32 07:23		07:19 08:02-08:39/37	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57 20:20-20:34/14	05:42	06:34 07:25		07:21 08:03-08:39/36	08:06
	21:23	20:36	19:27	18:16	16:16	15:51
14	04:58 20:20-20:34/14	05:44	06:35 07:26		07:23 08:04-08:39/35	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59 20:20-20:36/16	05:46	06:37 07:28		07:24 08:06-08:38/32	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00 20:20-20:36/16	05:47	06:39 07:30		07:26 08:08-08:38/30	08:09
	21:20	20:30	19:19	18:10	16:11	15:51
17	05:01 20:19-20:36/17	05:49	06:40 07:32		07:28 08:11-08:38/27	08:10
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:03 20:19-20:37/18	05:51	06:42 07:34		07:30 08:15-08:37/22	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04 20:18-20:37/19	05:52	06:44 07:35		07:32 08:16-08:37/21	08:11
	21:17	20:23	19:12	18:03	16:07	15:51
20	05:05 20:19-20:38/19	05:54	06:45 07:37 08:50-08:58/8		07:33 08:18-08:36/18	08:12
	21:15	20:21	19:10	18:01	16:06	15:52
21	05:07 20:19-20:38/19	05:55	06:47 07:39 08:47-09:01/14		07:35 08:19-08:35/16	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08 20:18-20:38/20	05:57	06:49 07:41 08:45-09:03/18		07:37 08:20-08:33/13	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09 06:10-06:15/5	05:59	06:50 07:43 08:44-09:05/21		07:38 08:23-08:30/7	08:13
	21:12 20:18-20:37/19	20:15	19:03 17:55		16:03	15:53
24	05:11 06:07-06:17/10	06:00	06:52 07:44 08:43-09:06/23		07:40	08:14
	21:10 20:19-20:38/19	20:13	19:00 17:53		16:01	15:54
25	05:12 06:06-06:18/12	06:02	06:54 06:46 07:42-08:06/24		07:42	08:14
	21:09 20:19-20:37/18	20:10	18:58 16:50		16:00	15:54
26	05:14 06:05-06:20/15	06:04	06:56 06:48 07:42-08:07/25		07:43	08:15
	21:07 20:20-20:36/16	20:08	18:56 16:48 08:09-08:18/9		15:59	15:55
27	05:15 06:04-06:20/16	06:05	06:57 06:50 07:40-08:20/40		07:45	08:15
	21:06 20:20-20:35/15	20:06	18:53 16:46		15:58	15:56
28	05:17 06:04-06:22/18	06:07	06:59 06:52 07:40-08:22/42		07:46	08:15
	21:04 20:20-20:33/13	20:04	18:51 16:44		15:58	15:57
29	05:18 06:03-06:22/19	06:09	07:01 06:53 07:40-08:23/43		07:48	08:15
	21:03 20:21-20:32/11	20:01	18:49 16:42		15:57	15:57
30	05:20 06:02-06:22/20	06:10	07:02 06:55 07:40-08:29/49		07:50	08:15
	21:01 20:22-20:30/8	19:59	18:46 16:40		15:56	15:58
31	05:21 06:02-06:23/21	06:12	07:03 06:57 07:40-08:32/52		07:51	08:15
	20:59 20:23-20:29/6	19:57	16:39		15:59	15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	468	202	0	368	824	0

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

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

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

**Berechnung:** WEA\_GB **WEA:** WEA\_ZB10\_EnBW - WEA\_ZB10\_EnBW, V162-6.2MW

#### Annahmen für Schattenwurfberechnung

- 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	08:15 16:01 16:02	07:47 16:49 16:51	06:53 17:42 17:44	06:41 19:37 19:39	18:46-18:54/8 20:29 20:31	04:49 21:16 21:17	04:45 21:30 21:30	05:23 20:58 20:56	06:14 19:55 19:52	07:04 18:44 18:42	07:30-07:47/17 16:37 16:35	07:51 15:55 15:54											
2	08:15	07:46	06:51	06:39	18:46	04:49	04:45	05:23	06:14	07:04	07:31-07:44/13	07:51											
3	08:15	07:44	06:49	06:36	18:46	04:47	04:47	05:26	06:17	07:07	07:33-07:42/9	07:54											
4	08:15	07:43	06:46	06:34	18:46	04:46	04:48	05:28	06:19	07:09	07:31-07:42/9	07:55											
5	08:14	07:41	06:44	06:32	18:46	04:46	04:48	05:29	06:20	07:11	07:31-07:42/9	07:57											
6	08:14	07:39	06:42	06:30	18:46	04:45	04:49	05:31	06:22	07:12	07:31-07:42/9	07:58											
7	08:14	07:37	06:40	06:27	18:46	04:44	04:50	05:32	06:24	07:14	07:31-07:42/9	07:59											
8	08:13	07:36	06:37	06:25	18:46	04:44	04:51	05:34	06:25	07:15	07:31-07:42/9	08:00											
9	08:13	07:34	06:35	06:23	18:46	04:43	04:52	05:36	06:27	07:18	07:31-07:42/9	08:02											
10	08:12	07:32	06:33	06:21	18:46	04:43	04:53	05:37	06:29	07:19	07:31-07:42/9	08:03											
11	08:12	07:30	06:30	06:18	18:46	04:42	04:54	05:39	06:30	07:21	07:31-07:42/9	08:04											
12	08:11	07:28	06:28	06:16	18:46	04:42	04:55	05:41	06:32	07:23	07:31-07:42/9	08:05											
13	08:10	07:26	06:26	06:14	18:46	04:42	04:56	05:42	06:34	07:25	07:31-07:42/9	08:06											
14	08:09	07:24	06:23	06:11	18:46	04:41	04:58	05:44	06:35	07:26	07:31-07:42/9	08:07											
15	08:09	07:22	06:21	06:09	18:46	04:41	04:59	05:45	06:37	07:28	07:31-07:42/9	08:08											
16	08:08	07:20	06:19	06:07	18:46	04:41	05:00	05:47	06:39	07:30	07:31-07:42/9	08:09											
17	08:07	07:18	06:16	06:05	18:46	04:41	05:01	05:49	06:40	07:32	07:31-07:42/9	08:10											
18	08:06	07:16	06:14	06:02	18:46	04:41	05:03	05:50	06:42	07:34	07:31-07:42/9	08:11											
19	08:05	07:14	06:12	06:00	18:46	04:41	05:04	05:52	06:44	07:35	07:31-07:42/9	08:12											
20	08:04	07:12	06:09	05:58	18:46	04:41	05:05	05:54	06:45	07:37	07:31-07:42/9	08:13											
21	08:03	07:10	06:07	05:56	18:46	04:41	05:07	05:55	06:47	07:39	07:31-07:42/9	08:14											
22	08:01	07:08	06:05	05:54	18:46	04:41	05:08	05:57	06:48	07:41	07:31-07:42/9	08:15											
23	08:00	07:06	06:02	05:52	18:46	04:42	05:09	05:59	06:50	07:42	07:31-07:42/9	08:16											
24	07:59	07:04	06:00	05:49	18:46	04:42	05:11	06:00	06:52	07:44	07:31-07:42/9	08:17											
25	07:58	07:02	05:58	05:47	18:46	04:42	05:12	06:02	06:54	07:46	07:31-07:42/9	08:18											
26	07:56	07:00	05:55	05:45	18:46	04:43	05:14	06:04	06:55	07:48	07:31-07:42/9	08:19											
27	07:55	06:57	05:53	05:43	18:46	04:43	05:15	06:05	06:57	07:50	07:31-07:42/9	08:20											
28	07:53	06:55	05:51	05:41	18:46	04:43	05:17	06:07	06:59	07:52	07:31-07:42/9	08:21											
29	07:52	06:54	05:50	05:40	18:46	04:44	05:18	06:09	07:01	07:54	07:31-07:42/9	08:22											
30	07:51	06:53	05:49	05:39	18:46	04:45	05:20	06:10	07:02	07:56	07:31-07:42/9	08:23											
31	07:49	06:52	05:48	05:38	18:46	04:46	05:22	06:12	07:04	07:58	07:31-07:42/9	08:24											
Sonnenscheinstunden												256	276	367	417	487	502	505	453	381	311	264	241
Anzahl Minuten mit Schatten												0	0	431	8	0	0	0	407	47	39	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB11\_EnBW - WEA ZB11\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:01	07:47 16:49	06:53 16:50-17:16/26 17:42	06:41 19:37	05:35 20:29	04:49 20:32-20:43/11 21:16	
2	08:15 16:02	07:46 16:51	06:51 16:52-17:17/25 17:44	06:39 19:39	05:33 20:31	04:48 20:31-20:44/13 21:17	
3	08:15 16:03	07:44 16:53	06:49 16:54-17:19/25 17:46	06:36 19:41	05:31 20:33	04:47 20:31-20:45/14 21:18	
4	08:15 16:04	07:43 16:55	06:46 16:56-17:21/25 17:47	06:34 19:42	05:29 20:34	04:46 20:31-20:46/15 21:20	
5	08:14 16:05	07:41 16:57	06:44 16:58-17:23/25 17:49	06:32 19:44	05:27 20:36	04:46 20:31-20:47/16 21:21	
6	08:14 16:06	07:39 16:59	06:42 17:00-17:25/25 17:51	06:30 19:46	05:26 20:38	04:45 20:31-20:48/17 21:22	
7	08:14 16:08	07:37 17:01	06:39 17:02-17:27/25 17:53	06:27 19:48	05:24 20:39	04:44 20:31-20:49/18 21:22	
8	08:13 16:09	07:36 17:02	06:37 17:03-17:28/25 17:55	06:25 19:49	05:22 20:41	04:44 20:31-20:50/19 21:23	
9	08:13 16:10	07:34 17:04	06:35 17:05-17:30/25 17:57	06:23 19:51	05:20 20:43	04:43 20:31-20:50/19 21:24	
10	08:12 16:12	07:32 17:06	06:33 17:08-17:33/25 17:58	06:20 19:53	05:18 20:44	04:43 20:31-20:51/20 21:25	
11	08:12 16:13	07:30 17:08	06:30 17:10-17:34/24 18:00	06:18 19:55	05:17 20:46	04:42 20:32-20:51/19 21:26	
12	08:11 16:15	07:28 17:10	06:28 17:10-17:36/26 18:02	06:16 19:56	05:15 20:48	04:42 20:31-20:51/20 21:27	
13	08:10 16:16	07:26 17:12	06:26 17:10-17:38/28 18:04	06:13 19:58	05:13 20:49	04:42 20:31-20:51/20 21:27	
14	08:09 16:18	07:24 17:14	06:23 17:09-17:39/30 18:06	06:11 20:00	05:12 20:51	04:41 20:32-20:52/20 21:28	
15	08:09 16:19	07:22 16:43-16:47/4 17:16	06:21 17:09-17:42/33 18:07	06:09 20:02	05:10 20:53	04:41 20:32-20:52/20 21:28	
16	08:08 16:21	07:20 16:42-16:49/7 17:18	06:19 17:10-17:44/34 18:09	06:07 20:03	05:09 20:54	04:41 20:32-20:52/20 21:29	
17	08:07 16:23	07:18 16:41-16:52/11 17:20	06:16 17:10-17:45/35 18:11	06:05 20:05	05:07 20:56	04:41 20:32-20:53/21 21:29	
18	08:06 16:24	07:16 16:40-16:54/14 17:21	06:14 17:12-17:45/33 18:13	06:02 20:07	05:05 20:57	04:41 20:33-20:53/20 21:30	
19	08:05 16:26	07:14 16:40-16:56/16 17:23	06:12 17:14-17:44/30 18:14	06:00 20:09	05:04 20:59	04:41 20:33-20:53/20 21:30	
20	08:04 16:28	07:12 16:40-16:58/18 17:25	06:09 17:17-17:43/26 18:16	05:58 20:10	05:03 21:00	04:41 20:33-20:53/20 21:31	
21	08:03 16:29	07:10 16:39-16:59/20 17:27	06:07 17:20-17:43/23 18:18	05:56 20:12	05:01 21:02	04:41 20:33-20:53/20 21:31	
22	08:01 16:31	07:08 16:39-17:01/22 17:29	06:05 17:21-17:41/20 18:20	05:54 20:14	05:00 21:03	04:41 20:34-20:54/20 21:31	
23	08:00 16:33	07:06 16:40-17:04/24 17:31	06:02 17:24-17:39/15 18:21	05:52 20:15	04:59 21:05	04:42 20:34-20:54/20 21:31	
24	07:59 16:35	07:04 16:40-17:06/26 17:33	06:00 17:30-17:35/5 18:23	05:49 20:17	04:57 21:06	04:42 20:34-20:54/20 21:31	
25	07:58 16:36	07:02 16:42-17:08/26 17:35	05:58 18:25	05:47 20:19	04:56 21:07	04:42 20:35-20:55/20 21:31	
26	07:56 16:38	07:00 16:43-17:09/26 17:36	05:55 18:27	05:45 20:21	04:55 21:09	04:43 20:34-20:54/20 21:31	
27	07:55 16:40	06:57 16:47-17:11/24 17:38	05:53 18:28	05:43 20:22	04:54 20:35-20:38/3 21:10	04:43 20:34-20:54/20 21:31	
28	07:53 16:42	06:55 16:48-17:14/26 17:40	05:51 18:30	05:41 20:24	04:53 20:33-20:39/6 21:11	04:44 20:35-20:55/20 21:31	
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 20:33-20:40/7 21:13	04:44 20:35-20:56/21 21:31	
30	07:51 16:45		06:46 19:34	05:37 20:28	04:51 20:32-20:41/9 21:14	04:45 20:35-20:55/20 21:31	
31	07:49 16:47		06:43 19:35		04:50 20:32-20:43/11 21:15		
	Sonnenscheinstunden	256	276	367	417	487	502
	Anzahl Minuten mit Schatten	0	264	613	0	36	563

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB11\_EnBW - WEA ZB11\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

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Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

	Juli	August	September	Oktober	November	Dezember
1	04:45 20:36-20:56/20	05:23 20:58	06:14 19:55	07:04 17:48-18:16/28	06:59 16:37	07:51 15:55
2	04:46 20:35-20:55/20	05:24 20:56	06:15 19:52	07:06 17:48-18:14/26	07:01 16:35	07:52 15:54
3	04:47 20:36-20:56/20	05:26 20:54	06:17 19:50	07:07 17:48-18:11/23	07:03 16:33	07:54 15:54
4	04:48 20:36-20:55/19	05:28 20:53	06:19 19:48	07:09 17:44-18:09/25	07:04 16:31	07:55 15:53
5	04:48 20:37-20:55/18	05:29 20:51	06:20 19:45	07:11 17:42-18:06/24	07:06 16:29	07:57 15:53
6	04:49 20:37-20:55/18	05:31 20:49	06:22 19:43	07:12 17:39-18:04/25	07:08 16:27	07:58 15:52
7	04:50 20:37-20:54/17	05:32 20:47	06:24 19:41	07:14 17:37-18:02/25	07:10 16:26	07:59 15:52
8	04:51 20:37-20:53/16	05:34 20:45	06:25 19:38	07:16 17:35-18:00/25	07:12 16:24	08:00 15:51
9	04:52 20:38-20:53/15	05:36 20:43	06:27 19:36	07:18 17:31-17:57/26	07:14 16:22	08:02 15:51
10	04:53 20:38-20:52/14	05:37 20:41	06:29 19:34	07:19 17:29-17:54/25	07:15 16:21	08:03 15:51
11	04:54 20:39-20:51/12	05:39 20:40	06:30 19:31	07:21 17:27-17:52/25	07:17 16:19	08:04 15:51
12	04:55 20:39-20:50/11	05:41 20:38	06:32 19:29	07:23 17:24-17:50/26	07:19 16:17	08:05 15:50
13	04:56 20:40-20:50/10	05:42 20:36	06:34 19:27	07:25 17:22-17:48/26	07:21 16:16	08:06 15:50
14	04:58 20:41-20:49/8	05:44 20:34	06:35 19:24	07:26 17:20-17:45/25	07:23 16:14	08:07 15:50
15	04:59 20:42-20:49/7	05:45 20:32	06:37 19:22	07:28 17:17-17:43/26	07:24 16:13	08:08 15:50
16	05:00 20:44-20:48/4	05:47 20:29	06:39 19:19	07:30 17:14-17:41/27	07:26 16:11	08:09 15:51
17	05:01 20:45-20:46/1	05:49 20:27	06:40 19:17	07:32 17:12-17:38/26	07:28 16:10	08:10 15:51
18	05:03 21:18	05:50 20:25	06:42 19:15	07:33 17:11-17:36/25	07:30 16:09	08:10 15:51
19	05:04 21:17	05:52 20:23	06:44 19:12	07:35 17:11-17:34/23	07:31 16:07	08:11 15:51
20	05:05 21:15	05:54 20:21	06:45 18:12-18:24/12	07:37 17:10-17:32/22	07:33 16:06	08:12 15:52
21	05:07 21:14	05:55 20:19	06:47 18:07-18:26/19	07:39 17:10-17:30/20	07:35 16:05	08:12 15:52
22	05:08 21:13	05:57 20:17	06:49 18:05-18:27/22	07:41 17:10-17:28/18	07:37 16:04	08:13 15:52
23	05:09 21:11	05:59 20:15	06:50 18:03-18:28/25	07:42 17:09-17:25/16	07:38 16:02	08:13 15:53
24	05:11 21:10	06:00 20:12	06:52 17:59-18:27/28	07:44 17:10-17:23/13	07:40 16:01	08:14 15:54
25	05:12 21:09	06:02 20:10	06:54 17:55-18:28/33	07:46 16:10-16:20/10	07:42 16:00	08:14 15:54
26	05:14 21:07	06:04 20:08	06:55 17:54-18:28/34	07:48 16:12-16:18/6	07:43 15:59	08:14 15:55
27	05:15 21:06	06:05 20:06	06:57 17:51-18:25/34	07:50 16:13-16:16/3	07:45 15:58	08:15 15:56
28	05:17 21:04	06:07 20:04	06:59 17:50-18:23/33	07:52 16:14	07:46 15:57	08:15 15:56
29	05:18 21:03	06:09 20:01	07:01 17:50-18:21/31	07:54 16:15	07:47 15:57	08:15 15:57
30	05:20 21:01	06:10 19:59	07:02 17:49-18:19/30	07:56 16:16	07:49 15:56	08:15 15:58
31	05:21 20:59	06:12 19:57	07:04 17:48-18:18/29	07:58 16:17	07:51 15:55	08:15 15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	230	0	301	589	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB12\_EnBW - WEA ZB12\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	08:15 16:01	07:47 16:49	06:53 16:49-17:04/15 17:42	06:41 19:37	05:35 19:46-20:01/15 20:29	04:49 20:02-20:31/29 21:16	
2	08:15 16:02	07:46 16:51	06:51 16:51-17:01/10 17:44	06:39 19:39	05:33 19:45-20:02/17 20:31	04:48 20:02-20:32/30 21:17	
3	08:15 16:03	07:44 16:53	06:49 17:46	06:36 19:41	05:31 19:44-20:03/19 20:33	04:47 20:01-20:32/31 21:18	
4	08:15 16:04	07:43 16:55	06:46 17:47	06:34 19:42	05:29 19:44-20:04/20 20:34	04:46 20:02-20:33/31 21:20	
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 19:45-20:06/21 20:36	04:46 20:01-20:33/32 21:21	
6	08:14 16:06	07:39 16:59	06:42 17:51	06:30 19:46	05:26 19:45-20:07/22 20:38	04:45 20:02-20:34/32 21:22	
7	08:14 16:08	07:37 17:01	06:40 17:53	06:27 19:48	05:24 19:45-20:08/23 20:39	04:44 20:01-20:34/33 21:22	
8	08:13 16:09	07:36 17:02	06:37 17:55	06:25 19:49	05:22 19:45-20:08/23 20:41	04:44 20:01-20:35/34 21:23	
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 19:45-20:09/24 20:43	04:43 20:01-20:34/33 21:24	
10	08:12 16:12	07:32 17:06	06:33 17:58	06:20 19:53	05:18 19:44-20:09/25 20:44	04:43 20:01-20:35/34 21:25	
11	08:12 16:13	07:30 17:08	06:30 18:00	06:18 19:55	05:17 19:44-20:10/26 20:46	04:42 20:02-20:36/34 21:26	
12	08:11 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 19:44-20:09/25 20:48	04:42 20:01-20:35/34 21:27	
13	08:10 16:16	07:26 17:12	06:26 18:04	06:14 19:58	05:13 19:44-20:10/26 20:49	04:42 20:01-20:36/35 21:27	
14	08:09 16:18	07:24 17:14	06:23 18:06	06:11 20:00	05:12 19:44-20:09/25 20:51	04:42 20:02-20:37/35 21:28	
15	08:09 16:19	07:22 17:16	06:21 18:07	06:09 20:02	05:10 19:44-20:10/26 20:53	04:41 20:02-20:39/37 21:28	
16	08:08 16:21	07:20 17:18	06:19 18:09	06:07 20:03	05:09 19:44-20:09/25 20:54	04:41 20:02-20:40/38 21:29	
17	08:07 16:23	07:18 16:49-16:52/3 17:20	06:16 18:11	06:05 20:05	05:07 19:44-20:09/25 20:56	04:41 20:02-20:40/38 21:29	
18	08:06 16:24	07:16 16:47-16:54/7 17:21	06:14 18:13	06:02 20:07	05:06 19:44-20:08/24 20:57	04:41 20:03-20:41/38 21:30	
19	08:05 16:26	07:14 16:45-16:56/11 17:23	06:12 18:14	06:00 20:09	05:04 19:45-20:08/23 20:59	04:41 20:03-20:41/38 21:30	
20	08:04 16:28	07:12 16:45-16:58/13 17:25	06:09 18:16	05:58 20:10	05:03 19:46-20:08/22 21:00	04:41 20:03-20:41/38 21:31	
21	08:03 16:29	07:10 16:43-16:59/16 17:27	06:07 18:18	05:56 20:12	05:01 19:46-20:08/22 21:02	04:41 20:03-20:42/39 21:31	
22	08:01 16:31	07:08 16:43-17:01/18 17:29	06:05 18:20	05:54 20:14	05:00 20:10-20:19/9 21:03	04:41 20:04-20:43/39 21:31	
23	08:00 16:33	07:06 16:43-17:04/21 17:31	06:02 18:21	05:52 20:15	04:59 20:08-20:22/14 21:05	04:42 20:04-20:42/38 21:31	
24	07:59 16:35	07:04 16:43-17:06/23 17:33	06:00 18:23	05:49 20:17	04:57 20:07-20:24/17 21:06	04:42 20:04-20:42/38 21:31	
25	07:58 16:36	07:02 16:44-17:07/23 17:35	05:58 18:25	05:47 20:19	04:56 20:06-20:25/19 21:07	04:42 20:04-20:43/39 21:31	
26	07:56 16:38	07:00 16:43-17:06/23 17:36	05:55 18:27	05:45 20:21	04:55 20:05-20:27/22 21:09	04:43 20:04-20:42/38 21:31	
27	07:55 16:40	06:57 16:44-17:05/21 17:38	05:53 18:28	05:43 19:51-19:54/3 20:22	04:54 20:04-20:28/24 21:10	04:43 20:05-20:42/37 21:31	
28	07:53 16:42	06:55 16:46-17:05/19 17:40	05:51 18:30	05:41 19:48-19:55/7 20:24	04:53 20:03-20:28/25 21:11	04:44 20:05-20:41/36 21:31	
29	07:52 16:44		06:48 19:32	05:39 19:47-19:57/10 20:26	04:52 20:03-20:29/26 21:13	04:44 20:06-20:40/34 21:31	
30	07:51 16:45		06:46 19:34	05:37 19:47-19:59/12 20:28	04:51 20:02-20:30/28 21:14	04:45 20:05-20:39/34 21:31	
31	07:49 16:47		06:43 19:35		04:50 20:03-20:31/28 21:15		
	Sonnenscheinstunden	256	276	367	417	487	502
	Anzahl Minuten mit Schatten	0	198	25	32	791	1056

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB12\_EnBW - WEA ZB12\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

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

	July	August	September	October	November	December
1	04:45 20:06-20:40/34	05:23 19:54-20:20/26	06:14 07:04	06:59 07:51		
	21:30 20:58	19:55 20:20/25	19:55 18:44	16:37 15:55		
2	04:46 20:05-20:39/34	05:24 19:55-20:20/25	06:15 07:06	07:01 07:52		
	21:30 20:56	19:52 18:42	16:35 15:54			
3	04:47 20:06-20:40/34	05:26 19:55-20:19/24	06:17 07:07	07:03 07:54		
	21:30 20:54	19:50 18:39	16:33 15:54			
4	04:48 20:07-20:40/33	05:28 19:54-20:18/24	06:19 07:09	07:04 07:55		
	21:29 20:53	19:48 18:37	16:31 15:53			
5	04:48 20:07-20:40/33	05:29 19:55-20:18/23	06:20 07:11	07:06 07:57		
	21:29 20:51	19:45 18:35	16:29 15:53			
6	04:49 20:08-20:40/32	05:31 19:54-20:17/23	06:22 07:12	07:08 07:58		
	21:28 20:49	19:43 18:32	16:27 15:52			
7	04:50 20:07-20:39/32	05:32 19:54-20:16/22	06:24 07:14	07:10 07:59		
	21:28 20:47	19:41 18:30	16:26 15:52			
8	04:51 20:08-20:39/31	05:34 19:53-20:15/22	06:25 07:16	07:12 08:00		
	21:27 20:45	19:38 18:28	16:24 15:51			
9	04:52 20:08-20:39/31	05:36 19:54-20:13/19	06:27 07:18	07:14 08:02		
	21:26 20:43	19:36 18:25	16:22 15:51			
10	04:53 20:09-20:39/30	05:37 19:54-20:12/18	06:29 07:19	07:15 08:03		
	21:26 20:41	19:34 18:23	16:21 15:51			
11	04:54 20:09-20:39/30	05:39 19:54-20:10/16	06:30 07:21 17:27-17:34/7	07:17 08:04		
	21:25 20:40	19:31 18:21	16:19 15:51			
12	04:55 20:10-20:39/29	05:41 19:54-20:09/15	06:32 07:23 17:24-17:36/12	07:19 08:05		
	21:24 20:38	19:29 18:19	16:17 15:51			
13	04:56 20:10-20:38/28	05:42 19:54-20:06/12	06:34 07:25 17:21-17:37/16	07:21 08:06		
	21:23 20:36	19:27 18:16	16:16 15:50			
14	04:58 20:11-20:38/27	05:44 19:56-20:05/9	06:35 07:26 17:18-17:37/19	07:23 08:07		
	21:22 20:34	19:24 18:14	16:14 15:50			
15	04:59 20:12-20:38/26	05:45 19:56-20:02/6	06:37 07:28 17:16-17:38/22	07:24 08:08		
	21:21 20:32	19:22 18:12	16:13 15:50			
16	05:00 20:13-20:38/25	05:47 19:59-20:01/2	06:39 07:30 17:15-17:38/23	07:26 08:09		
	21:20 20:03-20:11/8	20:29 19:19 18:10	16:11 15:51			
17	05:01 20:14-20:37/23	05:49 19:40 07:32 17:15-17:38/23	07:28 08:10			
	21:19 20:01-20:12/11	20:27 19:17 18:07	16:10 15:51			
18	05:03 20:15-20:36/21	05:50 19:42 07:33 17:14-17:36/22	07:30 08:10			
	21:18 20:00-20:14/14	20:25 19:15 18:05	16:09 15:51			
19	05:04 20:16-20:34/18	05:52 19:44 07:35 17:14-17:34/20	07:31 08:11			
	21:17 19:58-20:15/17	20:23 19:12 18:03	16:07 15:51			
20	05:05 20:18-20:34/16	05:54 19:45 07:37 17:14-17:32/18	07:33 08:12			
	21:15 19:58-20:16/18	20:21 19:10 18:01	16:06 15:52			
21	05:07 20:20-20:32/12	05:55 19:47 07:39 17:15-17:30/15	07:35 08:12			
	21:14 19:57-20:17/20	20:19 19:08 17:59	16:05 15:52			
22	05:08 20:23-20:28/5	05:57 19:49 07:41 17:15-17:28/13	07:37 08:13			
	21:13 19:56-20:17/21	20:17 19:05 17:57	16:04 15:53			
23	05:09 19:56-20:18/22	05:59 19:49 07:42 17:15-17:25/10	07:38 08:13			
	21:11 20:15	19:03 17:55	16:03 15:53			
24	05:11 19:56-20:19/23	06:00 19:47 07:44 17:17-17:23/6	07:40 08:14			
	21:10 20:12	19:00 17:52	16:01 15:54			
25	05:12 19:55-20:19/24	06:02 19:45 07:46 16:20-16:21/1	07:42 08:14			
	21:09 20:10	18:58 16:50	16:00 15:54			
26	05:14 19:54-20:19/25	06:04 19:43 07:48 16:19-16:20/1	07:43 08:14			
	21:07 20:08	18:56 16:48	15:59 15:55			
27	05:15 19:55-20:20/25	06:05 19:42 07:50 16:18-16:19/1	07:45 08:15			
	21:06 20:06	18:53 16:46	15:58 15:56			
28	05:17 19:54-20:20/26	06:07 19:41 07:52 16:17-16:18/1	07:46 08:15			
	21:04 20:04	18:51 16:44	15:58 15:56			
29	05:18 19:54-20:20/26	06:09 19:40 07:53 16:16-16:17/1	07:48 08:15			
	21:03 20:01	18:49 16:42	15:57 15:57			
30	05:20 19:54-20:20/26	06:10 19:39 07:55 16:15-16:16/1	07:49 08:15			
	21:01 19:59	18:46 16:40	15:56 15:58			
31	05:21 19:54-20:20/26	06:12 19:38 07:57 16:14-16:15/1	08:15 15:59			
	20:59 19:57	18:44 16:38	15:59 15:59			
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	916	286	0	227	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB13\_EnBW - WEA ZB13\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15	07:47 08:14-08:26/12	06:53	06:41	05:35 19:32-19:58/26	04:49 20:20-20:40/20
	16:01	16:49	17:42	19:37	20:29	21:16
2	08:15	07:46 08:12-08:27/15	06:51	06:39	05:33 19:33-19:58/25	04:48 20:19-20:41/22
	16:02	16:51	17:44	19:39	20:31	21:17
3	08:15	07:44 08:11-08:29/18	06:49	06:37	05:31 19:34-20:01/27	04:47 20:19-20:41/22
	16:03	16:53	17:46	19:41	20:33	21:18
4	08:15	07:43 08:09-08:30/21	06:46	06:34	05:29 19:33-20:02/29	04:46 20:19-20:42/23
	16:04	16:55	17:47	19:42	20:34	21:20
5	08:14	07:41 08:07-08:30/23	06:44	06:32	05:28 19:34-20:05/31	04:46 20:18-20:42/24
	16:05	16:57	17:49	19:44	20:36	21:21
6	08:14	07:39 08:06-08:30/24	06:42	06:30	05:26 19:34-20:05/31	04:45 20:19-20:43/24
	16:06	16:59	17:51	19:46	20:38	21:22
7	08:14	07:37 08:05-08:31/26	06:40	06:27	05:24 19:33-20:06/33	04:44 20:18-20:43/25
	16:08	17:01	17:53	19:48	20:39	21:23
8	08:13	07:36 08:04-08:30/26	06:37	06:25	05:22 19:33-20:06/33	04:44 20:19-20:44/25
	16:09	17:03	17:55	19:49	20:41	21:23
9	08:13	07:34 08:04-08:30/26	06:35	06:23	05:20 19:34-20:07/33	04:43 20:18-20:44/26
	16:10	17:04	17:57	19:51	20:43	21:24
10	08:12	07:32 08:05-08:31/26	06:33	06:20	05:18 19:34-20:07/33	04:43 20:18-20:45/27
	16:12	17:06	17:58	19:53	20:44	21:25
11	08:12	07:30 08:05-08:30/25	06:30	06:18	05:17 19:35-20:08/33	04:42 20:19-20:45/26
	16:13	17:08	18:00	19:55	20:46	21:26
12	08:11	07:28 08:05-08:29/24	06:28	06:16	05:15 19:35-20:08/33	04:42 20:18-20:45/27
	16:15	17:10	18:02	19:56	20:48	21:27
13	08:10	07:26 08:06-08:27/21	06:26	06:14	05:13 19:36-20:08/32	04:42 20:18-20:45/27
	16:16	17:12	18:04	19:58	20:49	21:27
14	08:09	07:24 08:06-08:24/18	06:23	06:11	05:12 19:37-20:08/31	04:42 20:19-20:46/27
	16:18	17:14	18:06	20:00	20:51	21:28
15	08:09	07:22 08:07-08:21/14	06:21	06:09	05:10 19:38-20:08/30	04:41 20:19-20:46/27
	16:19	17:16	18:07	20:02	20:53	21:28
16	08:08	07:20 08:09-08:19/10	06:19	06:07	05:09 19:39-20:08/29	04:41 20:19-20:46/27
	16:21	17:18	18:09	20:03	20:54	21:29
17	08:07	07:18	06:16	06:05	05:07 19:41-20:08/27	04:41 20:19-20:47/28
	16:23	17:20	18:11	20:05	20:56	21:29
18	08:06	07:16	06:14	06:02	05:06 19:41-20:07/26	04:41 20:19-20:47/28
	16:24	17:21	18:13	20:07	20:57	21:30
19	08:05	07:14	06:12	06:00 19:36-19:41/5	05:04 19:41-20:07/26	04:41 20:19-20:47/28
	16:26	17:23	18:14	20:09	20:59	21:30
20	08:04	07:12	06:09	05:58 19:34-19:43/9	05:03 19:42-20:07/25	04:41 20:20-20:47/27
	16:28	17:25	18:16	20:10	21:00	21:31
21	08:03	07:10	06:07	05:56 19:32-19:44/12	05:01 19:43-20:07/24	04:41 20:20-20:47/27
	16:29	17:27	18:18	20:12	21:02	21:31
22	08:01	07:08	06:05	05:54 19:31-19:46/15	05:00 19:43-20:06/23	04:42 20:21-20:48/27
	16:31	17:29	18:20	20:14	21:03	21:31
23	08:00	07:06	06:02	05:52 19:30-19:47/17	04:59 19:43-20:05/22	04:42 20:20-20:48/28
	16:33	17:31	18:21	20:16	21:05	21:31
24	07:59	07:04	06:00	05:49 19:29-19:49/20	04:57 19:44-20:05/21	04:42 20:20-20:48/28
	16:35	17:33	18:23	20:17	21:06	21:31
25	07:58	07:02	05:58	05:47 19:29-19:49/20	04:56 19:45-20:04/19	04:42 20:21-20:49/28
	16:36	17:35	18:25	20:19	21:07	21:31
26	07:56	07:00	05:55	05:45 19:29-19:49/20	04:55 19:46-20:04/18	04:43 20:21-20:49/28
	16:38	17:36	18:27	20:21	21:09 20:27-20:31/4	21:31
27	07:55	06:57	05:53	05:43 19:29-19:53/24	04:54 19:47-20:03/16	04:43 20:22-20:49/27
	16:40	17:38	18:28	20:22	21:10 20:24-20:34/10	21:31
28	07:53	06:55	05:51	05:41 19:29-19:55/26	04:53 19:49-20:02/13	04:44 20:22-20:49/27
	16:42	17:40	18:30	20:24	21:11 20:23-20:36/13	21:31
29	07:52		06:48	05:39 19:30-19:57/27	04:52 19:50-20:00/10	04:44 20:22-20:50/28
	16:44		19:32	20:26	21:13 20:21-20:37/16	21:31
30	07:51		06:46	05:37 19:31-19:58/27	04:51 19:52-19:58/6	04:45 20:22-20:49/27
	16:46		19:34	20:28	21:14 20:21-20:38/17	21:31
31	07:49 08:16-08:25/9		06:44		04:50 20:21-20:40/19	
	16:47		19:35		21:15	
Sonnenscheinstunden	256	276	367	417	487	502
Anzahl Minuten mit Schatten	9	329	0	222	844	785

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB13\_EnBW - WEA ZB13\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

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	04:45 20:23-20:49/26	05:23 19:45-20:18/33	06:14 19:55	07:04 18:44	06:59 07:34-07:59/25	07:51 15:55	
2	04:46 20:22-20:49/27	05:24 19:45-20:18/33	06:15 19:52	07:06 18:42	07:01 07:34-08:00/26	07:52 15:54	
3	04:47 20:23-20:49/26	05:26 19:44-20:18/34	06:17 19:50	07:07 18:39	07:03 07:34-08:00/26	07:54 15:54	
4	04:48 20:24-20:49/25	05:28 19:44-20:18/34	06:19 19:48	07:09 18:37	07:04 07:35-08:00/25	07:55 15:53	
5	04:49 20:24-20:50/26	05:29 19:43-20:16/33	06:20 19:45	07:11 18:35	07:06 07:35-08:00/25	07:57 15:53	
6	04:49 20:25-20:50/25	05:31 19:44-20:16/32	06:22 19:43	07:13 18:32	07:08 07:37-08:00/23	07:58 15:52	
7	04:50 20:25-20:49/24	05:32 19:43-20:14/31	06:24 19:41	07:14 18:30	07:10 07:39-08:00/21	07:59 15:52	
8	04:51 20:25-20:49/24	05:34 19:43-20:14/31	06:25 19:38	07:16 18:28	07:12 07:41-07:59/18	08:00 15:51	
9	04:52 20:26-20:49/23	05:36 19:43-20:11/28	06:27 19:36	07:18 18:25	07:14 07:43-07:58/15	08:02 15:51	
10	04:53 20:26-20:48/22	05:37 19:44-20:09/25	06:29 19:34	07:19 18:23	07:15 07:45-07:57/12	08:03 15:51	
11	04:54 20:27-20:48/21	05:39 19:41-20:07/26	06:30 19:31	07:21 18:21	07:17 07:47-07:55/8	08:04 15:51	
12	04:55 20:28-20:47/19	05:41 19:40-20:06/26	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:51	
13	04:57 20:03-20:04/1	05:42 19:38-20:05/27	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50	
14	04:58 19:59-20:08/9	05:44 19:38-20:04/26	06:35 19:24	07:26 18:14	07:23 16:14	08:07 15:50	
15	04:59 19:59-20:10/11	05:46 19:36-20:02/26	06:37 19:22	07:28 18:12	07:24 16:13	08:08 15:51	
16	05:00 19:57-20:12/15	05:47 19:36-20:00/24	06:39 19:19	07:30 18:10	07:26 16:11	08:09 15:51	
17	05:01 19:56-20:13/17	05:49 19:35-19:55/20	06:40 19:17	07:32 18:07	07:28 16:10	08:10 15:51	
18	05:03 19:55-20:13/18	05:50 19:36-19:56/20	06:42 19:15	07:34 18:05	07:30 16:09	08:10 15:51	
19	05:04 19:54-20:14/20	05:52 19:36-19:55/19	06:44 19:12	07:35 18:03	07:31 16:07	08:11 15:51	
20	05:05 19:54-20:16/22	05:54 19:36-19:53/17	06:45 19:10	07:37 18:01	07:33 16:06	08:12 15:52	
21	05:07 19:54-20:16/22	05:55 19:37-19:51/14	06:47 19:08	07:39 17:59	07:35 16:05	08:12 15:52	
22	05:08 19:53-20:16/23	05:57 19:37-19:48/11	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53	
23	05:09 19:52-20:17/25	05:59 19:38-19:47/9	06:50 19:03	07:42 17:55	07:38 16:03	08:13 15:53	
24	05:11 19:52-20:18/26	06:00 19:40-19:44/4	06:52 19:00	07:44 17:52	07:40 16:01	08:14 15:54	
25	05:12 19:52-20:18/26	06:02 20:10	06:54 18:58	06:46 16:50	07:42-07:47/5	07:42 16:00	
26	05:14 19:52-20:19/27	06:04 20:08	06:55 18:56	06:48 16:48	07:39-07:50/11	07:43 15:59	
27	05:15 19:51-20:18/27	06:05 20:06	06:57 18:53	06:50 16:46	07:36-07:50/14	07:45 15:58	
28	05:17 19:49-20:18/29	06:07 20:04	06:59 18:51	06:52 16:44	07:35-07:54/19	07:46 15:58	
29	05:18 19:48-20:19/31	06:09 20:01	07:01 18:49	06:53 16:42	07:34-07:56/22	07:48 15:57	
30	05:20 19:47-20:18/31	06:10 19:59	07:02 18:46	06:55 16:40	07:34-07:58/24	07:49 15:57	
31	05:21 19:46-20:19/33	06:12 19:57	07:04 18:44	06:57 16:38	07:34-07:59/25	07:50 15:58	
	Sonnenscheinstunden	505	455	381	331	264	241
	Anzahl Minuten mit Schatten	768	583	0	120	224	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB14\_EnBW - WEA ZB14\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 08:56-09:28/32	07:47 06:53	06:41	05:35	19:31-19:49/18	04:49
	16:01 16:49	17:42	19:37	20:29		21:16
2	08:15 08:56-09:29/33	07:46 06:51	06:39	05:33	19:31-19:48/17	04:48
	16:02 16:51	17:44	19:39	20:31		21:17
3	08:15 08:57-09:30/33	07:44 06:49	06:37	05:31	19:32-19:47/15	04:47
	16:03 16:53	17:46	19:41	20:33		21:19
4	08:15 08:57-09:29/32	07:43 06:46	06:34	05:29	19:33-19:45/12	04:46
	16:04 16:55	17:48	19:42	20:34		21:20
5	08:14 08:57-09:30/33	07:41 06:44	06:32	19:16-19:18/2	05:28	19:36-19:43/7
	16:05 16:57	17:49	19:44	20:36		21:21
6	08:14 08:47-08:54/7	07:39 06:42	06:30	06:54-06:57/3	05:26	04:45
	16:06 08:57-09:30/33	16:59 17:51	19:46	19:13-19:19/6	20:38	21:22
7	08:14 08:47-08:56/9	07:37 06:40	06:27	06:50-07:00/10	05:24	04:44
	16:08 08:58-09:31/33	17:01 17:53	19:48	19:11-19:21/10	20:40	21:23
8	08:13 08:46-08:57/11	07:36 06:37	06:25	06:48-07:02/14	05:22	04:44
	16:09 08:58-09:31/33	17:03 17:55	19:49	19:10-19:23/13	20:41	21:23
9	08:13 08:46-09:32/46	07:34 06:35	06:23	06:46-07:03/17	05:20	04:43
	16:10 17:04	17:57	19:51	19:09-19:25/16	20:43	21:24
10	08:12 08:45-09:32/47	07:32 06:33	06:20	06:45-07:04/19	05:18	04:43
	16:12 17:06	17:58	19:53	19:08-19:26/18	20:44	21:25
11	08:12 08:45-09:32/47	07:30 06:30	06:18	06:43-07:03/20	05:17	04:42
	16:13 17:08	18:00	19:55	19:08-19:28/20	20:46	21:26
12	08:11 08:44-09:32/48	07:28 06:28	06:16	06:43-07:04/21	05:15	04:42
	16:15 17:10	18:02	19:56	19:08-19:30/22	20:48	21:27
13	08:10 08:44-09:32/48	07:26 06:26	06:14	06:42-07:04/22	05:13	04:42
	16:16 17:12	18:04	19:58	19:08-19:31/23	20:49	21:27
14	08:09 08:44-09:31/47	07:24 06:23	06:11	06:42-07:04/22	05:12	04:42
	16:18 17:14	18:06	20:00	19:08-19:30/22	20:51	21:28
15	08:09 08:44-09:31/47	07:22 06:21	06:09	06:42-07:02/20	05:10	04:41
	16:19 17:16	18:07	20:02	19:09-19:30/21	20:53	21:28
16	08:08 08:44-09:31/47	07:20 06:19	06:07	06:42-07:02/20	05:09	04:41
	16:21 17:18	18:09	20:03	19:10-19:29/19	20:54	21:29
17	08:07 08:44-09:30/46	07:18 06:16	06:05	06:43-07:01/18	05:07	04:41
	16:23 17:20	18:11	20:05	19:11-19:29/18	20:56	21:29
18	08:06 08:45-09:29/44	07:16 06:14	06:02	06:44-06:59/15	05:06	04:41
	16:24 17:22	18:13	20:07	19:12-19:28/16	20:57	21:30
19	08:05 08:45-09:28/43	07:14 06:12	06:00	06:45-06:58/13	05:04	04:41
	16:26 17:23	18:14	20:09	19:13-19:26/13	20:59	21:30
20	08:04 08:44-09:23/39	07:12 06:09	05:58	06:47-06:55/8	19:38-19:43/5	05:03
	16:28 17:25	18:16	20:10	19:15-19:24/9	21:00	21:31
21	08:03 08:45-09:22/37	07:10 06:07	05:56	19:35-19:45/10	05:01	04:41
	16:29 17:27	18:18	20:12		21:02	21:31
22	08:01 08:46-09:22/36	07:08 06:05	05:54	19:33-19:46/13	05:00	04:42
	16:31 17:29	18:20	20:14		21:03	21:31
23	08:00 08:46-09:07/21	07:06 06:02	05:52	19:32-19:47/15	04:59	04:42
	16:33 09:10-09:20/10	17:31 18:21	20:16		21:05	21:31
24	07:59 08:46-09:08/22	07:04 06:00	05:50	19:31-19:49/18	04:57	04:42
	16:35 09:14-09:17/3	17:33 18:23	20:17		21:06	21:31
25	07:58 08:48-09:08/20	07:02 05:58	05:47	19:30-19:50/20	04:56	04:42
	16:36 17:35	18:25	20:19		21:07	21:31
26	07:56 08:48-09:07/19	07:00 05:55	05:45	19:30-19:50/20	04:55	04:43
	16:38 17:36	18:27	20:21		21:09	21:31
27	07:55 08:48-09:07/19	06:57 05:53	05:43	19:29-19:50/21	04:54	04:43
	16:40 17:38	18:28	20:22		21:10	21:31
28	07:54 08:50-09:06/16	06:55 05:51	05:41	19:29-19:50/21	04:53	04:44
	16:42 17:40	18:30	20:24		21:11	21:31
29	07:52 08:51-09:05/14	06:48 05:48	05:39	19:30-19:51/21	04:52	04:44
	16:44 17:44	18:32	20:26		21:13	21:31
30	07:51 08:54-09:04/10	06:46 05:37	05:37	19:30-19:50/20	04:51	04:45
	16:46 17:46	18:34	20:28		21:14	21:31
31	07:49 08:57-09:00/3	06:44 05:44			04:50	
	16:47 17:47	18:35			21:15	
Sonnenscheinstunden	256	276	367	417	487	502
Anzahl Minuten mit Schatten	1068	0	0	674	69	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB14\_EnBW - WEA ZB14\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	04:46 21:30	05:23 20:58	06:14 06:42-07:02/20 19:55 19:07-19:27/20	07:04 18:44	06:59 16:37	07:51 08:27-09:14/47 15:55	
2	04:46 21:30	05:24 20:56	06:16 06:43-07:02/19 19:52 19:07-19:25/18	07:06 18:42	07:01 16:35	07:52 08:28-09:15/47 15:54	
3	04:47 21:30	05:26 20:54	06:17 06:44-07:01/17 19:50 19:06-19:22/16	07:07 18:39	07:03 16:33	07:54 08:29-09:15/46 15:54	
4	04:48 21:29	05:28 20:53	06:19 06:45-06:59/14 19:48 19:07-19:20/13	07:09 18:37	07:04 16:31	07:55 08:31-08:42/11 15:53 08:43-09:16/33	
5	04:49 21:29	05:29 20:51	06:20 06:47-06:57/10 19:45 19:08-19:18/10	07:11 18:35	07:06 16:29	07:57 08:32-08:41/9 15:53 08:43-09:16/33	
6	04:49 21:28	05:31 20:49	06:22 06:48-06:53/5 19:43 19:09-19:15/6	07:13 18:32	07:08 16:27	07:58 08:33-08:40/7 15:52 08:43-09:16/33	
7	04:50 21:28	05:32 20:47	06:24 19:11-19:13/2 19:41	07:14 18:30	07:10 16:26	07:59 08:36-08:39/3 15:52 08:44-09:17/33	
8	04:51 21:27	05:34 19:45-19:54/9 20:45	06:25 19:38	07:16 18:28	07:12 16:24	08:00 08:45-09:18/33 15:51	
9	04:52 21:26	05:36 19:42-19:55/13 20:43	06:27 19:36	07:18 18:25	07:14 16:22	08:02 08:45-09:18/33 15:51	
10	04:53 21:26	05:37 19:41-19:56/15 20:42	06:29 19:34	07:19 18:23	07:15 16:21	08:03 08:45-09:18/33 15:51	
11	04:54 21:25	05:39 19:39-19:57/18 20:40	06:30 19:31	07:21 18:21	07:17 08:27-08:32/5 16:19	08:04 08:47-09:19/32 15:51	
12	04:55 21:24	05:41 19:39-19:58/19 20:38	06:32 19:29	07:23 18:19	07:19 08:24-08:35/11 16:17	08:05 08:47-09:20/33 15:51	
13	04:57 21:23	05:42 19:38-19:58/20 20:36	06:34 19:27	07:25 18:16	07:21 08:23-08:37/14 16:16	08:06 08:48-09:20/32 15:51	
14	04:58 21:22	05:44 19:38-19:58/20 20:34	06:35 19:24	07:26 18:14	07:23 08:22-08:38/16 16:14	08:07 08:48-09:20/32 15:51	
15	04:59 21:21	05:46 19:37-19:58/21 20:32	06:37 19:22	07:28 18:12	07:24 08:21-08:39/18 16:13	08:08 08:49-09:21/32 15:51	
16	05:00 21:20	05:47 19:37-19:58/21 20:30	06:39 19:19	07:30 18:10	07:26 08:21-08:40/19 16:11	08:09 08:49-09:20/31 15:51	
17	05:01 21:19	05:49 19:36-19:57/21 20:27	06:40 19:17	07:32 18:07	07:28 08:21-08:41/20 16:10	08:10 08:50-09:21/31 15:51	
18	05:03 21:18	05:51 19:37-19:57/20 20:25	06:42 19:15	07:34 18:05	07:30 08:20-08:42/22 16:09 08:48-08:51/3	08:10 08:50-09:22/32 15:51	
19	05:04 21:17	05:52 19:38-19:55/17 20:23	06:44 19:12	07:35 18:03	07:32 08:21-08:42/21 16:07 08:45-08:55/10	08:11 08:51-09:23/32 15:51	
20	05:05 21:15	05:54 19:37-19:53/16 20:21	06:45 19:10	07:37 18:01	07:33 08:21-08:57/36 16:06	08:12 08:51-09:22/31 15:52	
21	05:07 21:14	05:56 19:39-19:51/12 20:19	06:47 19:08	07:39 17:59	07:35 08:21-08:58/37 16:05	08:12 08:52-09:23/31 15:52	
22	05:08 21:13	05:57 19:21-19:25/4 20:17 19:39-19:48/9	06:49 19:05	07:41 17:57	07:37 08:20-08:59/39 16:04	08:13 08:52-09:23/31 15:53	
23	05:09 21:12	05:59 06:51-06:59/8 19:42-19:47/5 20:15 19:18-19:29/11	06:50 19:03	07:43 17:55	07:38 08:21-09:04/43 16:03	08:13 08:53-09:24/31 15:53	
24	05:11 21:10	06:00 06:49-07:02/13 20:12 19:16-19:30/14	06:52 19:00	07:44 17:53	07:40 08:22-09:06/44 16:01	08:14 08:53-09:25/32 15:54	
25	05:12 21:09	06:02 06:46-07:02/16 20:10 19:14-19:31/17	06:54 18:58	07:46 17:50	07:42 08:22-09:08/46 16:00	08:14 08:53-09:25/32 15:54	
26	05:14 21:07	06:04 06:45-07:04/19 20:08 19:14-19:32/18	06:55 18:56	07:48 17:48	07:43 08:23-09:10/47 15:59	08:14 08:54-09:26/32 15:55	
27	05:15 21:06	06:06 06:44-07:03/19 20:06 19:12-19:31/19	06:57 18:53	07:50 17:46	07:45 08:23-09:10/47 15:58	08:15 08:55-09:26/31 15:56	
28	05:17 21:04	06:07 06:43-07:04/21 20:04 19:11-19:32/21	06:59 18:51	07:52 17:44	07:46 08:24-09:11/47 15:57	08:15 08:55-09:27/32 15:57	
29	05:18 21:03	06:09 06:43-07:04/21 20:01 19:09-19:31/22	07:01 18:49	07:53 17:42	07:48 08:25-09:13/48 15:57	08:15 08:55-09:27/32 15:57	
30	05:20 21:01	06:11 06:42-07:04/22 19:59 19:08-19:31/23	07:02 18:46	07:54 17:40	07:50 08:25-09:13/48 15:56	08:15 08:56-09:28/32 15:58	
31	05:21 20:59	06:12 06:42-07:04/22 19:57 19:08-19:30/22	07:03 18:44	07:55 17:39	07:51 08:25-09:13/48 15:55	08:15 08:56-09:28/32 15:59	
	Sonnenscheinstunden	505	455	381	331	264	241
	Anzahl Minuten mit Schatten	0	588	170	0	641	1067

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB15\_EnBW - WEA ZB15\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:01	07:47 16:49	06:53 17:42	06:41 19:37	18:57-19:11/14 20:29	05:35 21:16
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 19:39	18:55-19:13/18 20:31	05:33 21:17
3	08:15 16:03	07:44 16:53	06:49 17:46	06:37 19:41	18:52-19:14/22 20:33	05:31 21:18
4	08:15 16:04	07:43 16:55	06:46 17:48	06:34 19:42	18:51-19:15/24 20:34	05:29 21:20
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 19:44	18:50-19:15/25 20:36	05:28 21:21
6	08:14 16:06	07:39 16:59	06:42 17:51	06:30 19:46	18:48-19:15/27 20:38	05:26 21:22
7	08:14 16:08	07:37 17:01	06:40 17:53	06:27 19:48	18:48-19:17/29 20:39	05:24 21:22
8	08:13 16:09	07:36 17:03	06:37 17:55	06:25 19:49	18:48-19:18/30 20:41	05:22 21:23
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	18:48-19:19/31 20:43	05:20 21:24
10	08:12 16:12	07:32 17:06	06:33 17:58	06:20 19:53	18:47-19:18/31 20:44	05:18 21:25
11	08:12 16:13	07:30 17:08	06:30 18:00	06:18 19:55	18:47-19:19/32 20:46	05:17 21:26
12	08:11 16:15	07:28 17:10	06:28 18:02	06:16 19:56	18:47-19:19/32 20:48	05:15 21:27
13	08:10 16:16	07:26 17:12	06:26 18:04	06:14 19:58	18:48-19:19/31 20:49	05:13 21:27
14	08:09 16:18	07:24 17:14	06:23 18:06	06:11 20:00	18:48-19:18/30 20:51	05:12 21:28
15	08:09 16:19	07:22 17:16	06:21 18:07	06:09 20:02	18:49-19:18/29 20:53	05:10 21:28
16	08:08 16:21	07:20 17:18	06:19 18:09	06:07 20:03	18:49-19:17/28 20:54	05:09 21:29
17	08:07 16:23	07:18 17:20	06:16 18:11	06:05 20:05	18:49-19:17/28 20:56	05:07 21:29
18	08:06 16:24	07:16 17:21	06:14 18:13	06:02 20:07	18:50-19:16/26 20:57	05:06 21:30
19	08:05 16:26	07:14 17:23	06:12 18:14	06:00 20:09	18:51-19:15/24 20:59	05:04 21:30
20	08:04 16:28	07:12 17:25	06:09 18:16	05:58 20:10	18:51-19:14/23 21:00	05:03 21:31
21	08:03 16:29	07:10 17:27	06:07 18:18	05:56 20:12	18:52-19:11/19 21:02	05:01 21:31
22	08:01 16:31	07:08 17:29	06:05 18:20	05:54 20:14	18:53-19:10/17 19:33-19:35/2	05:00 21:03
23	08:00 16:33	07:06 17:31	06:02 18:21	05:52 20:15	18:56-19:07/11 19:27-19:41/14	04:59 21:05
24	07:59 16:35	07:04 17:33	06:00 18:23	05:49 20:17	19:25-19:43/18 21:06	04:57 21:06
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	19:23-19:44/21 21:07	04:56 21:07
26	07:56 16:38	07:00 17:36	05:55 18:27	05:45 20:21	19:21-19:46/25 21:09	04:55 21:09
27	07:55 16:40	06:57 17:38	05:53 18:28	05:43 20:22	19:20-19:46/26 21:10	04:54 21:10
28	07:53 16:42	06:55 17:40	05:51 18:30	05:41 20:24	19:19-19:47/28 21:11	04:53 21:11
29	07:52 16:44		06:48 19:32	05:39 20:26	19:19-19:48/29 21:13	04:52 21:13
30	07:51 16:46		06:46 19:34	05:37 20:28	19:18-19:49/31 21:14	04:51 21:14
31	07:49 16:47		06:44 19:35		18:59-19:09/10 21:15	04:50 21:15
Sonnenscheinstunden						
Anzahl Minuten mit Schatten						
	256	276	367	417	775	503
	0	0	16	775	503	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
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**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB15\_EnBW - WEA ZB15\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

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

	July	August	September	Oktober	November	Dezember
1	04:46	05:23 19:29-19:57/28	06:14 18:46-19:18/32	07:04	06:59	07:51
	21:30	20:58	19:55	18:44	16:37	15:55
2	04:46	05:24 19:29-19:58/29	06:15 18:46-19:17/31	07:06	07:01	07:52
	21:30	20:56	19:52	18:42	16:35	15:54
3	04:47	05:26 19:28-19:58/30	06:17 18:45-19:16/31	07:07	07:03	07:54
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:48	05:28 19:28-19:58/30	06:19 18:45-19:15/30	07:09	07:04	07:55
	21:29	20:53	19:48	18:37	16:31	15:53
5	04:49	05:29 19:27-19:58/31	06:20 18:45-19:14/29	07:11	07:06	07:57
	21:29	20:51	19:45	18:35	16:29	15:53
6	04:49	05:31 19:27-19:59/32	06:22 18:44-19:11/27	07:12	07:08	07:58
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32 19:26-19:58/32	06:24 18:45-19:10/25	07:14	07:10	07:59
	21:28	20:47	19:41	18:30	16:26	15:52
8	04:51	05:34 19:26-19:59/33	06:25 18:45-19:09/24	07:16	07:12	08:00
	21:27	20:45	19:38	18:28	16:24	15:51
9	04:52	05:36 19:26-19:58/32	06:27 18:46-19:09/23	07:18	07:14	08:02
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53	05:37 19:26-19:58/32	06:29 18:48-19:07/19	07:19	07:15	08:03
	21:26	20:41	19:34	18:23	16:21	15:51
11	04:54	05:39 19:26-19:57/31	06:30 18:49-19:04/15	07:21	07:17	08:04
	21:25	20:40	19:31	18:21	16:19	15:51
12	04:55	05:41 19:26-19:57/31	06:32 18:51-19:02/11	07:23	07:19	08:05
	21:24	20:38	19:29	18:19	16:17	15:51
13	04:57	05:42 19:26-19:56/30	06:34 18:52-18:59/7	07:25	07:21	08:06
	21:23	20:36	19:27	18:16	16:16	15:50
14	04:58	05:44 19:27-19:56/29	06:35	07:26	07:23	08:07
	21:22	20:34	19:24	18:14	16:14	15:50
15	04:59	05:46 19:27-19:54/27	06:37	07:28	07:24	08:08
	21:21	20:32	19:22	18:12	16:13	15:51
16	05:00	05:47 19:28-19:54/26	06:39	07:30	07:26	08:09
	21:20	20:29	19:19	18:10	16:11	15:51
17	05:01	05:49 19:28-19:52/24	06:40	07:32	07:28	08:10
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:03	05:50 19:30-19:51/21	06:42	07:34	07:30	08:10
	21:18	20:25	19:15	18:05	16:09	15:51
19	05:04	05:52 19:07-19:09/2	06:44	07:35	07:31	08:11
	21:17	20:23 19:32-19:49/17	19:12	18:03	16:07	15:51
20	05:05	05:54 19:01-19:13/12	06:45	07:37	07:33	08:12
	21:15	20:21 19:34-19:46/12	19:10	18:01	16:06	15:52
21	05:07	05:55 18:59-19:16/17	06:47	07:39	07:35	08:12
	21:14	20:19	19:08	17:59	16:05	15:52
22	05:08	05:57 18:56-19:16/20	06:49	07:41	07:37	08:13
	21:13	20:17	19:05	17:57	16:04	15:53
23	05:09	05:59 18:55-19:18/23	06:50	07:42	07:38	08:13
	21:11	20:15	19:03	17:55	16:03	15:53
24	05:11 19:41-19:45/4	06:00 18:54-19:19/25	06:52	07:44	07:40	08:14
	21:10	20:12	19:00	17:52	16:01	15:54
25	05:12 19:37-19:48/11	06:02 18:53-19:19/26	06:54	07:46	07:42	08:14
	21:09	20:10	18:58	16:50	16:00	15:54
26	05:14 19:36-19:51/15	06:04 18:52-19:20/28	06:55	07:48	07:43	08:14
	21:07	20:08	18:56	16:48	15:59	15:55
27	05:15 19:34-19:52/18	06:05 18:51-19:19/28	06:57	07:50	07:45	08:15
	21:06	20:06	18:53	16:46	15:58	15:56
28	05:17 19:32-19:53/21	06:07 18:51-19:19/28	06:59	07:52	07:46	08:15
	21:04	20:04	18:51	16:44	15:58	15:57
29	05:18 19:32-19:55/23	06:09 18:48-19:19/31	07:01	07:53	07:48	08:15
	21:03	20:01	18:49	16:42	15:57	15:57
30	05:20 19:30-19:55/25	06:10 18:48-19:19/31	07:02	07:55	07:49	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21 19:30-19:56/26	06:12 18:47-19:19/32		07:57		08:15
	20:59	19:57		16:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	143	860	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA ZB16\_EnBW - WEA ZB16\_EnBW, V162-6.2MW

**Annahmen für Schattenwurfberechnung**

- 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	08:15 16:01 16:02	07:47 16:49 16:51	06:53 17:42 17:44	06:41 18:33-18:58/25 19:37 19:39	05:35 20:29 20:31	04:49 21:16 21:17	04:46 20:58 20:56	05:23 19:55 19:52	06:14 18:44 18:42	07:04 17:58-18:16/18 18:06 18:00-18:14/14	06:59 16:37 16:35	07:51 15:55 15:54
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 18:33-18:58/25 19:39	05:32 20:31	04:48 21:17	04:46 20:56	05:24 19:52	06:15 18:42	07:06 18:00-18:14/14	07:01 16:35	07:52 15:54
3	08:15 16:03	07:44 16:53	06:49 17:46	06:37 18:33-18:58/23 19:41	05:31 20:33	04:47 21:18	04:47 20:54	05:26 19:50	06:17 18:39	07:07 18:01-18:12/11 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:46 17:48	06:34 18:34-18:55/21 19:42	05:29 20:34	04:46 21:20	04:48 20:53	05:28 19:48	06:19 18:37	07:09 18:05-18:09/4 18:37	07:04 16:31	07:55 15:53
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 18:35-18:54/19 19:44	05:28 20:36	04:46 21:21	04:49 20:51	05:29 19:45	06:20 18:35	06:20 18:36-18:46/10 18:35	07:11 16:29	07:57 15:53
6	08:14 16:06	07:39 16:59	06:42 17:51	06:30 18:36-18:51/15 19:46	05:26 20:38	04:45 21:22	04:49 20:49	05:31 19:43	06:22 18:32	06:22 18:32-18:47/15 18:32	07:13 16:27	07:58 15:52
7	08:14 16:08	07:37 17:01	06:40 17:53	06:27 18:38-18:49/11 19:48	05:24 20:39	04:44 21:22	04:50 21:28	05:32 20:47	06:24 19:41	06:24 18:30-18:49/19 18:30	07:14 16:26	07:59 15:52
8	08:13 16:09	07:36 17:03	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23	04:51 20:45	05:34 19:38	06:25 18:28	06:25 18:28-18:49/21 18:28	07:16 16:24	08:00 15:51
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:24	04:52 21:26	05:36 20:43	06:27 18:25	06:27 18:27-18:50/23 18:25	07:18 16:22	08:02 15:51
10	08:12 16:12	07:32 17:06	06:33 17:25-17:33/8 17:58	06:20 19:53	05:18 20:44	04:43 21:25	04:53 21:26	05:37 20:41	06:29 18:23	06:29 18:27-18:51/24 18:23	07:19 16:21	08:03 15:51
11	08:12 16:13	07:30 17:08	06:30 17:21-17:34/13 18:00	06:18 19:55	05:17 20:46	04:42 21:26	04:54 21:25	05:39 20:40	06:30 18:21	06:30 18:25-18:50/25 18:21	07:21 16:19	08:04 15:51
12	08:11 16:15	07:28 17:10	06:28 17:20-17:36/16 18:02	06:16 19:56	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 18:25	06:32 18:25-18:51/26 18:25	07:23 16:17	08:05 15:51
13	08:10 16:16	07:26 17:12	06:26 17:19-17:38/19 18:04	06:14 19:58	05:13 20:49	04:42 21:27	04:57 21:23	05:42 20:36	06:34 18:24	06:34 18:24-18:50/26 18:24	07:25 16:16	08:06 15:51
14	08:09 16:19	07:24 17:16	06:23 17:18-17:39/21 18:07	06:11 20:02	05:12 20:53	04:42 21:21	04:58 20:32	05:44 19:22	06:35 18:24	06:35 18:24-18:50/26 18:24	07:26 16:13	08:07 15:51
15	08:09 16:21	07:22 17:18	06:21 17:17-17:39/22 18:09	06:09 20:03	05:10 20:54	04:41 21:29	04:59 21:20	05:46 19:19	06:37 18:24	06:37 18:24-18:49/25 18:19	07:28 16:11	08:08 15:51
16	08:08 16:23	07:20 17:20	06:19 17:17-17:40/23 18:11	06:07 20:05	05:09 20:56	04:41 21:29	05:00 20:27	05:47 19:17	06:39 18:07	06:39 18:24-18:48/24 18:07	07:30 16:10	08:09 15:51
17	08:07 16:23	07:18 17:20	06:16 17:16-17:39/23 18:11	06:05 20:05	05:07 20:56	04:41 21:29	05:01 20:27	05:49 19:17	06:40 18:24	06:40 18:24-18:47/23 18:07	07:32 16:10	08:10 15:51
18	08:06 16:24	07:16 17:22	06:14 17:16-17:40/24 18:13	06:02 20:07	05:06 20:57	04:41 21:30	05:03 20:25	05:51 19:15	06:42 18:13	06:42 18:13-18:15/2 18:15	07:34 16:09	08:10 15:51
19	08:05 16:26	07:14 17:23	06:12 17:16-17:39/23 18:14	06:00 20:09	05:04 20:59	04:41 21:17	05:04 20:23	05:52 18:06	06:44 18:07	06:44 18:07-18:19/12 18:03	07:35 16:07	08:11 15:51
20	08:04 16:28	07:12 17:25	06:09 17:16-17:38/22 18:16	05:58 20:10	05:03 21:00	04:41 21:31	05:05 20:21	05:54 19:10	06:45 18:26	06:45 18:05-18:21/16 18:41/13	07:37 16:06	08:12 15:52
21	08:03 16:29	07:10 17:27	06:07 17:17-17:38/21 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 20:19	05:55 18:08	06:47 18:02	06:47 18:02-18:21/19 18:08	07:39 16:05	08:12 15:52
22	08:01 16:31	07:08 17:29	06:05 17:17-17:36/19 18:20	05:54 20:14	05:00 21:03	04:42 21:31	05:08 20:17	05:57 19:05	06:49 18:01	06:49 18:01-18:22/21 18:01	07:41 16:04	08:13 15:53
23	08:00 16:33	07:06 17:31	06:02 17:18-17:35/17 18:21	05:52 20:16	04:59 21:05	04:42 21:31	05:09 20:15	05:59 19:03	06:50 18:01	06:50 18:01-18:23/22 18:01	07:42 16:03	08:13 15:53
24	07:59 16:35	07:04 17:33	06:00 17:20-17:33/13 18:23	05:50 20:17	04:57 21:06	04:42 21:31	05:11 20:12	06:00 19:00	06:52 17:59	06:52 17:59-18:22/23 18:00	07:44 16:01	08:14 15:54
25	07:58 16:36	07:02 17:35	05:58 17:22-17:28/6 18:25	05:47 20:19	04:56 21:07	04:42 21:31	05:12 20:10	06:02 18:58	06:54 17:59	06:54 17:59-18:22/23 18:00	07:46 16:00	08:14 15:54
26	07:56 16:38	07:00 17:36	05:55 17:36-17:58/22 18:27	05:45 20:21	04:55 21:09	04:43 21:31	05:14 20:08	06:04 18:56	06:55 17:59	06:55 17:59-18:22/23 18:00	07:48 16:00	08:14 15:55
27	07:55 16:40	06:57 17:38	05:53 17:35-17:59/24 18:30	05:43 20:22	04:54 21:10	04:43 21:31	05:15 20:06	06:05 18:53	06:57 17:59	06:57 17:59-18:22/23 18:00	07:50 16:00	08:15 15:55
28	07:53 16:42	06:55 17:40	05:51 17:34-17:59/25 18:30	05:41 20:24	04:53 21:11	04:44 21:31	05:17 20:04	06:07 18:51	06:59 17:58	06:59 17:58-18:20/22 18:00	07:52 16:00	08:15 15:57
29	07:52 16:44	06:48 17:41	05:48 18:34-18:59/25 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 20:01	06:09 18:49	07:01 17:58	07:01 17:58-18:20/22 18:00	07:53 16:00	08:15 15:57
30	07:51 16:46	06:46 17:42	05:46 18:34-18:59/25 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 19:59	06:10 18:46	07:02 17:59	07:02 17:59-18:19/20 18:46	07:54 16:00	08:15 15:58
31	07:49 16:47	06:44 17:43	05:44 18:33-18:58/25 19:35	05:35 20:28	04:50 21:15	04:45 21:31	05:21 19:57	06:12 18:39	07:02 17:59	07:02 17:59-18:19/20 18:46	07:57 16:00	08:15 15:59
	Sonnenscheinstunden	256	276	367	417	487	502	505	455	381	331	264
	Anzahl Minuten mit Schatten	0	0	484	139	0	0	0	590	47	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA : WEA 13 - WEA 13, V162 5.6 (Greenwind)

#### Annahmen für Schattenwurfberechnung

- 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	08:15	07:4708:34-08:56/22	06:53	06:41	05:35	04:49	04:45 20:30-20:57/27	05:23	06:14	07:04	06:59	07:51	
2	08:15	07:4608:35-08:56/21	06:51	06:39	05:33	04:48	04:46 20:30-20:56/28	05:24	06:15	07:06	07:01	07:52	
3	08:15	07:4408:36-08:56/20	06:48	06:36	05:31	04:47	04:47 20:31-20:56/29	05:25	06:17	07:07	07:03	07:54	
4	08:15	07:4308:37-08:55/18	06:46	06:34	05:29	04:46	04:48 20:32-20:56/24	05:27	06:19	07:09	07:0408:11-08:20/9	07:55	
5	08:14	07:3908:40-08:52/12	06:42	06:29	05:25	04:45	04:45 20:29-20:48/18	04:49 20:34-20:54/20	05:31	06:22	07:12	07:0808:08-08:24/16	07:58
6	08:13	07:3708:42-08:50/8	06:39	06:27	05:24	04:44	04:44 20:28-20:49/21	04:50 20:47-20:54/7	05:32	06:24	07:14	07:1008:07-08:25/18	07:59
7	08:13	07:36	06:37	06:25	05:22	04:44	04:44 20:27-20:50/23	04:51 20:49-20:53/4	05:34	06:25	07:16	07:1208:06-08:26/20	08:00
8	08:13	07:35	06:36	06:24	05:21	04:43	04:43 20:26-20:50/24	04:52	05:36	06:27	07:18	07:1408:05-08:27/22	08:02
9	08:13	07:34	06:35	06:23	05:20	04:43	04:43 20:26-20:50/24	04:52	05:36	06:27	07:18	07:1408:05-08:27/22	08:02
10	08:12	07:32	06:33	06:20	05:18	04:43	04:43 20:26-20:51/25	04:53	05:37	06:29	07:19	07:1508:05-08:27/22	08:03
11	08:12	07:30	06:30	06:18	05:17	04:42	04:42 20:26-20:52/28	04:54	05:39	06:30	07:21	07:1708:05-08:28/23	08:04
12	08:11	07:28	06:28	06:16	05:15	04:42	04:42 20:25-20:52/27	04:55	05:40	06:32	07:23	07:1908:05-08:28/23	08:05
13	08:10	07:26	06:26	06:13	05:13	04:42	04:42 20:25-20:53/28	04:56	05:42	06:34	07:25	07:2108:05-08:28/23	08:06
14	08:09	07:24	06:23	06:11	05:12	04:41	04:41 20:25-20:54/29	04:57	05:44	06:35	07:26	07:2208:05-08:28/23	08:07
15	08:09	07:22	06:21	06:09	05:10	04:41	04:41 20:25-20:54/29	04:59	05:45	06:37	07:28	07:2408:06-08:28/22	08:08
16	08:08	07:20	06:19	06:07	05:08	04:41	04:41 20:25-20:55/30	05:00	05:47	06:39	07:30	07:2608:06-08:28/22	08:09
17	08:07	07:18	06:16	06:04	05:07	04:41	04:41 20:25-20:55/30	05:01	05:49	06:40	07:32	07:2808:07-08:29/21	08:10
18	08:06 08:41-08:44/3	07:16	06:14	06:02	05:05	04:41	04:41 20:25-20:56/31	05:02	05:50	06:42	07:33	07:3008:08-08:28/20	08:11
19	08:05 08:38-08:47/9	07:14	06:12	06:00	05:04	04:41	04:41 20:25-20:56/31	05:04	05:52	06:44	07:35	07:3108:09-08:27/18	08:10
20	08:04 08:36-08:49/13	07:12	06:09	05:58	05:02	04:41	04:41 20:25-20:56/31	05:05	05:54	06:45	07:37	07:3308:10-08:27/17	08:12
21	08:03 08:35-08:50/15	07:10	06:07	05:56	05:01	04:41	04:41 20:25-20:56/31	05:06	05:55	06:47	07:39	07:3508:11-08:26/15	08:12
22	08:01 08:35-08:52/17	07:08	06:05	05:54	05:00	04:41	04:41 20:26-20:57/31	05:08	05:57	06:49	07:41	07:3708:12-08:25/13	08:13
23	08:00 08:34-08:52/18	07:06	06:02	05:51	04:58	04:42	04:42 20:26-20:57/31	05:09	05:59	06:50	07:42	07:3808:14-08:23/9	08:13
24	07:59 08:34-08:54/20	07:04	06:00	05:49	04:57	04:42	04:42 20:26-20:57/31	05:11	06:00	06:52	07:44	07:4008:17-08:21/4	08:14
25	07:58 08:33-08:54/21	07:02	05:58	05:47	04:56	04:42	04:42 20:26-20:56/30	05:12	06:02	06:54	06:46	07:42	08:14
26	07:56 08:33-08:55/22	07:00	05:55	05:45	04:55	04:43	04:43 20:27-20:57/30	05:14	06:04	06:55	06:48	07:43	08:14
27	07:55 08:33-08:55/22	06:57	05:53	05:43	04:54	04:43	04:43 20:27-20:57/30	05:15	06:05	06:57	06:50	07:45	08:15
28	07:53 08:34-08:56/22	06:55	05:50	05:41	04:53	04:44	04:44 20:28-20:57/29	05:17	06:07	06:59	06:52	07:46	08:15
29	07:52 08:33-08:56/23	06:53	05:48	05:39	04:51	04:44	04:44 20:28-20:56/28	05:18	06:09	07:00	06:53	07:48	08:15
30	07:51 08:34-08:57/23	06:51	05:46	05:37	04:50	04:45	04:45 20:29-20:57/28	05:20	06:10	07:02	06:55	07:49	08:15
31	07:49 08:34-08:57/23	06:49	05:44	05:35	04:49	04:50		05:21	06:12	07:04	06:57	07:49	08:15
	16:47		19:35		21:15			20:59	19:57	16:38		15:59	
Sonnenscheinstunden	256	276	367	417	488	502	505	455	381	331	264	241	
Anzahl Minuten mit Schatten	251	117	0	0	0	715	167	0	0	373	0	0	

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA 39 - WEA 39, V162-5.6

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:01	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:52	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:47	05:27	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:27	04:45	04:48	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:49	19:44	20:36	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:02	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:51
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
	16:10	17:04	17:57	19:51	20:43	21:25	21:27	20:44	19:36	18:25	16:22	15:51
10	08:13	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:20	07:16	08:03
	16:12	17:06	17:58	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:30	06:31	06:18	05:17	04:42	04:54	05:39	06:31	07:21	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:31	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:17	15:50
13	08:11	07:27	06:26	06:14	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:58	20:50	21:28	21:23	20:36	19:27	18:16	16:16	15:50
14	08:10	07:25	06:24	06:11	05:12	04:41	04:57	05:44	06:36	07:27	07:23	08:07
	16:18	17:14	18:06	20:00	20:51	21:28	21:23	20:34	19:24	18:14	16:14	15:50
15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:25	08:08
	16:19	17:16	18:07	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:50
16	08:08	07:21	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:20	20:30	19:20	18:10	16:11	15:50
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:22	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:07	16:10	15:51
18	08:06	07:17	06:14	06:02	05:05	04:41	05:02	05:50	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:12	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:27	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:51
21	08:03	07:11	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:05	17:57	16:04	15:52
23	08:01	07:06	06:02	05:52	04:58	04:42	05:09	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:45	07:40	08:14
	16:34	17:33	18:23	20:18	21:06	21:32	21:11	20:13	19:01	17:52	16:01	15:53
25	07:58	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:36	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:50	16:00	15:54
26	07:57	07:00	05:55	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:48	15:59	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	08:15
	16:40	17:38	18:29	20:23	21:11	21:32	21:06	20:06	18:53	16:46	15:58	15:56
28	07:54	06:55	05:51	05:41	04:53	04:43	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:30	20:24	21:12	21:32	21:05	20:04	18:51	16:44	15:57	15:56
29	07:52		06:48	05:39	04:51	04:44	05:18	06:09	07:01	07:54	07:48	08:16
	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:42	15:57	15:57
30	07:51		06:46	05:37	04:50	04:45	05:20	06:10	07:02	07:56	07:50	08:16
	16:45		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:38		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB01 - WEA VB01, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:38	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:25	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:55
3	08:15	07:45	06:49	06:37	05:32	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:40	16:33	15:54
4	08:15	07:43	06:47	06:34	05:30	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:28	04:46	04:49	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:50	19:45	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:50	05:31	06:22	07:13	07:09	07:58
	16:07	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:33	16:28	15:52
7	08:14	07:38	06:40	06:28	05:24	04:44	04:50	05:33	06:24	07:15	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:38	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:52
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
	16:11	17:05	17:57	19:52	20:43	21:25	21:27	20:44	19:36	18:26	16:22	15:51
10	08:13	07:32	06:33	06:21	05:19	04:43	04:53	05:38	06:29	07:20	07:16	08:03
	16:12	17:07	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:31	06:31	06:18	05:17	04:43	04:54	05:39	06:31	07:22	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:56	05:41	06:32	07:23	07:20	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:18	15:51
13	08:11	07:27	06:26	06:14	05:14	04:42	04:57	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:59	20:50	21:28	21:24	20:36	19:27	18:17	16:16	15:51
14	08:10	07:25	06:24	06:12	05:12	04:42	04:58	05:44	06:36	07:27	07:23	08:07
	16:18	17:14	18:06	20:00	20:51	21:28	21:23	20:34	19:25	18:14	16:15	15:51
15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:46	06:37	07:29	07:25	08:08
	16:20	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:51
16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:21	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
18	08:06	07:17	06:14	06:03	05:06	04:41	05:03	05:51	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:06	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:08	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:26	18:17	20:11	21:01	21:31	21:16	20:22	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:09	06:05	05:54	05:00	04:42	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:06	17:57	16:04	15:53
23	08:01	07:06	06:03	05:52	04:59	04:42	05:10	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:58	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:24	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:43	05:12	06:02	06:54	07:47	07:42	08:15
	16:37	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:01	15:54
26	07:57	07:00	05:56	05:46	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:49	16:00	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:31	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
29	07:53		06:49	05:39	04:52	04:44	05:18	06:09	07:01	07:54	07:48	08:16
	16:44		19:32	20:26	21:13	21:32	21:03	20:02	18:49	16:43	15:57	15:58
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:02	19:59	18:47	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:58		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB01, - WEA VB01, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	08:14-09:15/61 17:42	06:53 19:37	06:41 20:29	05:35 06:00-06:20/20 21:16	
2	08:15 08:52-08:57/5 16:01	07:46 16:51	08:12-09:14/62 17:44	06:51 19:39	06:39 20:31	05:33 05:59-06:20/21 21:17	
3	08:15 08:51-08:59/8 16:03	07:44 16:53	08:10-09:12/62 17:45	06:48 19:40	06:36 20:33	05:31 05:58-06:21/23 21:18	
4	08:14 08:50-09:01/11 16:04	07:42 16:55	08:09-09:10/61 17:47	06:46 19:42	06:34 20:34	05:29 05:58-06:21/23 21:19	
5	08:14 08:49-09:03/14 16:05	07:41 16:57	08:07-09:06/59 17:49	06:44 19:44	06:32 20:36	05:27 05:58-06:22/24 21:20	
6	08:14 08:45-09:03/18 16:06	07:39 16:58	08:05-09:03/58 17:51	06:42 19:46	06:29 20:38	05:25 05:57-06:22/25 21:21	
7	08:13 08:45-09:05/20 16:07	07:37 17:00	08:03-08:58/55 17:53	06:39 19:47	06:27 20:39	05:24 05:57-06:21/24 21:22	
8	08:13 08:44-09:06/22 16:09	07:35 17:02	08:01-08:55/54 17:55	06:37 19:49	06:25 20:41	05:22 05:56-06:21/25 21:23	
9	08:12 08:43-09:07/24 16:10	07:34 17:04	07:59-08:52/53 17:56	06:35 19:51	06:22 20:43	05:20 05:57-06:21/24 21:24	
10	08:12 08:43-09:09/26 16:12	07:32 17:06	07:57-08:52/55 17:58	06:32 19:53	06:20 20:44	05:18 05:57-06:21/24 21:25	
11	08:11 08:42-09:10/28 16:13	07:30 17:08	07:55-08:51/56 18:00	06:30 19:54	06:18 20:46	05:17 05:58-06:21/23 21:26	
12	08:11 08:41-09:10/29 16:14	07:28 17:10	07:54-08:50/56 18:02	06:28 19:56	06:16 20:48	05:15 05:58-06:20/22 21:26	
13	08:10 08:40-09:11/31 16:16	07:26 17:12	07:54-08:49/55 18:04	06:26 19:58	06:13 20:49	05:13 05:58-06:19/21 21:27	
14	08:09 08:39-09:12/33 16:18	07:24 17:14	07:53-08:47/54 18:05	06:23 20:00	06:11 20:51	05:12 05:59-06:19/20 21:28	
15	08:08 08:38-09:13/35 16:19	07:22 17:16	07:53-08:44/51 18:07	06:21 20:01	06:09 20:52	05:10 06:00-06:18/18 21:28	
16	08:07 08:37-09:14/37 16:21	07:20 17:17	07:53-08:38/45 18:09	06:19 20:03	06:07 20:54	05:08 06:01-06:17/16 21:29	
17	08:07 08:36-09:14/38 16:22	07:18 17:19	07:53-08:36/43 18:11	06:16 20:05	06:04 20:55	05:07 06:02-06:16/14 21:29	
18	08:06 08:35-09:15/40 16:24	07:16 17:21	07:54-08:33/39 18:12	06:14 20:07	06:02 20:57	05:05 06:03-06:13/10 21:30	
19	08:05 08:33-09:15/42 16:26	07:14 17:23	07:54-08:30/36 18:14	06:11 20:08	06:00 20:58	05:04 06:07-06:11/4 21:30	
20	08:03 08:32-09:16/44 16:27	07:12 17:25	07:55-08:25/30 18:16	06:09 20:10	05:58 21:00	05:02 21:30	
21	08:02 08:31-09:17/46 16:29	07:10 17:27	07:55-08:21/26 18:18	06:07 20:12	05:56 21:01	05:01 21:31	
22	08:01 08:30-09:17/47 16:31	07:08 17:29	07:56-08:16/20 18:19	06:04 20:14	05:54 21:03	05:00 21:31	
23	08:00 08:28-09:17/49 16:33	07:06 17:31	07:59-08:13/14 18:21	06:02 20:15	05:51 21:04	04:58 21:31	
24	07:59 08:27-09:18/51 16:34	07:04 17:33	08:04-08:05/1 18:23	06:00 20:17	05:49 21:06	04:57 21:31	
25	07:57 08:25-09:17/52 16:36	07:02 17:34	05:57 18:25	05:47 20:19	05:47 21:07	04:56 21:31	
26	07:56 08:24-09:18/54 16:38	06:59 17:36	05:55 18:26	05:45 20:20	05:45 21:08	04:55 21:31	
27	07:55 08:23-09:17/54 16:40	06:57 17:38	05:53 18:28	05:43 20:22	05:43 21:10	04:54 21:31	
28	07:53 08:21-09:18/57 16:42	06:55 17:40	05:50 18:30	05:41 20:24	06:05-06:15/10 21:11	04:52 21:31	
29	07:52 08:19-09:17/58 16:43		06:48 19:32	05:39 20:26	06:03-06:17/14 21:12	04:51 21:31	
30	07:50 08:17-09:16/59 16:45		06:46 19:33	05:37 20:27	06:02-06:19/17 21:14	04:50 21:31	
31	07:49 08:16-09:16/60 16:47		06:43 19:35		04:49 21:15		
Sonnenscheinstunden		256	276	367	417	487	502
Anzahl Minuten mit Schatten		1093	1106	0	41	381	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB01, - WEA VB01, SG6.2-170

**Annahmen für Schattenwurfberechnung**

- 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	04:45	05:23 06:08-06:31/23	06:14	07:04	06:59 07:27-08:21/54	07:51 08:24-08:52/28
	21:30	20:58	19:54	18:44	16:36	15:55
2	04:46	05:24 06:07-06:31/24	06:15	07:05	07:01 07:29-08:22/53	07:52 08:25-08:51/26
	21:30	20:56	19:52	18:41	16:34	15:54
3	04:47	05:26 06:07-06:31/24	06:17	07:07	07:02 07:31-08:26/55	07:54 08:27-08:51/24
	21:30	20:54	19:50	18:39	16:33	15:54
4	04:47	05:27 06:07-06:31/24	06:19	07:09	07:04 07:33-08:28/55	07:55 08:28-08:50/22
	21:29	20:52	19:47	18:37	16:31	15:53
5	04:48	05:29 06:07-06:32/25	06:20	07:11	07:06 07:35-08:33/58	07:56 08:30-08:50/20
	21:29	20:51	19:45	18:34	16:29	15:52
6	04:49	05:31 06:06-06:31/25	06:22	07:12	07:08 07:37-08:36/59	07:58 08:31-08:50/19
	21:28	20:49	19:43	18:32	16:27	15:52
7	04:50	05:32 06:07-06:31/24	06:24	07:14	07:10 07:39-08:40/61	07:59 08:35-08:49/14
	21:27	20:47	19:40	18:30	16:25	15:52 08:33-08:34/1
8	04:51	05:34 06:06-06:30/24	06:25	07:16	07:12 07:41-08:43/62	08:00 08:38-08:49/11
	21:27	20:45	19:38	18:27	16:24	15:51
9	04:52	05:35 06:07-06:30/23	06:27	07:17	07:13 07:43-08:45/62	08:01 08:39-08:48/9
	21:26	20:43	19:36	18:25	16:22	15:51
10	04:53	05:37 06:08-06:30/22	06:29	07:19	07:15 07:45-08:46/61	08:03 08:41-08:46/5
	21:25	20:41	19:33	18:23	16:20	15:51
11	04:54	05:39 06:08-06:29/21	06:30	07:21	07:17 07:47-08:47/60	08:04
	21:25	20:39	19:31	18:21	16:19	15:50
12	04:55	05:40 06:09-06:28/19	06:32	07:23	07:19 07:49-08:48/59	08:05
	21:24	20:37	19:29	18:18	16:17	15:50
13	04:56	05:42 06:10-06:26/16	06:34	07:24	07:21 07:51-08:49/58	08:06
	21:23	20:35	19:26	18:16	16:16	15:50
14	04:57	05:44 06:12-06:25/13	06:35	07:26	07:22 07:53-08:50/57	08:07
	21:22	20:33	19:24	18:14	16:14	15:50
15	04:59	05:45 06:14-06:21/7	06:37	07:28	07:24 07:56-08:50/54	08:08
	21:21	20:31	19:22	18:12	16:13	15:50
16	05:00	05:47	06:39	07:30	07:26 07:57-08:51/54	08:08
	21:20	20:29	19:19	18:09	16:11	15:50
17	05:01	05:49	06:40	07:32	07:28 07:59-08:51/52	08:09
	21:19	20:27	19:17	18:07	16:10	15:51
18	05:02	05:50	06:42	07:33 08:32-08:40/8	07:30 08:01-08:52/51	08:10
	21:18	20:25	19:14	18:05	16:08	15:51
19	05:04	05:52	06:44	07:35 08:29-08:46/17	07:31 08:03-08:52/49	08:11
	21:16	20:23	19:12	18:03	16:07	15:51
20	05:05	05:54	06:45	07:37 08:27-08:49/22	07:33 08:04-08:51/47	08:11
	21:15	20:21	19:10	18:01	16:06	15:51
21	05:06	05:55	06:47	07:39 08:26-08:54/28	07:35 08:06-08:52/46	08:12
	21:14	20:19	19:07	17:59	16:05	15:52
22	05:08	05:57	06:49	07:40 08:25-08:57/32	07:36 08:08-08:52/44	08:13
	21:13	20:17	19:05	17:56	16:03	15:52
23	05:09	05:59	06:50	07:42 08:23-09:00/37	07:38 08:10-08:52/42	08:13
	21:11	20:14	19:03	17:54	16:02	15:53
24	05:11	06:00	06:52	07:44 08:23-09:04/41	07:40 08:12-08:52/40	08:14
	21:10	20:12	19:00	17:52	16:01	15:53
25	05:12 06:16-06:23/7	06:02	06:54	06:46 07:23-08:06/43	07:41 08:14-08:53/39	08:14
	21:08	20:10	18:58	16:50	16:00	15:54
26	05:13 06:13-06:25/12	06:04	06:55	06:48 07:23-08:10/47	07:43 08:15-08:52/37	08:14
	21:07	20:08	18:55	16:48	15:59	15:55
27	05:15 06:12-06:27/15	06:05	06:57	06:50 07:23-08:15/52	07:45 08:17-08:52/35	08:14
	21:06	20:06	18:53	16:46	15:58	15:55
28	05:16 06:11-06:28/17	06:07	06:59	06:51 07:23-08:17/54	07:46 08:19-08:52/33	08:15
	21:04	20:03	18:51	16:44	15:57	15:56
29	05:18 06:10-06:29/19	06:09	07:00	06:53 07:23-08:18/55	07:48 08:20-08:51/31	08:15
	21:02	20:01	18:48	16:42	15:56	15:57
30	05:20 06:09-06:29/20	06:10	07:02	06:55 07:24-08:20/56	07:49 08:22-08:52/30	08:15
	21:01	19:59	18:46	16:40	15:56	15:58
31	05:21 06:09-06:31/22	06:12		06:57 07:25-08:21/56		08:15
	20:59	19:57		16:38		15:59
Sonnenscheinstunden	505	455	381	331	264	241
Anzahl Minuten mit Schatten	112	314	0	548	1498	179

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB02 - WEA VB02, Vestas V66

**Annahmen für Schattenwurfberechnung**

- 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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:38	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:25	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:55
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:40	16:33	15:54
4	08:15	07:43	06:47	06:34	05:30	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:28	04:46	04:49	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:50	19:45	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:09	07:58
	16:07	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:33	16:28	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:33	06:24	07:15	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:38	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:52
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
	16:11	17:05	17:57	19:52	20:43	21:25	21:27	20:44	19:36	18:26	16:22	15:51
10	08:13	07:32	06:33	06:21	05:19	04:43	04:53	05:37	06:29	07:20	07:16	08:03
	16:12	17:07	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:31	06:31	06:18	05:17	04:43	04:54	05:39	06:31	07:22	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:56	05:41	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:18	15:51
13	08:11	07:27	06:26	06:14	05:14	04:42	04:57	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:58	20:50	21:28	21:24	20:36	19:27	18:17	16:16	15:51
14	08:10	07:25	06:24	06:12	05:12	04:42	04:58	05:44	06:36	07:27	07:23	08:07
	16:18	17:14	18:06	20:00	20:51	21:28	21:23	20:34	19:25	18:14	16:15	15:51
15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:46	06:37	07:29	07:25	08:08
	16:19	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:51
16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:21	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
18	08:06	07:17	06:14	06:03	05:06	04:41	05:03	05:51	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:08	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:22	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:09	06:05	05:54	05:00	04:42	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:05	17:57	16:04	15:53
23	08:01	07:06	06:03	05:52	04:59	04:42	05:10	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:24	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:37	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:01	15:54
26	07:57	07:00	05:56	05:46	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:49	16:00	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:31	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:01	07:54	07:48	08:16
	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:58
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:02	19:59	18:47	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB02 - WEA VB02, SG6.2-170

**Annahmen für Schattenwurfberechnung**

- 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	08:15 08:53-10:26/93	07:47 06:53	06:41	05:35	06:12-06:38/26	04:49 06:12-06:37/25	
	16:00	16:49 17:42	19:37	20:29		21:16	
2	08:15 08:53-10:26/93	07:46 06:51	06:39	05:33	06:10-06:39/29	04:48 06:13-06:36/23	
	16:01	16:51 17:44	19:39	20:31		21:17	
3	08:15 08:54-10:26/92	07:44 06:48	06:36 06:59-07:05/6	05:31	06:09-06:40/31	04:47 06:13-06:35/22	
	16:03	16:53 17:45	19:40	20:33		21:18	
4	08:14 08:53-10:25/92	07:42 06:46	06:34 06:57-07:08/11	05:29	06:07-06:40/33	04:46 06:15-06:35/20	
	16:04	16:55 17:47	19:42	20:34		21:19	
5	08:14 08:54-10:26/92	07:41 06:44	06:32 06:55-07:09/14	05:27	06:07-06:42/35	04:45 06:16-06:34/18	
	16:05	16:57 17:49	19:44	20:36		21:20	
6	08:14 08:54-10:25/91	07:39 06:42	06:29 06:52-07:09/17	05:25	06:06-06:42/36	04:45 06:17-06:34/17	
	16:06	16:59 17:51	19:46	20:38		21:21	
7	08:13 08:55-10:25/90	07:37 06:39	06:27 06:50-07:10/20	05:24	06:06-06:42/36	04:44 06:18-06:33/15	
	16:07	17:00 17:53	19:47	20:39		21:22	
8	08:13 08:54-10:24/90	07:35 06:37	06:25 06:48-07:11/23	05:22	06:05-06:42/37	04:44 06:20-06:32/12	
	16:09	17:02 17:55	19:49	20:41		21:23	
9	08:13 08:54-10:23/89	07:34 06:35	06:22 06:48-07:11/23	05:20	06:05-06:43/38	04:43 06:20-06:30/10	
	16:10	17:04 17:56	19:51	20:43		21:24	
10	08:12 08:55-10:12/77	07:32 06:32	06:20 06:46-07:10/24	05:18	06:04-06:43/39	04:43 06:23-06:29/6	
	16:12 10:13-10:22/9	17:06 17:58	19:53	20:44		21:25	
11	08:11 08:55-10:12/77	07:30 06:30	06:18 06:44-07:09/25	05:17	06:05-06:43/38	04:42	
	16:13	17:08 18:00	19:54	20:46		21:26	
12	08:11 08:56-10:11/75	07:28 06:28	06:16 06:43-07:09/26	05:15	06:04-06:43/39	04:42	
	16:15	17:10 18:02	19:56	20:48		21:26	
13	08:10 08:56-10:10/74	07:26 06:26	06:13 06:43-07:08/25	05:13	06:03-06:43/40	04:42	
	16:16	17:12 18:04	19:58	20:49		21:27	
14	08:09 08:56-10:09/73	07:24 06:23	06:11 06:41-07:07/26	05:12	06:04-06:43/39	04:41	
	16:18	17:14 18:05	20:00	20:51		21:28	
15	08:08 08:57-10:08/71	07:22 06:21	06:09 06:41-07:07/26	05:10	06:04-06:43/39	04:41	
	16:19	17:16 18:07	20:01	20:52		21:28	
16	08:07 08:57-10:06/69	07:20 06:19	06:07 06:41-07:07/26	05:08	06:04-06:43/39	04:41	
	16:21	17:18 18:09	20:03	20:54		21:29	
17	08:07 08:58-10:03/65	07:18 06:16	06:04 06:41-07:07/26	05:07	06:04-06:43/39	04:41	
	16:22	17:19 18:11	20:05	20:55		21:29	
18	08:06 08:58-10:01/63	07:16 06:14	06:02 06:41-07:07/26	05:05	06:04-06:42/38	04:41	
	16:24	17:21 18:12	20:07	20:57		21:30	
19	08:05 08:58-09:56/58	07:14 06:12	06:00 06:41-07:06/25	05:04	06:05-06:42/37	04:41	
	16:26	17:23 18:14	20:08	20:59		21:30	
20	08:03 08:59-09:54/55	07:12 06:09	06:42-07:06/24	05:02	06:05-06:42/37	04:41	
	16:27	17:25 18:16	20:10	21:00		21:30	
21	08:02 09:00-09:51/51	07:10 06:07	05:56 06:41-07:04/23	05:01	06:06-06:42/36	04:41	
	16:29	17:27 18:18	20:12	21:01		21:31	
22	08:01 09:01-09:49/48	07:08 06:04	05:54 06:42-07:02/20	05:00	06:05-06:41/36	04:41	
	16:31	17:29 18:20	20:14	21:03		21:31	
23	08:00 09:02-09:45/43	07:06 06:02	05:51 06:43-07:01/18	04:58	06:06-06:41/35	04:42	
	16:33	17:31 18:21	20:15	21:04		21:31	
24	07:59 09:03-09:42/39	07:04 06:00	05:49 06:45-06:59/14	04:57	06:07-06:41/34	04:42	
	16:34	17:33 18:23	20:17	21:06		21:31	
25	07:57 09:04-09:38/34	07:02 05:57	05:47 06:47-06:56/9	04:56	06:07-06:40/33	04:42	
	16:36	17:34 18:25	20:19	21:07		21:31	
26	07:56 09:06-09:36/30	06:59 05:55	05:45	04:55	06:08-06:40/32	04:43	
	16:38	17:36 18:27	20:21	21:09		21:31	
27	07:55 09:08-09:31/23	06:57 05:53	05:43	04:54	06:08-06:39/31	04:43	
	16:40	17:38 18:28	20:22	21:10		21:31	
28	07:53 09:11-09:27/16	06:55 05:50	05:41 06:18-06:32/14	04:53	06:09-06:39/30	04:44	
	16:42	17:40 18:30	20:24	21:11		21:31	
29	07:52 09:14-09:23/9		06:48 05:39	06:15-06:34/19	04:51	06:10-06:38/28	04:44
	16:43		19:32 20:26	21:12		21:31	
30	07:50		06:46 05:37	06:13-06:37/24	04:50	06:10-06:38/28	04:45
	16:45		19:34 20:27	21:14		21:31	
31	07:49		06:43		04:50	06:12-06:38/26	
	16:47		19:35		21:15		
Sonnenscheinstunden	256	276	367	417	487	502	168
Anzahl Minuten mit Schatten	1881	0	0	534	1074		

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB02 - WEA VB02, SG6.2-170

**Annahmen für Schattenwurfberechnung**

- 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	04:45 21:30	05:23 06:14-06:53/39 20:58	06:14 06:43-07:08/25 19:54	07:04 18:44	06:59 16:36	07:51 08:38-09:54/76 15:55
2	04:46 06:28-06:33/5 21:30	05:24 06:14-06:53/39 20:56	06:15 06:45-07:09/24 19:52	07:05 18:41	07:01 16:35	07:52 08:37-09:54/77 15:54 09:55-10:03/8
3	04:47 06:26-06:35/9 21:30	05:26 06:15-06:53/38 20:54	06:17 06:45-07:08/23 19:50	07:07 18:39	07:02 16:33	07:54 08:38-10:06/88 15:54
4	04:48 06:25-06:37/12 21:29	05:27 06:15-06:52/37 20:52	06:19 06:45-07:08/23 19:47	07:09 18:37	07:04 16:31	07:55 08:39-10:08/89 15:53
5	04:48 06:25-06:38/13 21:29	05:29 06:15-06:52/37 20:51	06:20 06:47-07:07/20 19:45	07:11 18:34	07:06 16:29	07:56 08:40-10:10/90 15:52
6	04:49 06:24-06:40/16 21:28	05:31 06:15-06:51/36 20:49	06:22 06:48-07:06/18 19:43	07:12 18:32	07:08 16:27	07:58 08:40-10:11/91 15:52
7	04:50 06:22-06:40/18 21:27	05:32 06:16-06:51/35 20:47	06:24 06:50-07:05/15 19:40	07:14 18:30	07:10 16:25	07:59 08:40-10:12/92 15:52
8	04:51 06:22-06:41/19 21:27	05:34 06:16-06:50/34 20:45	06:25 06:51-07:02/11 19:38	07:16 18:27	07:12 16:24	08:00 08:41-10:13/92 15:51
9	04:52 06:21-06:42/21 21:26	05:35 06:17-06:50/33 20:43	06:27 06:53-06:59/6 19:36	07:17 18:25	07:13 16:22	08:01 08:42-10:14/92 15:51
10	04:53 06:21-06:43/22 21:25	05:37 06:18-06:49/31 20:41	06:29 19:33	07:19 18:23	07:15 16:20	08:03 08:42-10:15/93 15:51
11	04:54 06:20-06:44/24 21:25	05:39 06:19-06:47/28 20:39	06:30 19:31	07:21 18:21	07:17 16:19	08:04 08:43-10:16/93 15:50
12	04:55 06:19-06:45/26 21:24	05:40 06:20-06:46/26 20:37	06:32 19:29	07:23 18:18	07:19 16:17	08:05 08:43-10:16/93 15:50
13	04:56 06:19-06:46/27 21:23	05:42 06:21-06:44/23 20:35	06:34 19:26	07:24 18:16	07:21 08:45-08:55/10 16:16	08:06 08:44-10:17/93 15:50
14	04:57 06:18-06:46/28 21:22	05:44 06:24-06:42/18 20:33	06:35 19:24	07:26 18:14	07:22 08:43-09:00/17 16:14	08:07 08:45-10:18/93 15:50
15	04:59 06:19-06:48/29 21:21	05:45 06:26-06:38/12 20:31	06:37 19:22	07:28 18:12	07:24 08:41-09:05/24 16:13	08:08 08:45-10:19/94 15:50
16	05:00 06:18-06:49/31 21:20	05:47 20:29	06:39 19:19	07:30 18:09	07:26 08:39-09:09/30 16:11	08:09 08:46-10:19/93 15:50
17	05:01 06:18-06:49/31 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:28 08:38-09:12/34 16:10	08:09 08:47-10:20/93 15:51
18	05:02 06:17-06:50/33 21:18	05:50 06:53-07:03/10 20:25	06:42 19:14	07:33 18:05	07:30 08:37-09:16/39 16:09	08:10 08:48-10:21/93 15:51
19	05:04 06:16-06:50/34 21:16	05:52 06:51-07:06/15 20:23	06:44 19:12	07:35 18:03	07:31 08:37-09:20/43 16:07	08:11 08:48-10:21/93 15:51
20	05:05 06:17-06:51/34 21:15	05:54 06:49-07:07/18 20:21	06:45 19:10	07:37 18:01	07:33 08:36-09:23/47 16:06	08:11 08:49-10:22/93 15:51
21	05:06 06:16-06:51/35 21:14	05:55 06:48-07:08/20 20:19	06:47 19:07	07:39 17:59	07:35 08:35-09:26/51 16:05	08:12 08:50-10:23/93 15:52
22	05:08 06:16-06:52/36 21:13	05:57 06:46-07:08/22 20:17	06:49 19:05	07:40 17:56	07:36 08:35-09:30/55 16:04	08:13 08:50-10:23/93 15:52
23	05:09 06:15-06:52/37 21:11	05:59 06:45-07:09/24 20:14	06:50 19:03	07:42 17:54	07:38 08:35-09:33/58 16:02	08:13 08:50-10:23/93 15:53
24	05:11 06:15-06:53/38 21:10	06:00 06:44-07:09/25 20:12	06:52 19:00	07:44 17:52	07:40 08:35-09:38/63 16:01	08:14 08:51-10:24/93 15:53
25	05:12 06:15-06:53/38 21:08	06:02 06:44-07:10/26 20:10	06:54 18:58	07:46 16:50	07:41 08:36-09:41/65 16:00	08:14 08:51-10:24/93 15:54
26	05:14 06:14-06:53/39 21:07	06:04 06:44-07:10/26 20:08	06:55 18:56	07:48 16:48	07:43 08:35-09:43/68 15:59	08:14 08:51-10:24/93 15:55
27	05:15 06:15-06:53/38 21:06	06:05 06:43-07:09/26 20:06	06:57 18:53	07:50 16:46	07:45 08:36-09:47/71 15:58	08:15 08:51-10:24/93 15:56
28	05:17 06:14-06:53/39 21:04	06:07 06:43-07:09/26 20:03	06:59 18:51	07:52 16:44	07:46 08:36-09:49/73 15:57	08:15 08:52-10:25/93 15:56
29	05:18 06:15-06:54/39 21:02	06:09 06:42-07:08/26 20:01	07:00 18:48	07:54 16:42	07:48 08:37-09:50/73 15:57	08:15 08:53-10:26/93 15:57
30	05:20 06:14-06:54/40 21:01	06:10 06:43-07:08/25 19:59	07:02 18:46	07:56 16:40	07:49 08:37-09:52/75 15:56	08:15 08:53-10:25/92 15:58
31	05:21 06:15-06:54/39 20:59	06:12 06:43-07:09/26 19:57		07:58 16:38		08:15 08:52-10:25/93 15:59
	Sonnenscheinstunden  505	455	381	331	264	241
	Anzahl Minuten mit Schatten  850	781	655	0	896	2841

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB03 - WEA VB03, SG6.2-170

**Annahmen für Schattenwurfberechnung**

- 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	08:15 08:47-09:27/40	07:47 08:31-08:51/20	06:53	06:41 07:04-07:19/15	05:35	04:49
	16:00	16:49	17:42	19:37	20:29	21:16
2	08:15 08:47-09:28/41	07:46 08:32-08:47/15	06:51	06:39 07:02-07:20/18	05:33	04:48
	16:01	16:51	17:44	19:39	20:31	21:17
3	08:15 08:47-09:29/42	07:44 08:34-08:44/10	06:48	06:36 06:59-07:20/21	05:31	04:47
	16:03	16:53	17:45	19:40	20:32	21:18
4	08:14 08:46-09:28/42	07:42 08:37-08:42/5	06:46	06:34 06:59-07:21/22	05:29	04:46
	16:04	16:55	17:47	19:42	20:34	21:19
5	08:14 08:46-09:29/43	07:41	06:44	06:32 06:58-07:21/23	05:27	04:45
	16:05	16:57	17:49	19:44	20:36	21:20
6	08:14 08:45-09:28/43	07:39	06:42	06:29 06:57-07:20/23	05:25	04:45
	16:06	16:58	17:51	19:46	20:38	21:21
7	08:13 08:45-09:29/44	07:37	06:39	06:27 06:57-07:20/23	05:24	04:44
	16:07	17:00	17:53	19:47	20:39	21:22
8	08:13 08:44-09:29/45	07:35	06:37	06:25 06:57-07:20/23	05:22	04:44
	16:09	17:02	17:55	19:49	20:41	21:23
9	08:12 08:43-09:28/45	07:34	06:35	06:22 06:57-07:18/21	05:20	04:43
	16:10	17:04	17:56	19:51	20:43	21:24
10	08:12 08:43-09:29/46	07:32	06:32	06:20 06:57-07:17/20	05:18	04:43
	16:12	17:06	17:58	19:53	20:44	21:25
11	08:11 08:42-09:28/46	07:30	06:30	06:18 06:58-07:16/18	05:17	04:42
	16:13	17:08	18:00	19:54	20:46	21:26
12	08:11 08:41-09:27/46	07:28	06:28	06:16 07:00-07:15/15	05:15	04:42
	16:14	17:10	18:02	19:56	20:47	21:26
13	08:10 08:40-09:26/46	07:26	06:25	06:13 07:02-07:13/11	05:13	04:42
	16:16	17:12	18:04	19:58	20:49	21:27
14	08:09 08:39-09:23/44	07:24	06:23	06:11	05:12	04:41
	16:18	17:14	18:05	20:00	20:51	21:28
15	08:08 08:38-09:22/44	07:22	06:21	06:09	05:10	04:41
	16:19	17:16	18:07	20:01	20:52	21:28
16	08:07 08:37-09:20/43	07:20	06:19	06:07	05:08	04:41
	16:21	17:17	18:09	20:03	20:54	21:29
17	08:06 08:36-09:17/41	07:18	06:16	06:04	05:07	04:41
	16:22	17:19	18:11	20:05	20:55	21:29
18	08:05 08:35-09:16/41	07:16	06:14	06:02	05:05	04:41
	16:24	17:21	18:12	20:07	20:57	21:30
19	08:04 08:33-09:13/40	07:14	06:11	06:00	05:04	04:41
	16:26	17:23	18:14	20:08	20:58	21:30
20	08:03 08:32-09:13/41	07:12	06:09	05:58	05:02	04:41
	16:27	17:25	18:16	20:10	21:00	21:30
21	08:02 08:31-09:13/42	07:10	06:07	05:56	05:01	04:41
	16:29	17:27	18:18	20:12	21:01	21:31
22	08:01 08:30-09:13/43	07:08	06:04	05:54	05:00	04:41
	16:31	17:29	18:19	20:14	21:03	21:31
23	08:00 08:28-09:11/43	07:06	06:02	05:51	04:58	04:42
	16:33	17:31	18:21	20:15	21:04	21:31
24	07:59 08:28-09:11/43	07:04	06:00	05:49	04:57	04:42
	16:34	17:33	18:23	20:17	21:06	21:31
25	07:57 08:27-09:08/41	07:01	05:57	05:47	04:56	04:42
	16:36	17:34	18:25	20:19	21:07	21:31
26	07:56 08:28-09:04/36	06:59	05:55	05:45	04:55	04:43
	16:38	17:36	18:26	20:20	21:08	21:31
27	07:55 08:28-09:02/34	06:57	05:53	05:43	04:54	04:43
	16:40	17:38	18:28	20:22	21:10	21:31
28	07:53 08:29-09:01/32	06:55	05:50	05:41	04:52	04:44
	16:42	17:40	18:30	20:24	21:11	21:31
29	07:52 08:29-08:58/29		06:48	05:39	04:51	04:44
	16:43		19:32	20:26	21:12	21:31
30	07:50 08:29-08:55/26		06:46 07:10-07:14/4	05:37	04:50	04:45
	16:45		19:33	20:27	21:14	21:30
31	07:49 08:30-08:53/23		06:43 07:06-07:17/11		04:49	
	16:47		19:35		21:15	
Sonnenscheinstunden	256	276	367	417	487	502
Anzahl Minuten mit Schatten	1255	50	15	253	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB03 - WEA VB03, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	04:45 21:30	05:23 20:58	06:14 06:57-07:15/18 19:54	07:04 18:44	06:59 16:36	07:51 08:24-09:10/46 15:55	
2	04:46 21:30	05:24 20:56	06:15 06:56-07:16/20 19:52	07:05 18:41	07:01 16:34	07:52 08:25-09:11/46 15:54	
3	04:47 21:29	05:26 20:54	06:17 06:55-07:16/21 19:50	07:07 18:39	07:02 16:33	07:54 08:27-09:12/45 15:54	
4	04:47 21:29	05:27 20:52	06:19 06:54-07:17/23 19:47	07:09 18:37	07:04 16:31	07:55 08:28-09:13/45 15:53	
5	04:48 21:29	05:29 20:51	06:20 06:54-07:17/23 19:45	07:11 18:34	07:06 16:29	07:56 08:30-09:14/44 15:52	
6	04:49 21:28	05:31 20:49	06:22 06:53-07:16/23 19:43	07:12 18:32	07:08 16:27	07:58 08:31-09:14/43 15:52	
7	04:50 21:27	05:32 20:47	06:24 06:54-07:16/22 19:40	07:14 18:30	07:10 08:07-08:13/6 16:25	07:59 08:32-09:15/43 15:52	
8	04:51 21:27	05:34 20:45	06:25 06:53-07:15/22 19:38	07:16 18:27	07:12 08:04-08:15/11 16:24	08:00 08:34-09:16/42 15:51	
9	04:52 21:26	05:35 20:43	06:27 06:54-07:14/20 19:36	07:17 18:25	07:13 08:03-08:19/16 16:22	08:01 08:35-09:17/42 15:51	
10	04:53 21:25	05:37 20:41	06:29 06:55-07:13/18 19:33	07:19 18:23	07:15 08:02-08:22/20 16:20	08:03 08:36-09:17/41 15:51	
11	04:54 21:25	05:39 20:39	06:30 06:56-07:11/15 19:31	07:21 18:21	07:17 08:01-08:24/23 16:19	08:04 08:37-09:17/40 15:50	
12	04:55 21:24	05:40 20:37	06:32 06:58-07:09/11 19:29	07:23 18:18	07:19 08:01-08:27/26 16:17	08:05 08:38-09:18/40 15:50	
13	04:56 21:23	05:42 20:35	06:34 06:59-07:05/6 19:26	07:24 18:16	07:21 08:01-08:30/29 16:16	08:06 08:39-09:18/39 15:50	
14	04:57 21:22	05:44 20:33	06:35 19:24	07:26 18:14	07:22 08:01-08:33/32 16:14	08:07 08:40-09:19/39 15:50	
15	04:59 21:21	05:45 20:31	06:37 19:22	07:28 18:12	07:24 08:01-08:35/34 16:13	08:08 08:41-09:20/39 15:50	
16	05:00 21:20	05:47 20:29	06:39 19:19	07:30 18:09	07:26 08:01-08:37/36 16:11	08:08 08:42-09:20/38 15:50	
17	05:01 21:19	05:49 20:27	06:40 19:17	07:31 18:07	07:28 08:01-08:42/41 16:10	08:09 08:43-09:21/38 15:51	
18	05:02 21:18	05:50 20:25	06:42 19:14	07:33 18:05	07:29 08:02-08:45/43 16:08	08:10 08:44-09:22/38 15:51	
19	05:04 21:16	05:52 20:23	06:43 19:12	07:35 18:03	07:31 08:03-08:46/43 16:07	08:11 08:44-09:22/38 15:51	
20	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	07:33 08:04-08:47/43 16:06	08:11 08:45-09:22/37 15:51	
21	05:06 21:14	05:55 20:19	06:47 19:07	07:39 17:59	07:35 08:06-08:48/42 16:05	08:12 08:46-09:23/37 15:52	
22	05:08 21:13	05:57 20:17	06:49 19:05	07:40 17:56	07:36 08:08-08:49/41 16:03	08:13 08:46-09:23/37 15:52	
23	05:09 21:11	05:59 20:14	06:50 19:03	07:42 17:54	07:38 08:10-08:50/40 16:02	08:13 08:46-09:23/37 15:53	
24	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	07:40 08:12-08:53/41 16:01	08:13 08:47-09:25/38 15:53	
25	05:12 21:08	06:02 20:10	06:54 18:58	07:46 16:50	07:41 08:14-08:55/41 16:00	08:14 08:47-09:25/38 15:54	
26	05:14 21:07	06:04 20:08	06:55 18:55	07:48 16:48	07:43 08:15-08:58/43 15:59	08:14 08:47-09:25/38 15:55	
27	05:15 21:05	06:05 20:06	06:57 18:53	07:50 16:46	07:45 08:17-09:01/44 15:58	08:14 08:47-09:25/38 15:56	
28	05:16 21:04	06:07 20:03	06:59 18:51	07:52 16:44	07:46 08:19-09:03/44 15:57	08:15 08:48-09:27/39 15:56	
29	05:18 21:02	06:09 07:06-07:08/2 20:01	07:00 18:48	07:54 16:42	07:48 08:20-09:06/46 15:56	08:15 08:48-09:27/39 15:57	
30	05:20 21:01	06:10 07:01-07:13/12 19:59	07:02 18:46	07:56 16:40	07:49 08:22-09:08/46 15:56	08:15 08:47-09:26/39 15:58	
31	05:21 20:59	06:12 07:00-07:15/15 19:57		07:58 16:38		08:15 08:47-09:27/40 15:59	
	Sonnenscheinstunden	505	455	381	331	264	241
	Anzahl Minuten mit Schatten	0	29	242	0	831	1243

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB04 - WEA VB04, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
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	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:53	18:42	16:35	15:55
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	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
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	16:05	16:57	17:50	19:44	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
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	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:28	15:52
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	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
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	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:18	15:51
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15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:46	06:37	07:29	07:25	08:08
	16:19	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:51
16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:20	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
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	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:08	06:05	05:54	05:00	04:42	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:31	21:13	20:17	19:05	17:57	16:04	15:53
23	08:01	07:06	06:03	05:52	04:59	04:42	05:09	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:23	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:36	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:01	15:54
26	07:57	07:00	05:56	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:49	15:59	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:31	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:01	07:54	07:48	08:16
	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:57
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:47	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA VB04 - WEA VB04, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:15	07:47	06:53 07:17-08:10/53	06:41	05:35	04:49	04:45	05:23	06:14	07:04 08:14-08:41/27	06:59	07:51	
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44 07:43-07:57/14	16:36	15:55	
2	08:15	07:46	06:51 07:14-08:09/55	06:39	05:33	04:48	04:46	05:24	06:15	07:05 08:15-08:42/30	07:01	07:52	
	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41 07:42-08:02/20	16:35	15:54	
3	08:15	07:44	06:48 07:12-08:09/57	06:36	05:31	04:47	04:47	05:26	06:17	07:07 08:08-08:43/35	07:02	07:54	
	16:03	16:53	17:45	19:40	20:33	21:18	21:30	20:54	19:50	18:39 07:41-08:04/23	16:33	15:54	
4	08:14	07:42	06:46 07:10-08:09/59	06:34	05:29	04:46	04:48	05:27	06:19	07:09 07:41-08:43/62	07:04	07:55	
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53	
5	08:14	07:41	06:44 07:07-08:09/62	06:32	05:27	04:45	04:48	05:29	06:20	07:11 07:39-08:44/65	07:06	07:56	
	16:05	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:53	
6	08:14	07:39	06:42 07:05-08:08/63	06:29	05:25	04:45	04:49	05:31	06:22	07:12 07:39-08:44/65	07:08	07:58	
	16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52	
7	08:13	07:37	06:39 07:03-08:08/65	06:27	05:24	04:44	04:50	05:32	06:24	07:14 07:40-08:44/64	07:10	07:59	
	16:08	17:00	17:53	19:47	20:39	21:22	21:27	20:47	19:40	18:30	16:26	15:52	
8	08:13	07:35	06:37 07:02-08:07/65	06:25	05:22	04:44	04:51	05:34	06:25	07:16 07:42-08:45/63	07:12	08:00	
	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51	
9	08:12	07:34	06:35 07:03-08:06/63	06:22	05:20	04:43	04:52	05:35	06:27	07:17 07:43-08:44/61	07:13	08:01	
	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51	
10	08:12	07:32	06:32 07:28-08:06/38	06:20	05:18	04:43	04:53	05:37	06:29	07:19 07:45-08:44/59	07:15	08:03	
	16:12	17:06	17:58 07:03-07:26/23	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:20	15:51	
11	08:11	07:30	06:30 07:33-08:04/31	06:18	05:17	04:42	04:54	05:39	06:30	07:21 07:47-08:43/56	07:17	08:04	
	16:13	17:08	18:00 07:03-07:24/21	19:54	20:46	21:26	21:25	20:39	19:31	18:21	16:19	15:51	
12	08:11	07:28	06:28 07:34-08:02/28	06:16	05:15	04:42	04:55	05:40	06:32	07:23 07:49-08:43/54	07:19	08:05	
	16:15	17:10	18:02 07:04-07:20/16	19:56	20:48	21:26	21:24	20:37	19:29	18:18	16:17	15:50	
13	08:10	07:26	06:26 07:36-08:01/25	06:13	05:13	04:42	04:56	05:42	06:34	07:24 07:51-08:42/51	07:21	08:06	
	16:16	17:12	18:04 07:06-07:17/11	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50	
14	08:09	07:24	06:23 07:37-07:58/21	06:11	05:12	04:41	04:58	05:44	06:35	07:26 07:52-08:41/49	07:22	08:07	
	16:18	17:14	18:05 07:08-07:13/5	20:00	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50	
15	08:08	07:22	06:21 07:40-07:55/15	06:09	05:10	04:41	04:59	05:45	06:37	07:28 07:56-08:40/44	07:24	08:08	
	16:19	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	16:13	15:50	
16	08:07	07:20	06:19 07:45-07:50/5	06:07	05:08	04:41	05:00	05:47	06:39	07:30 07:57-08:39/42	07:26	08:08	
	16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:09	16:11	15:50	
17	08:07	07:18	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:32 07:59-08:38/39	07:28	08:09	
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18	08:06	07:16	06:14	06:02	05:05	04:41	05:02	05:50	06:42	07:33 08:00-08:37/37	07:30	08:10	
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19	08:04	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35 08:03-08:35/32	07:31	08:11	
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20	08:03	07:12 07:51-07:54/3	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37 08:14-08:33/19	07:33	08:11	
	16:27	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:52	
21	08:02	07:10 07:44-07:59/15	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39 08:17-08:29/12	07:35	08:12	
	16:29	17:27	18:18	20:12	21:01	21:31	21:14	20:19	19:07	17:59	16:05	15:52	
22	08:01	07:08 07:42-08:02/20	06:04	05:54	05:00	04:41	05:08	05:57	06:49	07:40	07:36	08:13	
	16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:56	16:04	15:52	
23	08:00	07:06 07:31-08:04/33	06:02	05:51	04:58	04:42	05:09	05:59	06:50	07:42	07:38	08:13	
	16:33	17:31	18:21	20:15	21:04	21:31	21:11	20:14	19:03	17:54	16:02	15:53	
24	07:59	07:04 07:28-08:06/38	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:14	
	16:34	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:53	
25	07:57	07:02 07:27-08:07/40	05:57	05:47	04:56	04:42	05:12	06:02	06:54	06:46	07:41	08:14	
	16:36	17:34	18:25	20:19	21:07	21:31	21:08	20:10	18:58	16:50	16:00	15:54	
26	07:56	06:59 07:25-08:07/42	05:55	05:45	04:55	04:43	05:14	06:04	06:55	06:48	07:43	08:14	
	16:38	17:36	18:27	20:20	21:08	21:31	21:07	20:08	18:56	16:48	15:59	15:55	
27	07:55	06:57 07:24-08:08/44	05:53	05:43	04:54	04:43	05:15	06:05	06:57	06:50	07:45	08:14	
	16:40	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	16:46	15:56	15:56	
28	07:53	06:55 07:19-08:09/50	05:50	05:41	04:53	04:44	05:17	06:07	06:59 08:22-08:35/13	06:51	07:46	08:15	
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:56	
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:00 08:19-08:38/19	06:53	07:48	08:15	
	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57	
30	07:50		06:46	05:37	04:51	04:45	05:20	06:10	07:02 08:16-08:40/24	06:55	07:49	08:15	
	16:45		19:34	20:27	21:14	21:30	21:01	19:59	18:46 07:46-07:56/10	16:40	15:56	15:58	
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15	
	16:47		19:35		21:15		20:59	19:57		16:38		15:59	
	Sonnenscheinstunden	256	276	367	417	487	502	505	455	381	331	264	241
	Anzahl Minuten mit Schatten	0	285	781	0	0	0	0	0	66	1023	0	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB05 - WEA VB05, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
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	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
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	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
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	16:31	17:29	18:20	20:14	21:04	21:31	21:13	20:17	19:05	17:57	16:04	15:53
23	08:01	07:06	06:03	05:52	04:59	04:42	05:09	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:23	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:36	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:00	15:54
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27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
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	16:42	17:40	18:30	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:57
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB05 - WEA VB05, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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

- Die Sonne scheint täglich von Sonnenauf- bis -untergang
- Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04 07:43-08:05/22	06:59	07:51	
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55	
2	08:15	07:46	06:51	07:16-07:18/2	06:39	05:33	04:48	04:46	05:24	06:15	07:05 07:42-08:05/23	07:01	07:52
	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54	
3	08:15	07:44	06:48	07:12-07:23/11	06:36	05:31	04:47	04:47	05:26	06:17	07:07 07:42-08:06/24	07:02	07:54
	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54	
4	08:14	07:42	06:46	07:10-07:25/15	06:34	05:29	04:46	04:48	05:27	06:19	07:09 07:41-08:05/24	07:04	07:55
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53	
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7	08:13	07:37	06:39	07:05-07:28/23	06:27	05:24	04:44	04:50	05:32	06:24	07:14 07:41-08:03/22	07:10	07:59
	16:07	17:00	17:53	19:47	20:39	21:22	21:27	20:47	19:40	18:30	16:25	15:52	
8	08:13	07:35	06:37	07:04-07:27/23	06:25	05:22	04:44	04:51	05:34	06:25	07:16 07:42-08:02/20	07:12	08:00
	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51	
9	08:12	07:34	06:35	07:04-07:28/24	06:22	05:20	04:43	04:52	05:35	06:27	07:17 07:43-08:00/17	07:13	08:01
	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51	
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	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:20	15:51	
11	08:11	07:30	06:30	07:03-07:27/24	06:18	05:17	04:42	04:54	05:39	06:30	07:21 07:47-07:56/9	07:17	08:04
	16:13	17:08	18:00	19:54	20:46	21:26	21:24	20:39	19:31	18:21	16:19	15:50	
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	16:22	17:19	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51	
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	16:40	17:38	18:28	20:22	21:10	21:31	21:05	20:06	18:53	16:46	15:58	15:56	
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	16:47	17:45	18:35	20:29	21:15	21:31	21:02	19:59	18:46	16:38	15:59	15:59	
Sonnenscheinstunden	256	1276	287	417	487	502	455	381	68	331	264	241	
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB06 - WEA VB06, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
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2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:25	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:55
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	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
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	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
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	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB06 - WEA VB06, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
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	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54
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Sonnenscheinstunden	256	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB07 - WEA VB07, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
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	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
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	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:22	19:10	18:01	16:06	15:52
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	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:24	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:37	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:01	15:54
26	07:57	07:00	05:56	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
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27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:31	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:57
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:02	19:59	18:47	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB07 - WEA VB07, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47 08:14-08:32/18	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59 07:41-08:05/24	07:51
2	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
3	08:15	07:46 08:12-08:32/20	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:01 07:41-08:05/24	07:52
4	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54
5	08:14	07:44 08:12-08:33/21	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02 07:41-08:05/24	07:54
6	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54
7	08:14	07:42 08:12-08:35/23	06:46	06:34	05:29	04:46	04:48	05:27	06:19	07:09	07:04 07:41-08:05/24	07:55
8	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
9	08:14	07:41 08:11-08:35/24	06:44	06:32	05:27	04:45	04:48	05:29	06:20	07:11	07:06 07:41-08:05/24	07:56
10	16:05	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:53
11	08:14	07:39 08:11-08:35/24	06:42	06:29	05:25	04:45	04:49	05:31	06:22	07:12	07:08 07:41-08:05/24	07:58
12	16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52
13	08:13	07:37 08:11-08:35/24	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10 07:42-08:04/22	07:59
14	16:08	17:00	17:53	19:47	20:39	21:22	21:27	20:47	19:40	18:30	16:26	15:52
15	08:13	07:35 08:11-08:36/25	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:12 07:43-08:04/21	08:00
16	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51
17	08:12	07:34 08:11-08:35/24	06:35	06:22	05:20	04:43	04:52	05:35	06:27	07:17	07:13 07:43-08:03/20	08:01
18	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51
19	08:12	07:32 08:11-08:35/24	06:32	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15 07:45-08:02/17	08:02
20	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:20	15:51
21	08:11	07:30 08:12-08:35/23	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17 07:47-08:01/14	08:04
22	16:13	17:08	18:00	19:54	20:46	21:26	21:24	20:39	19:31	18:21	16:19	15:51
23	08:11	07:28 08:12-08:34/22	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19 07:49-08:00/11	08:05
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25	08:10	07:26 08:13-08:33/20	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:24	07:21 07:51-07:57/6	08:06
26	16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50
27	08:09	07:24 08:15-08:32/17	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22	08:07
28	16:17	17:14	18:05	19:59	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50
29	08:08	07:22 08:16-08:31/15	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:08
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31	08:07	07:20 08:19-08:28/9	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:26	08:08
32	16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:09	16:11	15:50
33	08:06	07:18	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:32	07:28	08:09
34	16:22	17:19	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51
35	08:05	07:16	06:14	06:02	05:05	04:41	05:02	05:50	06:42	07:33	07:29	08:10
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37	08:04	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	08:11
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39	08:03	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	08:11
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51	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	06:48 07:47-07:58/11	07:43	08:14
52	16:38	17:36	18:26	20:20	21:08	21:31	21:07	20:08	18:55	16:48	15:59	15:55
53	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	06:50 07:45-08:00/15	07:45	08:14
54	16:40	17:38	18:28	20:22	21:10	21:31	21:05	20:06	18:53	16:46	15:57	15:58
55	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	06:51 07:44-08:02/18	07:46	08:15
56	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:56
57	07:52 08:19-08:25/6		06:48	05:39	04:52	04:44	05:18	06:09	07:00	06:53 07:43-08:03/20	07:48	08:15
58	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57
59	07:50 08:17-08:28/11		06:46	05:37	04:51	04:45	05:20	06:10	07:02	06:55 07:42-08:04/22	07:49	08:15
60	16:45		19:33	20:27	21:14	21:30	21:01	19:59	18:46	16:40	15:56	15:58
61	07:49 08:16-08:30/14		06:43		04:50		05:21	06:12		06:57 07:41-08:04/23		08:15
62	16:47		19:35		21:15		20:59	19:57		16:38		15:59
Sonnensheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
Anzahl Minuten mit Schatten	31	333	0	0	0	0	0	0	0	109	255	0

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB08 - WEA VB08, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:38	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:25	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:55
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:40	16:33	15:54
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	16:05	16:57	17:50	19:45	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:09	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:33	16:28	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:33	06:24	07:15	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:38	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:52
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
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	16:12	17:07	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:31	06:31	06:18	05:17	04:43	04:54	05:39	06:31	07:22	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:20	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:18	15:51
13	08:11	07:27	06:26	06:14	05:14	04:42	04:57	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:59	20:50	21:28	21:24	20:36	19:27	18:17	16:16	15:51
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16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:30	21:21	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
18	08:06	07:17	06:14	06:03	05:06	04:41	05:03	05:51	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:08	15:51
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25	07:58	07:02	05:58	05:48	04:56	04:42	05:12	06:02	06:54	07:47	07:42	08:15
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	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB08 - WEA VB08, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
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3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54
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	16:06	16:58	17:51	19:46	20:37	21:21	21:28	20:49	19:43	18:32	16:27	15:52
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20	08:03	07:12	06:09	05:58	05:02	04:41	05:05	05:54	06:45	07:37	07:33	08:11
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21	08:02	07:10	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:12
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31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:57		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB09 - WEA VB09, Vestas V66

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
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	16:40	17:38	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:46	15:58	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:30	20:25	21:12	21:32	21:05	20:04	18:51	16:44	15:58	15:57
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:57
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	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB09 - WEA VB09, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:51 15:55
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:17	04:46 21:30	05:24 20:56	06:15 19:52	07:05 18:41	07:00 16:35	07:52 15:54
3	08:15 16:03	07:44 16:53	06:48 17:45	06:36 19:40	05:31 20:32	04:47 21:18	04:47 21:29	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	07:54 15:54
4	08:14 16:04	07:42 16:55	06:46 17:47	06:34 19:42	05:29 20:34	04:46 21:19	04:48 21:29	05:27 20:52	06:19 19:47	07:09 18:37	07:04 16:31	07:55 15:53
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:36	04:46 21:20	04:48 21:28	05:29 20:51	06:20 19:45	07:11 18:34	07:06 16:29	07:56 15:53
6	08:14 16:06	07:39 16:59	06:42 17:51	06:29 19:46	05:25 20:38	04:45 21:21	04:49 21:28	05:31 20:49	06:22 19:43	07:12 18:32	07:08 16:27	07:58 15:52
7	08:13 16:08	07:37 17:00	06:39 17:53	06:27 19:47	05:24 20:39	04:44 21:22	04:50 21:27	05:32 20:47	06:24 19:40	07:14 18:30	07:10 16:26	07:59 15:52
8	08:13 16:09	07:35 17:02	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:27	07:11 16:24	08:00 15:51
9	08:12 16:10	07:34 17:04	06:35 17:56	06:22 19:51	05:20 20:43	04:43 21:24	04:52 21:26	05:35 20:43	06:27 19:36	07:17 18:25	07:13 16:22	08:01 15:51
10	08:12 16:12	07:32 17:06	06:32 17:58	06:20 19:53	05:18 20:44	04:43 21:25	04:53 21:25	05:37 20:41	06:29 19:33	07:19 18:23	07:15 16:20	08:02 15:51
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14	08:09 16:18	07:24 17:14	06:23 18:05	06:11 20:00	05:12 20:51	04:41 21:28	04:58 21:22	05:44 20:33	06:35 19:24	07:26 18:14	07:22 16:14	08:07 15:50
15	08:08 16:19	07:22 17:16	06:21 18:07	06:09 20:01	05:10 20:52	04:41 21:28	04:59 21:21	05:45 20:31	06:37 19:22	07:28 18:12	07:24 16:13	08:08 15:50
16	08:07 16:21	07:20 17:18	06:19 18:09	06:07 20:03	05:08 20:54	04:41 21:29	05:00 21:20	05:47 20:29	06:39 19:19	07:30 18:09	07:26 16:11	08:08 15:51
17	08:06 16:22	07:18 17:19	06:16 18:11	06:04 20:05	05:07 20:55	04:41 21:29	05:01 21:19	05:49 20:27	06:40 19:17	07:31 18:07	07:28 16:10	08:09 15:51
18	08:05 16:24	07:16 17:21	06:14 18:12	06:02 20:07	05:05 20:57	04:41 21:30	05:02 21:17	05:50 20:25	06:42 19:14	07:33 18:05	07:29 16:09	08:10 15:51
19	08:04 16:26	07:14 17:23	06:11 18:14	06:00 20:08	05:04 20:58	04:41 21:30	05:04 21:16	05:52 20:23	06:44 19:12	07:35 18:03	07:31 16:07	08:11 15:51
20	08:03 16:27	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:30	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	08:11 15:52
21	08:02 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:01	04:41 21:30	05:06 21:14	05:55 20:19	06:47 19:07	07:39 17:59	07:35 16:05	08:12 15:52
22	08:01 16:31	07:08 17:29	06:04 18:19	05:54 20:14	05:00 21:03	04:41 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:40 17:56	07:36 16:04	08:13 15:52
23	08:00 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:58 21:04	04:42 21:31	05:09 21:11	05:59 20:14	06:50 19:03	07:42 17:54	07:38 16:02	08:13 15:53
24	07:59 16:34	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:06	04:42 21:31	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	07:40 16:01	08:13 15:54
25	07:57 16:36	07:01 17:34	05:57 18:25	05:47 20:19	04:56 21:07	04:42 21:31	05:12 21:08	06:02 20:10	06:54 18:58	07:46 16:50	07:41 16:00	08:14 15:54
26	07:56 16:38	06:59 17:36	05:55 18:26	05:45 20:20	04:55 21:08	04:43 21:31	05:14 21:07	06:04 20:08	06:55 18:55	07:48 16:48	07:43 15:59	08:14 15:55
27	07:55 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 21:10	04:43 21:31	05:15 21:05	06:05 20:06	06:57 18:53	07:49 16:46	07:45 15:58	08:14 15:56
28	07:53 16:42	06:55 17:40	05:50 18:30	05:41 20:24	04:53 21:11	04:44 21:31	05:17 21:04	06:07 20:03	06:59 18:51	07:51 16:44	07:46 15:57	08:15 15:56
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:12	04:44 21:31	05:18 21:02	06:09 20:01	07:00 18:48	07:53 16:42	07:48 15:57	08:15 15:57
30	07:50 16:45		06:46 19:33	05:37 20:27	04:51 21:14	04:45 21:30	05:20 21:01	06:10 19:59	07:02 18:46	07:55 16:40	07:49 15:56	08:15 15:58
31	07:49 16:47		06:43 19:35		04:50 21:15		05:21 20:59	06:12 19:57		07:57 16:38		08:15 15:59
Sonnenscheinstunden												
Anzahl Minuten mit Schatten												
	257	276	367	417	487	502	505	455	381	331	264	241

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB10 - WEA VB10, Vestas V80

**Annahmen für Schattenwurfberechnung**

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

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:53	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
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	16:05	16:57	17:49	19:44	20:36	21:21	21:29	20:51	19:46	18:35	16:29	15:53
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	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
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	16:09	17:03	17:55	19:50	20:42	21:24	21:27	20:46	19:39	18:28	16:24	15:51
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
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	16:12	17:06	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
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	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05
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14	08:10	07:25	06:24	06:11	05:12	04:41	04:58	05:44	06:36	07:27	07:23	08:07
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	16:19	17:16	18:07	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:50
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19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
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20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
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22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
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24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
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26	07:57	07:00	05:55	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
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30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:02	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB10 - WEA VB10, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
2	08:15	07:46	06:50	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:00	07:52
	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:53
	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54
4	08:14	07:42	06:46	06:34	05:29	04:46	04:48	05:27	06:19	07:09	07:04	07:55
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19	08:04	07:14	06:11	06:00	05:04	04:41	05:04	05:52	06:43	07:35	07:31	08:11
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20	08:03	07:12	06:09	05:58	05:02	04:41	05:05	05:54	06:45	07:37	07:33	08:11
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21	08:02	07:10	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:12
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	16:33	17:31	18:21	20:15	21:04	21:31	21:11	20:14	19:03	17:54	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:13
	16:34	17:32	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:53
25	07:57	07:01	05:57	05:47	04:56	04:42	05:12	06:02	06:53	07:46	07:41	08:14
	16:36	17:34	18:25	20:19	21:07	21:31	21:08	20:10	18:58	16:50	16:00	15:54
26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14
	16:38	17:36	18:26	20:20	21:08	21:31	21:07	20:08	18:55	16:48	15:59	15:55
27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:44	08:14
	16:40	17:38	18:28	20:22	21:10	21:31	21:05	20:06	18:53	16:46	15:58	15:56
28	07:53	06:55	05:50	05:41	04:53	04:44	05:16	06:07	06:59	07:51	07:46	08:15
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:56
29	07:52		06:48	05:39	04:51	04:44	05:18	06:09	07:00	07:53	07:48	08:15
	16:43		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:56	15:57
30	07:50		06:46	05:37	04:50	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:33	20:27	21:13	21:30	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:49		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:56		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB11 - WEA VB11, Vestas V80

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:15	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:52	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
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	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:49	19:44	20:36	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:14	07:39	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
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8	08:14	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:27	20:46	19:39	18:28	16:24	15:51
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	16:12	17:06	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
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	16:16	17:12	18:04	19:58	20:50	21:28	21:23	20:36	19:27	18:16	16:16	15:50
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16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:54	21:29	21:20	20:30	19:20	18:10	16:11	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:22	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:07	16:10	15:51
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	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:12	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35	08:13
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22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
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24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:00	06:52	07:45	07:40	08:14
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25	07:58	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:42	15:57	15:57
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	16:45		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB11 - WEA VB11, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51	
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55	
2	08:15	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:00	07:52	
	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54	
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54	
	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54	
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	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53	
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	16:13	17:08	18:00	19:54	20:46	21:25	21:24	20:39	19:31	18:21	16:19	15:51	
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24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:13	
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25	07:57	07:01	05:57	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:14	
	16:36	17:34	18:25	19:59	20:19	21:07	21:31	21:08	20:10	18:58	16:50	16:00	15:54
26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14	
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27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:45	08:14	
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28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15	
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	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57	
30	07:50		06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:15	
	16:45		19:33	20:27	21:14	21:30	21:01	19:59	18:46	16:40	15:56	15:58	
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15	
	16:47		19:35		21:15		20:59	19:57		16:38		15:59	
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241	
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB12 - WEA VB12, Vestas V80

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:53	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
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	16:05	16:57	17:49	19:44	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:51
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	16:12	17:06	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
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	16:21	17:18	18:09	20:04	20:55	21:29	21:21	20:30	19:20	18:10	16:11	15:50
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	16:22	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
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	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
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21	08:03	07:11	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:13
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25	07:58	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
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	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB12 - WEA VB12, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
2	08:15	07:46	06:50	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:00	07:52
	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:53
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	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
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7	08:13	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59
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	16:13	17:08	18:00	19:54	20:46	21:25	21:24	20:39	19:31	18:21	16:19	15:51
12	08:11	07:28	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19	08:05
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	16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50
14	08:09	07:24	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22	08:07
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15	08:08	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:07
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19	08:04	07:14	06:11	06:00	05:04	04:41	05:04	05:52	06:43	07:35	07:31	08:11
	16:26	17:23	18:14	19:59	20:58	21:30	21:16	20:23	19:12	18:03	16:07	15:51
20	08:03	07:12	06:09	05:58	05:02	04:41	05:05	05:54	06:45	07:37	07:33	08:11
	16:27	17:25	18:16	19:59	20:59	21:30	21:15	20:21	19:10	18:01	16:06	15:52
21	08:02	07:10	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:12
	16:29	17:27	18:18	19:59	20:59	21:30	21:14	20:19	19:07	17:59	16:05	15:52
22	08:01	07:08	06:04	05:54	05:00	04:41	05:08	05:57	06:48	07:40	07:36	08:12
	16:31	17:29	18:19	19:59	20:59	21:31	21:12	20:17	19:05	17:56	16:04	15:52
23	08:00	07:06	06:02	05:51	04:58	04:42	05:09	05:59	06:50	07:42	07:38	08:13
	16:33	17:31	18:21	19:59	20:59	21:31	21:11	20:14	19:03	17:54	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:13
	16:34	17:33	18:23	19:59	20:59	21:31	21:10	20:12	19:00	17:52	16:01	15:53
25	07:57	07:01	05:57	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:14
	16:36	17:34	18:25	19:59	20:59	21:31	21:08	20:10	18:58	16:50	16:00	15:54
26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14
	16:38	17:36	18:26	19:59	20:59	21:31	21:07	20:08	18:55	16:48	15:59	15:55
27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:44	08:14
	16:40	17:38	18:28	19:59	20:59	21:31	21:05	20:06	18:53	16:46	15:58	15:56
28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15
	16:42	17:40	18:30	19:59	20:59	21:31	21:04	20:03	18:51	16:44	15:57	15:56
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:00	07:53	07:48	08:15
	16:43		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57
30	07:50		06:46	05:37	04:50	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:33	20:27	21:13	21:30	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:57		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB13 - WEA VB13, Vestas V80

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:01	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:52	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:27	04:45	04:48	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:49	19:44	20:36	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:02	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:51
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
	16:10	17:04	17:57	19:51	20:43	21:25	21:27	20:44	19:36	18:25	16:22	15:51
10	08:13	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:20	07:16	08:03
	16:12	17:06	17:58	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:30	06:31	06:18	05:17	04:42	04:54	05:39	06:31	07:21	07:18	08:04
	16:13	17:08	18:00	19:55	20:46	21:26	21:25	20:40	19:31	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05
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	16:16	17:12	18:04	19:58	20:50	21:28	21:23	20:36	19:27	18:16	16:16	15:50
14	08:10	07:25	06:24	06:11	05:12	04:41	04:58	05:44	06:36	07:27	07:23	08:07
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15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:25	08:08
	16:19	17:16	18:07	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:50
16	08:08	07:21	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:20	20:30	19:20	18:10	16:11	15:50
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
	16:22	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:07	16:10	15:51
18	08:06	07:17	06:14	06:02	05:05	04:41	05:02	05:50	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:12	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:27	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:05	17:57	16:04	15:52
23	08:01	07:06	06:02	05:52	04:58	04:42	05:09	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:45	07:40	08:14
	16:35	17:33	18:23	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:01	15:53
25	07:58	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:36	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:50	16:00	15:54
26	07:57	07:00	05:55	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:48	15:59	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	08:15
	16:40	17:38	18:29	20:23	21:10	21:32	21:06	20:06	18:53	16:46	15:58	15:56
28	07:54	06:55	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:30	20:24	21:12	21:32	21:05	20:04	18:51	16:44	15:57	15:56
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:42	15:57	15:57
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:02	07:56	07:50	08:16
	16:45		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:38		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB13 - WEA VB13, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
2	08:15	07:46	06:50	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:00	07:52
	16:01	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54
3	08:14	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:53
	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54
4	08:14	07:42	06:46	06:34	05:29	04:46	04:48	05:27	06:19	07:09	07:04	07:55
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
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	16:05	16:57	17:49	19:44	20:36	21:20	21:28	20:50	19:45	18:34	16:29	15:53
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	16:06	16:58	17:51	19:46	20:37	21:21	21:28	20:49	19:43	18:32	16:27	15:52
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	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51
9	08:12	07:33	06:35	06:22	05:20	04:43	04:52	05:35	06:27	07:17	07:13	08:01
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	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:20	15:51
11	08:11	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:03
	16:13	17:08	18:00	19:54	20:46	21:25	21:24	20:39	19:31	18:21	16:19	15:51
12	08:10	07:28	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:56	20:47	21:26	21:24	20:37	19:29	18:18	16:17	15:50
13	08:10	07:26	06:25	06:13	05:13	04:42	04:56	05:42	06:33	07:24	07:20	08:06
	16:16	17:12	18:03	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50
14	08:09	07:24	06:23	06:11	05:12	04:41	04:57	05:44	06:35	07:26	07:22	08:07
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15	08:08	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:07
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16	08:07	07:20	06:18	06:07	05:08	04:41	05:00	05:47	06:38	07:30	07:26	08:08
	16:21	17:17	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:09	16:11	15:50
17	08:06	07:18	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:31	07:28	08:09
	16:22	17:19	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51
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	16:24	17:21	18:12	20:06	20:57	21:29	21:17	20:25	19:14	18:05	16:08	15:51
19	08:04	07:14	06:11	06:00	05:04	04:41	05:04	05:52	06:43	07:35	07:31	08:11
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	16:27	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:51
21	08:02	07:10	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:12
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22	08:01	07:08	06:04	05:53	05:00	04:41	05:08	05:57	06:48	07:40	07:36	08:12
	16:31	17:29	18:19	20:13	21:03	21:31	21:12	20:16	19:05	17:56	16:03	15:52
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	16:38	17:36	18:26	20:20	21:08	21:31	21:07	20:08	18:55	16:48	15:59	15:55
27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:44	08:14
	16:40	17:38	18:28	20:22	21:10	21:31	21:05	20:05	18:53	16:46	15:58	15:56
28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:56
29	07:52		06:48	05:39	04:51	04:44	05:18	06:09	07:00	07:53	07:48	08:15
	16:43		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57
30	07:50		06:46	05:37	04:50	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:33	20:27	21:13	21:30	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:56		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB14 - WEA VB14, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:38	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:25	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:55
3	08:15	07:45	06:49	06:37	05:32	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:40	16:33	15:54
4	08:15	07:43	06:47	06:34	05:30	04:47	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:28	04:46	04:49	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:50	19:45	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:50	05:31	06:22	07:13	07:09	07:58
	16:07	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:33	16:28	15:52
7	08:14	07:38	06:40	06:28	05:24	04:45	04:50	05:33	06:24	07:15	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:38	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:52
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
	16:11	17:05	17:57	19:52	20:43	21:25	21:27	20:44	19:36	18:26	16:23	15:51
10	08:13	07:32	06:33	06:21	05:19	04:43	04:53	05:38	06:29	07:20	07:16	08:03
	16:12	17:07	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:31	06:31	06:18	05:17	04:43	04:54	05:39	06:31	07:22	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:56	05:41	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:18	15:51
13	08:11	07:27	06:26	06:14	05:14	04:42	04:57	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:59	20:50	21:28	21:23	20:36	19:27	18:17	16:16	15:51
14	08:10	07:25	06:24	06:12	05:12	04:42	04:58	05:44	06:36	07:27	07:23	08:07
	16:18	17:14	18:06	20:00	20:51	21:28	21:23	20:34	19:25	18:14	16:15	15:51
15	08:09	07:23	06:21	06:09	05:10	04:42	04:59	05:46	06:37	07:29	07:25	08:08
	16:20	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:51
16	08:08	07:21	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:27	08:09
	16:21	17:18	18:09	20:04	20:55	21:29	21:20	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:02	05:49	06:41	07:32	07:28	08:10
	16:23	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
18	08:06	07:17	06:14	06:03	05:06	04:41	05:03	05:51	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:06	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:08	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:26	18:17	20:11	21:01	21:31	21:16	20:22	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
	16:30	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:09	06:05	05:54	05:00	04:42	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:31	21:13	20:17	19:06	17:57	16:04	15:53
23	08:01	07:06	06:03	05:52	04:59	04:42	05:10	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:58	04:42	05:11	06:01	06:52	07:45	07:40	08:14
	16:35	17:33	18:24	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:02	15:54
25	07:58	07:02	05:58	05:48	04:56	04:43	05:12	06:02	06:54	07:47	07:42	08:15
	16:37	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:51	16:01	15:54
26	07:57	07:00	05:56	05:46	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
	16:38	17:37	18:27	20:21	21:09	21:32	21:08	20:08	18:56	16:49	16:00	15:55
27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:39	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:47	15:59	15:56
28	07:54	06:56	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:31	20:25	21:12	21:32	21:05	20:04	18:51	16:45	15:58	15:57
29	07:52		06:49	05:39	04:52	04:44	05:18	06:09	07:01	07:54	07:48	08:16
	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:43	15:57	15:58
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:02	19:59	18:47	16:41	15:56	15:58
31	07:49		06:44		04:50		05:22	06:12		06:57		08:16
	16:48		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	455	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB14 - WEA VB14, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
2	08:15	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:00	07:52
	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54
	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54
4	08:14	07:42	06:46	06:34	05:29	04:46	04:48	05:27	06:19	07:09	07:04	07:55
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
5	08:14	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:06	07:56
	16:05	16:57	17:49	19:44	20:36	21:20	21:28	20:50	19:45	18:34	16:29	15:53
6	08:14	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52
7	08:13	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59
	16:08	17:00	17:53	19:47	20:39	21:22	21:27	20:47	19:40	18:30	16:26	15:52
8	08:13	07:35	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:11	08:00
	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51
9	08:12	07:34	06:35	06:22	05:20	04:43	04:52	05:36	06:27	07:17	07:13	08:01
	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51
10	08:12	07:32	06:32	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:02
	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:21	15:51
11	08:11	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:04
	16:13	17:08	18:00	19:54	20:46	21:25	21:24	20:39	19:31	18:21	16:19	15:51
12	08:11	07:28	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:56	20:47	21:26	21:24	20:37	19:29	18:18	16:17	15:50
13	08:10	07:26	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:24	07:21	08:06
	16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50
14	08:09	07:24	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22	08:07
	16:18	17:14	18:05	19:59	20:51	21:27	21:22	20:33	19:24	18:14	16:14	15:50
15	08:08	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:07
	16:19	17:16	18:07	19:59	20:52	21:28	21:21	20:31	19:22	18:12	16:13	15:50
16	08:07	07:20	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:26	08:08
	16:21	17:18	18:09	19:59	20:54	21:29	21:20	20:29	19:19	18:09	16:11	15:51
17	08:06	07:18	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:31	07:28	08:09
	16:22	17:19	18:11	19:59	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51
18	08:05	07:16	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:29	08:10
	16:24	17:21	18:12	19:59	20:57	21:29	21:17	20:25	19:14	18:05	16:09	15:51
19	08:04	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	08:11
	16:26	17:23	18:14	19:59	20:58	21:30	21:16	20:23	19:12	18:03	16:07	15:51
20	08:03	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	08:11
	16:27	17:25	18:16	19:59	20:59	21:30	21:15	20:21	19:10	18:01	16:06	15:52
21	08:02	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35	08:12
	16:29	17:27	18:18	19:59	20:59	21:30	21:14	20:19	19:07	17:59	16:05	15:52
22	08:01	07:08	06:04	05:54	05:00	04:41	05:08	05:57	06:49	07:40	07:36	08:12
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23	08:00	07:06	06:02	05:51	04:59	04:42	05:09	05:59	06:50	07:42	07:38	08:13
	16:33	17:31	18:21	19:59	20:59	21:31	21:11	20:14	19:03	17:54	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:13
	16:34	17:33	18:23	19:59	20:59	21:31	21:10	20:12	19:00	17:52	16:01	15:54
25	07:57	07:01	05:57	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:14
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26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14
	16:38	17:36	18:26	19:59	20:59	21:31	21:07	20:08	18:55	16:48	15:59	15:55
27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:45	08:14
	16:40	17:38	18:28	19:59	20:59	21:31	21:05	20:06	18:53	16:46	15:58	15:56
28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15
	16:42	17:40	18:30	19:59	20:59	21:31	21:04	20:03	18:51	16:44	15:57	15:56
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:00	07:53	07:48	08:15
	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:57
30	07:50		06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:33	20:27	21:14	21:30	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:57		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB15 - WEA VB15, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:38	05:35 20:30	04:49 21:17	04:46 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:25 20:57	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:55
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:32 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:40	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:30 20:35	04:47 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
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27	07:55 16:40	06:58 17:39	05:53 18:29	05:43 20:23	04:54 21:11	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:45 16:47	07:45 15:59	08:15 15:56
28	07:54 16:42	06:56 17:40	05:51 18:31	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:47 16:45	07:47 15:58	08:15 15:57
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30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:02	06:11 19:59	07:03 18:47	07:50 16:41	07:50 15:56	08:16 15:58
31	07:49 16:48		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		07:03 16:39		08:16 15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB15 - WEA VB15, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:51 15:55
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13	08:10 16:16	07:26 17:12	06:25 18:04	06:13 19:58	05:13 20:49	04:42 21:27	04:56 21:23	05:42 20:35	06:34 19:26	07:24 18:16	07:20 16:16	08:06 15:50
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18	08:05 16:24	07:16 17:21	06:14 18:12	06:02 20:06	05:05 20:57	04:41 21:29	05:02 21:17	05:50 20:25	06:42 19:14	07:33 18:05	07:29 16:09	08:10 15:51
19	08:04 16:26	07:14 17:23	06:11 18:14	06:00 20:08	05:04 20:58	04:41 21:30	05:04 21:16	05:52 20:23	06:43 19:12	07:35 18:03	07:31 16:07	08:11 15:51
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22	08:01 16:31	07:08 17:29	06:04 18:19	05:54 20:13	05:00 21:03	04:41 21:31	05:08 21:12	05:57 20:16	06:48 19:05	07:40 17:56	07:36 16:04	08:12 15:52
23	08:00 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:58 21:04	04:42 21:31	05:09 21:11	05:59 20:14	06:50 19:03	07:42 17:54	07:38 16:02	08:13 15:53
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31	07:49 16:47		06:43 19:35		04:50 21:15		05:21 20:59	06:12 19:56	07:03 18:46	07:57 16:38		08:15 15:59
Sonnenscheinstunden   257   276   367   417   487   502   505   455   381   331   264   241												
Anzahl Minuten mit Schatten   0   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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
 Bonifatiusstr. 400  
 DE-48432 Rheine  
 +49 5971 9710-31  
 Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
 Berechnet:  
 04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA : WEA VB16 - WEA VB16, Enercon E-82

#### Annahmen für Schattenwurfberechnung

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
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19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:08	08:11 15:51
20	08:04 16:28	07:13 17:26	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:22	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:52
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 21:15	05:56 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:42 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53
23	08:01 16:33	07:06 17:31	06:03 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:10 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53
24	07:59 16:35	07:04 17:33	06:00 18:24	05:50 20:18	04:58 21:06	04:42 21:32	05:11 21:11	06:01 20:13	06:52 19:01	07:45 17:53	07:40 16:02	08:14 15:54
25	07:58 16:37	07:02 17:35	05:58 18:25	05:48 20:19	04:56 21:08	04:43 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:01	08:15 15:54
26	07:57 16:38	07:00 17:37	05:56 18:27	05:46 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:49	07:44 16:00	08:15 15:55
27	07:55 16:40	06:58 17:39	05:53 18:29	05:43 20:23	04:54 21:11	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:47	07:45 15:59	08:15 15:56
28	07:54 16:42	06:56 17:40	05:51 18:31	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:45	07:47 15:58	08:15 15:57
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	06:54 16:43	07:48 15:57	08:16 15:58
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:03 18:47	06:56 16:41	07:50 15:56	08:16 15:58
31	07:49 16:48		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57	06:57 16:39		07:51 15:59	08:16 15:59
Sonnenscheinstunden 256 276 367 417 488 502 505 456 381 331 264 241												
Anzahl Minuten mit Schatten 0 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	

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB16 - WEA VB16, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:51 15:55	
2	08:15 16:02	07:45 16:51	06:50 17:44	06:39 19:39	05:33 20:31	04:48 21:17	04:48 21:30	05:24 20:56	06:15 19:52	07:05 18:41	07:00 16:35	07:52 15:54	
3	08:14 16:03	07:44 16:53	06:48 17:45	06:36 19:40	05:31 20:32	04:47 21:18	04:47 21:29	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	07:53 15:54	
4	08:14 16:04	07:42 16:55	06:46 17:47	06:34 19:42	05:29 20:34	04:46 21:19	04:46 21:29	05:27 20:52	06:19 19:47	07:09 18:37	07:04 16:31	07:55 15:53	
5	08:14 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:36	04:46 21:20	04:48 21:28	05:29 20:50	06:20 19:45	07:10 18:34	07:06 16:29	07:56 15:53	
6	08:14 16:06	07:39 16:59	06:41 17:51	06:29 19:46	05:25 20:37	04:45 21:21	04:49 21:28	05:31 20:49	06:22 19:43	07:12 18:32	07:08 16:27	07:57 15:52	
7	08:13 16:08	07:37 17:00	06:39 17:53	06:27 19:47	05:24 20:39	04:44 21:22	04:50 21:27	05:32 20:47	06:24 19:40	07:14 18:30	07:10 16:26	07:59 15:52	
8	08:13 16:09	07:35 17:02	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:27	07:11 16:24	08:00 15:51	
9	08:12 16:10	07:33 17:04	06:35 17:56	06:22 19:51	05:20 20:42	04:43 21:24	04:52 21:26	05:35 20:43	06:27 19:36	07:17 18:25	07:13 16:22	08:01 15:51	
10	08:12 16:12	07:32 17:06	06:32 17:58	06:20 19:53	05:18 20:44	04:43 21:25	04:53 21:25	05:37 20:41	06:29 19:33	07:19 18:23	07:15 16:20	08:02 15:51	
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12	08:10 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 20:47	04:42 21:26	04:55 21:23	05:40 20:37	06:32 19:29	07:23 18:18	07:19 16:17	08:05 15:50	
13	08:10 16:16	07:26 17:12	06:25 18:04	06:13 19:58	05:13 20:49	04:42 21:27	04:56 21:23	05:42 20:35	06:34 19:26	07:24 18:16	07:20 16:16	08:06 15:50	
14	08:09 16:18	07:24 17:14	06:23 18:05	06:11 20:00	05:12 20:51	04:41 21:27	04:58 21:22	05:44 20:33	06:35 19:24	07:26 18:14	07:22 16:14	08:00 15:50	
15	08:08 16:19	07:22 17:16	06:21 18:07	06:09 20:01	05:10 20:52	04:41 21:28	04:59 21:21	05:45 20:31	06:37 19:22	07:28 18:12	07:24 16:13	08:07 15:50	
16	08:07 16:21	07:20 17:18	06:18 18:09	06:07 20:03	05:08 20:54	04:41 21:28	05:00 21:20	05:47 20:29	06:38 19:19	07:30 18:09	07:26 16:11	08:08 15:51	
17	08:06 16:22	07:18 17:19	06:16 18:11	06:04 20:05	05:07 20:55	04:41 21:29	05:01 21:18	05:49 20:27	06:40 19:17	07:31 18:07	07:28 16:10	08:09 15:51	
18	08:05 16:24	07:16 17:21	06:14 18:12	06:02 20:06	05:05 20:57	04:41 21:29	05:03 21:17	05:50 20:25	06:42 19:14	07:33 18:05	07:29 16:09	08:10 15:51	
19	08:04 16:26	07:14 17:23	06:11 18:14	06:00 20:08	05:04 20:58	04:41 21:30	05:04 21:16	05:52 20:23	06:43 19:12	07:35 18:03	07:31 16:07	08:11 15:51	
20	08:03 16:27	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:30	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	08:11 15:52	
21	08:02 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:01	04:41 21:30	05:07 21:14	05:55 20:19	06:47 19:07	07:39 17:59	07:35 16:05	08:12 15:52	
22	08:01 16:31	07:08 17:29	06:04 18:19	05:54 20:13	05:00 21:03	04:41 21:31	05:08 21:12	05:57 20:16	06:48 19:05	07:40 17:56	07:36 16:04	08:12 15:52	
23	08:00 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:59 21:04	04:42 21:31	05:09 21:11	05:59 20:14	06:50 19:03	07:42 17:54	07:38 16:02	08:13 15:53	
24	07:59 16:34	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:06	04:42 21:31	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	07:40 16:01	08:13 15:54	
25	07:57 16:36	07:01 17:34	05:57 18:25	05:47 20:19	04:56 21:07	04:42 21:31	05:12 21:08	06:02 20:10	06:54 18:58	07:46 16:50	07:41 16:00	08:14 15:54	
26	07:56 16:38	06:59 17:36	05:55 18:26	05:45 20:20	04:55 21:08	04:43 21:31	05:14 21:07	06:04 20:08	06:55 18:55	07:48 16:48	07:43 15:59	08:14 15:55	
27	07:55 16:40	06:57 17:38	05:53 18:28	05:43 20:22	04:54 21:10	04:43 21:31	05:15 21:05	06:05 20:05	06:57 18:53	07:49 16:46	07:44 15:58	08:14 15:56	
28	07:53 16:42	06:55 17:40	05:50 18:30	05:41 20:24	04:53 21:11	04:44 21:31	05:17 21:04	06:07 20:03	06:59 18:51	07:51 16:44	07:46 15:57	08:14 15:56	
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:12	04:44 21:31	05:18 21:02	06:09 20:01	07:00 18:48	07:53 16:42	07:48 15:57	08:15 15:57	
30	07:50 16:45		06:46 19:33	05:37 20:27	04:51 21:13	04:45 21:30	05:20 21:01	06:10 19:59	07:02 18:46	07:55 16:40	07:49 15:56	08:15 15:58	
31	07:49 16:47		06:43 19:35		04:50 21:15		05:21 20:59	06:12 19:56	06:57 18:46	07:57 16:38		08:15 15:59	
		Sonnenscheinstunden   257   276   367   417   487   502   505   455   381   331   264   241											
		Anzahl Minuten mit Schatten   0   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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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 Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
 Berechnet:  
 04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA VB17 - WEA VB17, Enercon E-82

**Annahmen für Schattenwurfberechnung**

- 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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:01	16:51	17:44	19:39	20:31	21:18	21:31	20:57	19:53	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:27	04:45	04:48	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:49	19:44	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
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	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:51
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:14	08:02
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	16:12	17:06	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
11	08:12	07:30	06:31	06:18	05:17	04:42	04:54	05:39	06:31	07:21	07:18	08:04
	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
12	08:11	07:29	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:57	20:48	21:27	21:24	20:38	19:29	18:19	16:17	15:50
13	08:11	07:27	06:26	06:14	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:58	20:50	21:28	21:24	20:36	19:27	18:16	16:16	15:50
14	08:10	07:25	06:24	06:11	05:12	04:41	04:58	05:44	06:36	07:27	07:23	08:07
	16:18	17:14	18:06	20:00	20:51	21:28	21:23	20:34	19:24	18:14	16:14	15:50
15	08:09	07:23	06:21	06:09	05:10	04:41	04:59	05:46	06:37	07:28	07:25	08:08
	16:19	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:50
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	16:22	17:20	18:11	20:05	20:56	21:30	21:19	20:28	19:17	18:08	16:10	15:51
18	08:06	07:17	06:14	06:02	05:05	04:41	05:02	05:50	06:42	07:34	07:30	08:11
	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:07	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:05	17:57	16:04	15:52
23	08:01	07:06	06:02	05:52	04:58	04:42	05:09	05:59	06:51	07:43	07:39	08:14
	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:02	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:00	06:52	07:45	07:40	08:14
	16:35	17:33	18:23	20:18	21:06	21:32	21:11	20:13	19:01	17:53	16:01	15:53
25	07:58	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:42	08:15
	16:36	17:35	18:25	20:19	21:08	21:32	21:09	20:11	18:58	16:50	16:00	15:54
26	07:57	07:00	05:55	05:45	04:55	04:43	05:14	06:04	06:56	07:48	07:44	08:15
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27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
	16:40	17:38	18:29	20:23	21:11	21:32	21:06	20:06	18:54	16:46	15:58	15:56
28	07:54	06:55	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
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29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:01	07:54	07:48	08:16
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30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:02	07:56	07:50	08:16
	16:45		19:34	20:28	21:14	21:31	21:02	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (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:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA: WEA VB17 - WEA VB17, SG6.2-170

Annahmen für Schattenwurfberechnung

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:57	19:54	18:44	16:36	15:55
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	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:34	15:54
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	16:03	16:53	17:45	19:40	20:32	21:18	21:29	20:54	19:50	18:39	16:33	15:54
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	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
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	16:05	16:57	17:49	19:44	20:36	21:20	21:28	20:50	19:45	18:34	16:29	15:53
6	08:14	07:39	06:41	06:29	05:25	04:45	04:49	05:31	06:22	07:12	07:08	07:57
	16:06	16:59	17:51	19:46	20:37	21:21	21:28	20:49	19:43	18:32	16:27	15:52
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	16:08	17:00	17:53	19:47	20:39	21:22	21:27	20:47	19:40	18:30	16:25	15:52
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	16:09	17:02	17:54	19:49	20:41	21:23	21:27	20:45	19:38	18:27	16:24	15:51
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	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:20	15:51
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14	08:09	07:24	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22	08:06
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17	08:06	07:18	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:31	07:28	08:09
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19	08:04	07:14	06:11	06:00	05:04	04:41	05:04	05:52	06:43	07:35	07:31	08:11
	16:26	17:23	18:14	20:08	20:58	21:30	21:16	20:23	19:12	18:03	16:07	15:51
20	08:03	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	08:11
	16:27	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:52
21	08:02	07:10	06:07	05:56	05:01	04:41	05:06	05:55	06:47	07:39	07:35	08:12
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22	08:01	07:08	06:04	05:54	05:00	04:41	05:08	05:57	06:48	07:40	07:36	08:12
	16:31	17:29	18:19	20:13	21:03	21:31	21:12	20:16	19:05	17:56	16:04	15:52
23	08:00	07:06	06:02	05:51	04:58	04:42	05:09	05:59	06:50	07:42	07:38	08:13
	16:33	17:31	18:21	20:15	21:04	21:31	21:11	20:14	19:03	17:54	16:02	15:53
24	07:58	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:13
	16:34	17:32	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:54
25	07:57	07:01	05:57	05:47	04:56	04:42	05:12	06:02	06:53	07:46	07:41	08:14
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26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14
	16:38	17:36	18:26	20:20	21:08	21:31	21:07	20:08	18:55	16:48	15:59	15:55
27	07:54	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:49	07:44	08:14
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	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:56
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	16:43		19:32	20:25	21:12	21:30	21:02	20:01	18:48	16:42	15:57	15:57
30	07:50		06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:33	20:27	21:13	21:30	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:56		16:38		15:59
Sonneneinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

**Berechnung:** WEA\_GB WEA : WEA VB18 - WEA VB18, Enercon E-82

#### Annahmen für Schattenwurfberechnung

- 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 Sonneneinstrichrichtung
- Die Windenergieanlage/n ist/sind immer in Betrieb

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
2	08:16 16:01	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54	
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54	
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53	
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:37	04:45 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53	
6	08:15 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:27	07:58 15:52	
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52	
8	08:14 16:09	07:36 17:02	06:37 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:28	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51	
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:25	07:14 16:22	08:02 15:51	
10	08:13 16:12	07:32 17:06	06:33 17:59	06:20 19:53	05:18 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51	
11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:47	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51	
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:50	
13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:56 21:24	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50	
14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:41 21:28	04:58 21:23	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:50	
15	08:09 16:19	07:23 17:16	06:21 18:07	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:22	05:45 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:08 15:50	
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:08 20:55	04:41 21:29	05:00 21:21	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:11	08:09 15:50	
17	08:07 16:22	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:07	07:28 16:10	08:10 15:51	
18	08:06 16:24	07:17 17:22	06:14 18:13	06:02 20:07	05:05 20:58	04:41 21:30	05:02 21:18	05:50 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51	
19	08:05 16:26	07:15 17:23	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:12 15:51	
20	08:04 16:27	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:51	
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:06 21:15	05:55 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52	
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:32	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:52	
23	08:01 16:33	07:06 17:31	06:02 18:22	05:52 20:16	04:58 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:02	08:14 15:53	
24	07:59 16:35	07:04 17:33	06:00 18:23	05:49 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:00 20:13	06:52 19:01	07:45 17:53	07:40 16:01	08:14 15:53	
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:50	07:42 16:00	08:15 15:54	
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:48	07:44 15:59	08:15 15:55	
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:11	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:53	07:50 16:46	07:45 15:58	08:15 15:56	
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:57	08:15 15:56	
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:32	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57	
30	07:51 16:45		06:46 19:34	05:37 20:28	04:50 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:40	07:50 15:56	08:16 15:58	
31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		06:57 16:38		08:16 15:59	
	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA: WEA VB18 - WEA VB18, SG6.2-170

#### Annahmen für Schattenwurfberechnung

- 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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:51 15:55
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3	08:14 16:03	07:44 16:53	06:48 17:45	06:36 19:40	05:31 20:32	04:47 21:18	04:47 21:29	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	07:53 15:54
4	08:14 16:04	07:42 16:55	06:46 17:47	06:34 19:42	05:29 20:34	04:46 21:19	04:48 21:29	05:27 20:52	06:19 19:47	07:09 18:37	07:04 16:31	07:55 15:53
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8	08:13 16:09	07:35 17:02	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:27	07:11 16:24	08:00 15:51
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10	08:12 16:12	07:32 17:06	06:32 17:58	06:20 19:53	05:18 20:44	04:43 21:25	04:53 21:25	05:37 20:41	06:29 19:33	07:19 18:23	07:15 16:20	08:02 15:51
11	08:11 16:13	07:30 17:08	06:30 18:00	06:18 19:54	05:17 20:46	04:42 21:25	04:54 21:24	05:39 20:39	06:30 19:31	07:21 18:21	07:17 16:19	08:03 15:51
12	08:10 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 20:47	04:42 21:26	04:55 21:23	05:40 20:37	06:32 19:29	07:23 18:18	07:19 16:17	08:04 15:50
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Sonneneinstunden												
Anzahl Minuten mit Schatten	257	276	367	417	487	502	505	455	381	331	264	241

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:  
R-2-2023-0060

Lizenzierter Anwender:  
KÖTTER Consulting Engineers GmbH & Co. KG  
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DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA : WEA VB19 - WEA VB19, Enercon E-82

#### Annahmen für Schattenwurfberechnung

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	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
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31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		07:02 16:39		08:16 15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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DE-48432 Rheine  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB19 - WEA VB19, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:50 15:55
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31	07:49 16:47		06:43 19:35	05:35 21:15	04:50 21:15	04:45 21:30	05:21 20:59	06:12 19:56	07:04 18:46	07:57 16:38	07:52 15:59	08:15 15:59
Sonneneinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**Lizenzierter Anwender:  
**KÖTTNER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366**SHADOW - Kalender pro WEA**

Berechnung: WEA\_GB WEA: WEA VB20 - WEA VB20, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:37	04:46 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53
6	08:15 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:27	07:58 15:52
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52
8	08:14 16:09	07:36 17:03	06:37 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:28	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:25	07:14 16:22	08:02 15:51
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14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:41 21:28	04:58 21:23	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:50
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22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:32	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:52
23	08:01 16:33	07:06 17:31	06:02 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:02	08:14 15:53
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29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:40	07:50 15:56	08:16 15:58
31	07:49 16:47		06:44 19:36	05:36 21:16	04:50 21:16	04:44 21:00	05:21 19:57	06:12 19:57	07:03 16:39	07:57 15:59	07:51 15:59	08:16 15:59
Sonnenscheinstunden   256   276   367   417   488   502   505   456   381   331   264   241												
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)	Sonnenuntergang (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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

Berechnung: WEA\_GB WEA: WEA VB20 - WEA VB20, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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
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3	08:14 16:03	07:44 16:53	06:48 17:45	06:36 19:40	05:31 20:32	04:47 21:18	04:47 21:29	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	07:53 15:54
4	08:14 16:04	07:42 16:55	06:46 17:47	06:34 19:42	05:29 20:34	04:46 21:19	04:48 21:29	05:27 20:52	06:19 19:47	07:09 18:37	07:04 16:31	07:55 15:53
5	08:14 16:05	07:40 16:57	06:44 17:49	06:32 19:44	05:27 20:36	04:46 21:20	04:48 21:28	05:29 20:50	06:20 19:45	07:10 18:34	07:06 16:29	07:56 15:53
6	08:14 16:06	07:39 16:59	06:41 17:51	06:29 19:46	05:25 20:37	04:45 21:21	04:49 21:28	05:31 20:49	06:22 19:43	07:12 18:32	07:08 16:27	07:57 15:52
7	08:13 16:08	07:37 17:00	06:39 17:53	06:27 19:47	05:24 20:39	04:44 21:22	04:50 21:27	05:32 20:47	06:24 19:40	07:14 18:30	07:10 16:26	07:59 15:52
8	08:13 16:09	07:35 17:02	06:37 17:55	06:25 19:49	05:22 20:41	04:44 21:23	04:51 21:26	05:34 20:45	06:25 19:38	07:16 18:27	07:11 16:24	08:00 15:51
9	08:12 16:10	07:33 17:04	06:35 17:56	06:22 19:51	05:20 20:42	04:43 21:24	04:52 21:26	05:35 20:43	06:27 19:36	07:17 18:25	07:13 16:22	08:01 15:51
10	08:12 16:12	07:32 17:06	06:32 17:58	06:20 19:53	05:18 20:44	04:43 21:25	04:53 21:25	05:37 20:41	06:29 19:33	07:19 18:23	07:15 16:20	08:02 15:51
11	08:11 16:13	07:30 17:08	06:30 18:00	06:18 19:54	05:17 20:46	04:42 21:25	04:54 21:24	05:39 20:39	06:30 19:31	07:21 18:21	07:17 16:19	08:03 15:51
12	08:10 16:15	07:28 17:10	06:28 18:02	06:16 19:56	05:15 20:47	04:42 21:26	04:55 21:23	05:40 20:37	06:32 19:29	07:23 18:18	07:19 16:17	08:04 15:50
13	08:10 16:16	07:26 17:12	06:25 18:03	06:13 19:58	05:13 20:49	04:42 21:27	04:56 21:22	05:42 20:35	06:33 19:26	07:24 18:16	07:20 16:16	08:05 15:50
14	08:09 16:18	07:24 17:14	06:23 18:05	06:11 19:59	05:12 20:50	04:41 21:27	04:58 21:22	05:44 20:33	06:35 19:24	07:26 18:14	07:22 16:14	08:06 15:50
15	08:08 16:19	07:22 17:16	06:21 18:07	06:09 20:01	05:10 20:52	04:41 21:28	04:59 21:21	05:45 20:31	06:37 19:21	07:28 18:12	07:24 16:13	08:07 15:50
16	08:07 16:21	07:20 17:18	06:18 18:09	06:07 20:03	05:08 20:54	04:41 21:28	05:00 21:20	05:47 20:29	06:38 19:19	07:30 18:09	07:26 16:11	08:08 15:51
17	08:06 16:22	07:18 17:19	06:16 18:11	06:04 20:05	05:07 20:55	04:41 21:29	05:01 21:18	05:49 20:27	06:40 19:17	07:31 18:07	07:28 16:10	08:09 15:51
18	08:05 16:24	07:16 17:21	06:14 18:12	06:02 20:06	05:05 20:57	04:41 21:29	05:03 21:17	05:50 20:25	06:42 19:14	07:33 18:05	07:29 16:09	08:10 15:51
19	08:04 16:26	07:14 17:23	06:11 18:14	06:00 20:08	05:04 20:58	04:41 21:30	05:04 21:16	05:52 20:23	06:43 19:12	07:35 18:03	07:31 16:07	08:10 15:51
20	08:03 16:27	07:12 17:25	06:09 18:16	05:58 20:10	05:03 21:00	04:41 21:30	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	08:11 15:52
21	08:02 16:29	07:10 17:27	06:07 18:18	05:56 20:12	05:01 21:01	04:41 21:30	05:07 21:14	05:55 20:19	06:47 19:07	07:39 17:59	07:34 16:05	08:12 15:52
22	08:01 16:31	07:08 17:29	06:04 18:19	05:54 20:13	05:00 21:03	04:41 21:30	05:08 21:12	05:57 20:16	06:48 19:05	07:40 17:56	07:36 16:04	08:12 15:52
23	08:00 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:59 21:04	04:42 21:31	05:09 21:11	05:59 20:14	06:50 19:02	07:42 17:54	07:38 16:02	08:13 15:53
24	07:58 16:34	07:04 17:33	06:00 18:23	05:49 20:17	04:57 21:05	04:42 21:31	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	07:40 16:01	08:13 15:54
25	07:57 16:36	07:01 17:34	05:57 18:25	05:47 20:19	04:56 21:07	04:42 21:31	05:12 21:08	06:02 20:10	06:53 18:58	07:46 16:50	07:41 16:00	08:14 15:54
26	07:56 16:38	06:59 17:36	05:55 18:26	05:45 20:20	04:55 21:08	04:43 21:31	05:14 21:07	06:04 20:08	06:55 18:55	07:48 16:48	07:43 15:59	08:14 15:55
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29	07:52 16:44		06:48 19:32	05:39 20:25	04:52 21:12	04:44 21:30	05:18 21:02	06:09 20:01	07:00 18:48	07:53 16:42	07:47 15:57	08:15 15:57
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31	07:49 16:47		06:43 19:35	05:35 21:15	04:50 21:15	04:50 20:59	05:21 19:56	06:12 19:56	07:03 16:38	07:57 15:59	07:48 15:59	08:15 15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA: WEA VB21 - WEA VB21, Enercon E-82

#### Annahmen für Schattenwurfberechnung

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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	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
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11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:46	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:31	07:21 18:21	07:18 16:19	08:04 15:51	
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:50	
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31	07:49 16:47	6:	05:44 18:36	05:36 20:31	04:50 21:16	04:45 21:17	05:21 21:00	06:12 19:57	07:03 16:38	07:57 15:59	07:51 15:59	08:16 15:59	
	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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)	Sonnenuntergang (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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB21 - WEA VB21, SG6.2-170

**Annahmen für Schattenwurfberechnung**

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	08:15 16:00	07:47 16:49	06:53 17:42	06:41 19:37	05:35 20:29	04:49 21:16	04:45 21:30	05:23 20:57	06:14 19:54	07:04 18:44	06:59 16:36	07:51 15:55
2	08:15 16:01	07:46 16:51	06:50 17:44	06:39 19:39	05:33 20:31	04:48 21:17	04:46 21:30	05:24 20:56	06:15 19:52	07:05 18:41	07:00 16:34	07:52 15:54
3	08:15 16:03	07:44 16:53	06:48 17:45	06:36 19:40	05:31 20:32	04:47 21:18	04:47 21:29	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	07:53 15:54
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23	08:00 16:33	07:06 17:31	06:02 18:21	05:51 20:15	04:58 21:04	04:42 21:31	05:09 21:11	05:59 20:14	06:50 19:03	07:42 17:54	07:38 16:02	08:13 15:53
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Sonnenscheinstunden   257   276   367   417   487   502   505   455   381   331   264   241												
Anzahl Minuten mit Schatten   0   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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB22 - WEA VB22, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
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28	07:54 16:42	06:56 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:56
29	07:52 16:44	06:54 17:37	05:48 18:32	05:39 20:26	04:52 21:13	04:44 21:32	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
30	07:51 16:46	06:53 17:34	05:46 18:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:02	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58
31	07:49 16:47	06:51 17:36	05:44 18:36	05:36 21:16	04:50 21:16	04:45 21:31	05:21 21:00	06:12 19:57	07:03 18:46	07:57 16:39	07:52 15:59	08:16 15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

 Lizenzierter Anwender:  
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 Berechnet:  
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**SHADOW - Kalender pro WEA**

Berechnung: WEA\_GB WEA: WEA VB23 - WEA VB23, Enercon E-82

**Annahmen für Schattenwurfberechnung**

 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	08:16	07:48	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:00	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
2	08:16	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:16	07:06	07:01	07:53
	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:53	18:42	16:35	15:54
3	08:15	07:45	06:49	06:37	05:31	04:47	04:47	05:26	06:17	07:08	07:03	07:54
	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
5	08:15	07:41	06:44	06:32	05:28	04:46	04:48	05:29	06:21	07:11	07:07	07:57
	16:05	16:57	17:49	19:44	20:37	21:21	21:29	20:51	19:46	18:35	16:29	15:53
6	08:15	07:40	06:42	06:30	05:26	04:45	04:49	05:31	06:22	07:13	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:27	15:52
7	08:14	07:38	06:40	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	08:00
	16:08	17:01	17:53	19:48	20:40	21:23	21:28	20:48	19:41	18:30	16:26	15:52
8	08:14	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:26	07:16	07:12	08:01
	16:09	17:03	17:55	19:50	20:42	21:24	21:28	20:46	19:39	18:28	16:24	15:51
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	16:12	17:06	17:59	19:53	20:45	21:26	21:26	20:42	19:34	18:23	16:21	15:51
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	16:13	17:08	18:00	19:55	20:47	21:26	21:25	20:40	19:32	18:21	16:19	15:51
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	16:19	17:16	18:08	20:02	20:53	21:29	21:22	20:32	19:22	18:12	16:13	15:50
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	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:12
	16:26	17:23	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:07	15:51
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	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
	16:29	17:27	18:18	20:12	21:02	21:31	21:15	20:19	19:08	17:59	16:05	15:52
22	08:02	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:37	08:13
	16:31	17:29	18:20	20:14	21:04	21:32	21:13	20:17	19:05	17:57	16:04	15:52
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	16:33	17:31	18:22	20:16	21:05	21:32	21:12	20:15	19:03	17:55	16:03	15:53
24	07:59	07:04	06:00	05:50	04:57	04:42	05:11	06:01	06:52	07:45	07:40	08:14
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27	07:55	06:58	05:53	05:43	04:54	04:43	05:15	06:06	06:57	07:50	07:45	08:15
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28	07:54	06:55	05:51	05:41	04:53	04:44	05:17	06:07	06:59	07:52	07:47	08:15
	16:42	17:40	18:30	20:25	21:12	21:32	21:05	20:04	18:51	16:44	15:57	15:56
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	16:44		19:32	20:26	21:13	21:31	21:03	20:02	18:49	16:42	15:57	15:57
30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:02	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:47		19:36		21:16		21:00	19:57		16:39		15:59
Sonneneinstunden												
Anzahl Minuten mit Schatten												
	256	276	367	417	488	502	505	456	381	331	264	241

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA: WEA VB24 - WEA VB24, Enercon E-82

#### Annahmen für Schattenwurfberechnung

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:57	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
5	08:15 16:05	07:41 16:57	06:44 17:50	06:32 19:44	05:28 20:37	04:46 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53
6	08:15 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:09 16:28	07:58 15:52
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:15 18:30	07:10 16:26	08:00 15:52
8	08:14 16:09	07:36 17:03	06:38 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:28	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51
9	08:13 16:10	07:34 17:05	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:26	07:14 16:22	08:02 15:51
10	08:13 16:12	07:32 17:06	06:33 17:59	06:21 19:53	05:19 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51
11	08:12 16:13	07:31 17:08	06:31 18:00	06:18 19:55	05:17 20:47	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:51
13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:56 21:24	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50
14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:41 21:28	04:58 21:23	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:50
15	08:09 16:19	07:23 17:16	06:21 18:08	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:22	05:46 20:32	06:37 19:22	07:29 18:12	07:25 16:13	08:08 15:50
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:09 20:55	04:41 21:29	05:00 21:21	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:12	08:09 15:51
17	08:07 16:23	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:08	07:28 16:10	08:10 15:51
18	08:06 16:24	07:17 17:22	06:14 18:13	06:03 20:07	05:06 20:58	04:41 21:30	05:03 21:18	05:51 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51
19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:12 15:51
20	08:04 16:28	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:52
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 21:15	05:56 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:32	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53
23	08:01 16:33	07:06 17:31	06:03 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53
24	07:59 16:35	07:04 17:33	06:00 18:23	05:50 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:01 20:13	06:52 19:01	07:45 17:53	07:40 16:01	08:14 15:54
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:00	08:15 15:54
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:49	07:44 15:59	08:15 15:55
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:11	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56
28	07:54 16:42	06:56 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:56
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:32	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:02	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58
31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		07:02 16:39		08:16 15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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	
	Sonnenaufgang (SS:MM)		Zeitpunkt (SS:MM)		Schattenanfang-Zeitpunkt (SS:MM)		Schattende/Minuten mit Schatten	

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA: WEA VB25 - WEA VB25, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54	
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54	
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53	
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	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB26 - WEA VB26, Enercon E-82

**Annahmen für Schattenwurfberechnung**

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
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Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

**Berechnung:** WEA\_GB **WEA:** WEA VB27 - WEA VB27, Enercon E-82

#### Annahmen für Schattenwurfberechnung

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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25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:00	08:15 15:54
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:48	07:44 15:59	08:15 15:55
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:56
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58
31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		07:57 16:39		08:16 15:59
Sonnenscheinstunden   256   276   367   417   488   502   505   456   381   331   264   241												
Anzahl Minuten mit Schatten   0   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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA : WEA VB28 - WEA VB28, Enercon E-82

#### Annahmen für Schattenwurfberechnung

- 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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54	
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54	
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9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:26	07:14 16:22	08:02 15:51	
10	08:13 16:12	07:32 17:06	06:33 17:59	06:20 19:53	05:18 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51	
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22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53	
23	08:01 16:33	07:06 17:31	06:03 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53	
24	07:59 16:35	07:04 17:33	06:00 18:23	05:50 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:01 20:13	06:52 19:01	07:45 17:53	07:40 16:01	08:14 15:54	
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:00	08:15 15:54	
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28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:56	
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30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58	
31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57	07:03 16:39	07:57 15:59		08:16 15:59	
	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB29 - WEA VB29, Nordex N117 2.4

**Annahmen für Schattenwurfberechnung**

- 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 Sonneneinstrichrichtung
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	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:16 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:28 20:36	04:46 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53
6	08:15 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:27	07:58 15:52
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52
8	08:14 16:09	07:36 17:03	06:37 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:27	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51
9	08:13 16:10	07:34 17:04	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:25	07:14 16:22	08:02 15:51
10	08:13 16:12	07:32 17:06	06:33 17:59	06:20 19:53	05:18 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51
11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:46	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:50
13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:56 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50
14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:41 21:28	04:58 21:23	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:50
15	08:09 16:19	07:23 17:16	06:21 18:08	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:22	05:46 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:08 15:50
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:09 20:55	04:41 21:29	05:00 21:20	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:11	08:09 15:51
17	08:07 16:23	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:08	07:28 16:10	08:10 15:51
18	08:06 16:24	07:17 17:22	06:14 18:13	06:02 20:07	05:06 20:58	04:41 21:30	05:03 21:18	05:51 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51
19	08:05 16:26	07:15 17:23	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:11 15:51
20	08:04 16:28	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:52
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 21:15	05:56 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:52
23	08:01 16:33	07:06 17:31	06:02 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53
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25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:50	07:42 16:00	08:15 15:54
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27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:24	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:56
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
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31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		06:57 16:39		08:16 15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
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**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA VB30 - WEA VB30, Nordex N117 2.4

**Annahmen für Schattenwurfberechnung**

Die dargestellten Zeiten sind die astronomisch maximal mögliche Beschattungsdauer, berechnet unter folgenden Annahmen:  
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Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
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5	08:15 16:05	07:41 16:57	06:44 17:50	06:32 19:44	05:28 20:37	04:46 21:21	04:49 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53	
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19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:11 15:51	
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26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:49	07:44 15:59	08:15 15:55	
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56	
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:57	
29	07:52 16:44	06:52 17:40	05:48 18:30	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57	
30	07:51 16:46	06:51 17:40	05:46 18:30	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58	
31	07:49 16:47	06:49 17:36	05:44 18:36	05:36 20:36	04:50 21:16	04:45 21:21	05:21 21:00	06:12 19:57	07:04 18:46	07:57 16:39	07:53 15:59	08:16 15:59	
	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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)	Sonnenuntergang (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:  
R-2-2023-0060

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

Berechnung: WEA\_GB WEA : WEA VB31 - WEA VB31, V162-5.6

#### Annahmen für Schattenwurfberechnung

- 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	08:16 16:00	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:16 16:01	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:24 20:57	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:47 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:27 20:37	04:45 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53
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7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52
8	08:14 16:09	07:36 17:02	06:37 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:28	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51
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10	08:13 16:12	07:32 17:06	06:33 17:59	06:20 19:53	05:18 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51
11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:47	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51
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13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:56 21:24	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:07 15:50
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15	08:09 16:19	07:23 17:16	06:21 18:07	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:22	05:45 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:08 15:50
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:08 20:55	04:41 21:30	05:00 21:21	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:11	08:09 15:50
17	08:07 16:22	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:07	07:28 16:10	08:10 15:51
18	08:06 16:24	07:17 17:22	06:14 18:13	06:02 20:07	05:05 20:58	04:41 21:30	05:02 21:18	05:50 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51
19	08:05 16:26	07:15 17:23	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:12 15:51
20	08:04 16:27	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:51
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:06 21:15	05:55 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:32	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:52
23	08:01 16:33	07:06 17:31	06:02 18:22	05:52 20:16	04:58 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:02	08:14 15:53
24	07:59 16:34	07:04 17:33	06:00 18:23	05:49 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:00 20:13	06:52 19:01	07:45 17:53	07:40 16:01	08:14 15:53
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:50	07:42 16:00	08:15 15:54
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:48	07:44 15:59	08:15 15:55
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:11	04:43 21:32	05:15 21:06	06:05 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:43 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:57	08:15 15:56
29	07:52 16:44		06:48 19:32	05:39 20:26	04:51 21:13	04:44 21:32	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:16 15:57
30	07:51 16:45		06:46 19:34	05:37 20:28	04:50 21:14	04:45 21:31	05:20 21:02	06:11 19:59	07:02 18:46	07:56 16:40	07:50 15:56	08:16 15:58
31	07:49 16:47		06:44 19:36		04:50 21:16		05:21 21:00	06:12 19:57		07:57 16:38		08:16 15:59
Sonnenscheinstunden												
Anzahl Minuten mit Schatten												
	256	276	367	417	488	502	505	456	381	331	264	241

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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

Berechnung: WEA\_GB WEA : WEA Z01 - WEA Z01, SG 6.0-170

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
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	16:03	16:53	17:46	19:41	20:33	21:19	21:30	20:55	19:50	18:39	16:33	15:54
4	08:15	07:43	06:47	06:34	05:30	04:46	04:48	05:28	06:19	07:09	07:05	07:56
	16:04	16:55	17:48	19:43	20:35	21:20	21:30	20:53	19:48	18:37	16:31	15:53
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	16:07	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:33	16:28	15:52
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	16:09	17:03	17:55	19:50	20:42	21:24	21:27	20:46	19:39	18:28	16:24	15:52
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	16:13	17:08	18:00	19:55	20:46	21:26	21:25	20:40	19:32	18:21	16:19	15:51
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	16:16	17:12	18:04	19:58	20:50	21:28	21:23	20:36	19:27	18:17	16:16	15:51
14	08:10	07:25	06:24	06:12	05:12	04:42	04:58	05:44	06:36	07:27	07:23	08:07
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	16:21	17:18	18:09	20:04	20:55	21:29	21:20	20:30	19:20	18:10	16:12	15:51
17	08:07	07:19	06:17	06:05	05:07	04:41	05:01	05:49	06:41	07:32	07:28	08:10
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	16:24	17:22	18:13	20:07	20:58	21:30	21:18	20:26	19:15	18:05	16:09	15:51
19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
	16:26	17:24	18:15	20:09	20:59	21:31	21:17	20:24	19:13	18:03	16:08	15:51
20	08:04	07:13	06:10	05:58	05:03	04:41	05:05	05:54	06:46	07:37	07:34	08:12
	16:28	17:25	18:16	20:11	21:01	21:31	21:16	20:21	19:10	18:01	16:06	15:52
21	08:03	07:11	06:07	05:56	05:01	04:41	05:07	05:56	06:47	07:39	07:35	08:13
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	16:48		19:36		21:15		21:00	19:57		16:39		15:59
Sonnenscheinstunden  256   276   367   417   488   502   505   456   381   331   264   241												
Anzahl Minuten mit Schatten  0   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:  
R-2-2023-0060

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
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 +49 5971 9710-31  
 Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
 Berechnet:  
 04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

Berechnung: WEA\_GB WEA : WEA Z02 - WEA Z02, V162-6.0

**Annahmen für Schattenwurfberechnung**

- 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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:37	20:30	21:17	21:31	20:58	19:55	18:44	16:37	15:55
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	16:02	16:51	17:44	19:39	20:31	21:18	21:31	20:56	19:53	18:42	16:35	15:55
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	16:05	16:57	17:50	19:44	20:36	21:21	21:29	20:51	19:46	18:35	16:29	15:53
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	16:06	16:59	17:51	19:46	20:38	21:22	21:29	20:49	19:43	18:32	16:28	15:52
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	16:09	17:03	17:55	19:50	20:42	21:24	21:27	20:46	19:39	18:28	16:24	15:52
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19	08:05	07:15	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:36	07:32	08:11
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30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:03	07:56	07:50	08:16
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	16:48		19:36		21:15		21:00	19:57		16:39		15:59
Sonneneinstrahlung	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
DE-48432 Rheine  
+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA\_Z03\_1 - WEA\_Z03\_1, V162-6.0

**Annahmen für Schattenwurfberechnung**

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	08:16	07:48	06:53	06:41	05:35	04:49	04:46	05:23	06:14	07:04	06:59	07:51
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30	07:51		06:46	05:37	04:51	04:45	05:20	06:11	07:02	07:56	07:50	08:16
	16:46		19:34	20:28	21:14	21:31	21:01	19:59	18:46	16:41	15:56	15:58
31	07:49		06:44		04:50		05:21	06:12		06:57		08:16
	16:48		19:36		21:15		21:00	19:57		16:39		15:59
Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA Z03\_2 - WEA Z03\_2, V162-6.0

**Annahmen für Schattenwurfberechnung**

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	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:46 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55
2	08:15 16:02	07:46 16:51	06:51 17:44	06:39 19:39	05:33 20:31	04:48 21:18	04:46 21:31	05:25 20:56	06:16 19:53	07:06 18:42	07:01 16:35	07:53 15:54
3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53
5	08:15 16:05	07:41 16:57	06:44 17:50	06:32 19:44	05:28 20:36	04:46 21:21	04:49 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53
6	08:14 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:28	07:58 15:52
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:33 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52
8	08:14 16:09	07:36 17:03	06:38 17:55	06:25 19:50	05:22 20:42	04:44 21:24	04:51 21:27	05:34 20:46	06:26 19:39	07:16 18:28	07:12 16:24	08:01 15:51
9	08:13 16:10	07:34 17:05	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:26	07:14 16:22	08:02 15:51
10	08:13 16:12	07:32 17:06	06:33 17:59	06:21 19:53	05:19 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51
11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:46	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:18	08:05 15:51
13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:57 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:51
14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:42 21:28	04:58 21:22	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:51
15	08:09 16:19	07:23 17:16	06:21 18:08	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:21	05:46 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:08 15:51
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:09 20:54	04:41 21:29	05:00 21:20	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:12	08:09 15:51
17	08:07 16:23	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:08	07:28 16:10	08:10 15:51
18	08:06 16:24	07:17 17:22	06:14 18:13	06:03 20:07	05:06 20:58	04:41 21:30	05:03 21:18	05:51 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51
19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:11 15:51
20	08:04 16:28	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:52
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 21:15	05:56 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:42 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53
23	08:01 16:33	07:06 17:31	06:03 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53
24	07:59 16:35	07:04 17:33	06:00 18:23	05:50 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:01 20:13	06:52 19:01	07:45 17:53	07:40 16:02	08:14 15:54
25	07:58 16:36	07:02 17:35	05:58 18:25	05:48 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:00	08:15 15:54
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:49	07:44 15:59	08:15 15:55
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:45 16:46	07:45 15:59	08:15 15:56
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:25	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:47 16:44	07:47 15:58	08:15 15:57
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:48 16:43	07:48 15:57	08:15 15:57
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:48 16:41	07:50 15:56	08:16 15:58
31	07:49 16:47		06:44 19:36		04:50 21:15		05:21 21:00	06:12 19:57		07:49 16:39		08:16 15:59
Sonnenscheinstunden												
	256	276	367	417	488	502	505	456	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
R-2-2023-0060

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA Z06 - WEA Z06, V162-6.0

**Annahmen für Schattenwurfberechnung**

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

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	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:16 16:01	07:48 16:49	06:53 17:42	06:41 19:37	05:35 20:30	04:49 21:17	04:45 21:31	05:23 20:58	06:14 19:55	07:04 18:44	06:59 16:37	07:51 15:55	
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3	08:15 16:03	07:45 16:53	06:49 17:46	06:37 19:41	05:31 20:33	04:47 21:19	04:47 21:30	05:26 20:55	06:17 19:50	07:08 18:39	07:03 16:33	07:54 15:54	
4	08:15 16:04	07:43 16:55	06:47 17:48	06:34 19:43	05:29 20:35	04:46 21:20	04:48 21:30	05:28 20:53	06:19 19:48	07:09 18:37	07:05 16:31	07:56 15:53	
5	08:15 16:05	07:41 16:57	06:44 17:49	06:32 19:44	05:28 20:36	04:46 21:21	04:48 21:29	05:29 20:51	06:21 19:46	07:11 18:35	07:07 16:29	07:57 15:53	
6	08:14 16:06	07:40 16:59	06:42 17:51	06:30 19:46	05:26 20:38	04:45 21:22	04:49 21:29	05:31 20:49	06:22 19:43	07:13 18:32	07:08 16:28	07:58 15:52	
7	08:14 16:08	07:38 17:01	06:40 17:53	06:27 19:48	05:24 20:40	04:44 21:23	04:50 21:28	05:32 20:48	06:24 19:41	07:14 18:30	07:10 16:26	08:00 15:52	
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9	08:13 16:10	07:34 17:05	06:35 17:57	06:23 19:51	05:20 20:43	04:43 21:25	04:52 21:27	05:36 20:44	06:27 19:36	07:18 18:26	07:14 16:22	08:02 15:51	
10	08:13 16:12	07:32 17:06	06:33 17:59	06:21 19:53	05:19 20:45	04:43 21:26	04:53 21:26	05:37 20:42	06:29 19:34	07:20 18:23	07:16 16:21	08:03 15:51	
11	08:12 16:13	07:30 17:08	06:31 18:00	06:18 19:55	05:17 20:46	04:42 21:26	04:54 21:25	05:39 20:40	06:31 19:32	07:21 18:21	07:18 16:19	08:04 15:51	
12	08:11 16:15	07:29 17:10	06:28 18:02	06:16 19:57	05:15 20:48	04:42 21:27	04:55 21:24	05:41 20:38	06:32 19:29	07:23 18:19	07:19 16:17	08:05 15:51	
13	08:11 16:16	07:27 17:12	06:26 18:04	06:14 19:58	05:13 20:50	04:42 21:28	04:57 21:23	05:42 20:36	06:34 19:27	07:25 18:16	07:21 16:16	08:06 15:50	
14	08:10 16:18	07:25 17:14	06:24 18:06	06:11 20:00	05:12 20:51	04:42 21:28	04:58 21:22	05:44 20:34	06:36 19:24	07:27 18:14	07:23 16:14	08:07 15:50	
15	08:09 16:19	07:23 17:16	06:21 18:08	06:09 20:02	05:10 20:53	04:41 21:29	04:59 21:21	05:46 20:32	06:37 19:22	07:28 18:12	07:25 16:13	08:08 15:51	
16	08:08 16:21	07:21 17:18	06:19 18:09	06:07 20:04	05:09 20:54	04:41 21:29	05:00 21:20	05:47 20:30	06:39 19:20	07:30 18:10	07:27 16:12	08:09 15:51	
17	08:07 16:23	07:19 17:20	06:17 18:11	06:05 20:05	05:07 20:56	04:41 21:30	05:01 21:19	05:49 20:28	06:41 19:17	07:32 18:08	07:28 16:10	08:10 15:51	
18	08:06 16:24	07:17 17:22	06:14 18:13	06:03 20:07	05:06 20:58	04:41 21:30	05:03 21:18	05:51 20:26	06:42 19:15	07:34 18:05	07:30 16:09	08:11 15:51	
19	08:05 16:26	07:15 17:24	06:12 18:15	06:00 20:09	05:04 20:59	04:41 21:31	05:04 21:17	05:52 20:24	06:44 19:13	07:36 18:03	07:32 16:07	08:11 15:51	
20	08:04 16:28	07:13 17:25	06:10 18:16	05:58 20:11	05:03 21:01	04:41 21:31	05:05 21:16	05:54 20:21	06:46 19:10	07:37 18:01	07:34 16:06	08:12 15:52	
21	08:03 16:29	07:11 17:27	06:07 18:18	05:56 20:12	05:01 21:02	04:41 21:31	05:07 21:15	05:56 20:19	06:47 19:08	07:39 17:59	07:35 16:05	08:13 15:52	
22	08:02 16:31	07:08 17:29	06:05 18:20	05:54 20:14	05:00 21:04	04:41 21:31	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	08:13 15:53	
23	08:01 16:33	07:06 17:31	06:03 18:22	05:52 20:16	04:59 21:05	04:42 21:32	05:09 21:12	05:59 20:15	06:51 19:03	07:43 17:55	07:39 16:03	08:14 15:53	
24	07:59 16:35	07:04 17:33	06:00 18:23	05:50 20:18	04:57 21:06	04:42 21:32	05:11 21:11	06:01 20:13	06:52 19:01	07:45 17:53	07:40 16:01	08:14 15:54	
25	07:58 16:36	07:02 17:35	05:58 18:25	05:47 20:19	04:56 21:08	04:42 21:32	05:12 21:09	06:02 20:11	06:54 18:58	07:46 16:51	07:42 16:00	08:15 15:54	
26	07:57 16:38	07:00 17:37	05:55 18:27	05:45 20:21	04:55 21:09	04:43 21:32	05:14 21:08	06:04 20:08	06:56 18:56	07:48 16:48	07:44 15:59	08:15 15:55	
27	07:55 16:40	06:58 17:38	05:53 18:29	05:43 20:23	04:54 21:10	04:43 21:32	05:15 21:06	06:06 20:06	06:57 18:54	07:50 16:46	07:45 15:58	08:15 15:56	
28	07:54 16:42	06:55 17:40	05:51 18:30	05:41 20:24	04:53 21:12	04:44 21:32	05:17 21:05	06:07 20:04	06:59 18:51	07:52 16:44	07:47 15:58	08:15 15:57	
29	07:52 16:44		06:48 19:32	05:39 20:26	04:52 21:13	04:44 21:31	05:18 21:03	06:09 20:02	07:01 18:49	07:54 16:42	07:48 15:57	08:15 15:57	
30	07:51 16:46		06:46 19:34	05:37 20:28	04:51 21:14	04:45 21:31	05:20 21:01	06:11 19:59	07:02 18:46	07:56 16:41	07:50 15:56	08:16 15:58	
31	07:49 16:47		06:44 19:36		04:50 21:15		05:21 21:00	06:12 19:57		07:57 16:39		08:16 15:59	
	Sonnenscheinstunden	256	276	367	417	488	502	505	456	381	331	264	241
	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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA1 - WEA1, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

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	08:15 10:22-10:36/14 09:21-09:55/34	07:47	06:53 08:05-08:27/22	06:41	05:35	04:49
	16:01 13:36-13:53/17	16:49	17:42	19:37	20:29	21:16
2	08:15 10:23-10:36/13 09:22-09:55/33	07:46	06:51 08:06-08:23/17	06:39	05:33	04:48
	16:02 13:38-13:53/15	16:51	17:44	19:39	20:31	21:17
3	08:15 10:25-10:36/11 09:23-09:56/33	07:44	06:48 08:09-08:20/11	06:36	05:31	04:47
	16:03 13:39-13:53/14	16:53	17:46	19:41	20:33	21:18
4	08:15 10:27-10:34/7 09:23-09:56/33	07:42	06:46	06:34	05:29	04:46
	16:04 13:41-13:52/11	16:55	17:47	19:42	20:34	21:19
5	08:14 13:43-13:51/8	07:41	06:44	06:32	05:27	04:46
	16:05 09:23-09:57/34	16:57	17:49	19:44	20:36	21:20
6	08:14 09:23-09:57/34	07:39	06:42	06:29	05:26	04:45
	16:06	16:59	17:51	19:46	20:38	21:21
7	08:14 09:25-09:58/33	07:37	06:39	06:27	05:24	04:44
	16:08	17:01	17:53	19:48	20:39	21:22
8	08:13 09:25-09:57/32	07:36 16:26-16:33/7	06:37	06:25	05:22	04:44
	16:09	17:02 08:15-08:18/3	17:55	19:49	20:41	21:23
9	08:13 09:25-09:57/32	07:34 16:24-16:35/11	06:35	06:23	05:20	04:43
	16:10	17:04 08:10-08:23/13	17:56	19:51	20:43	21:24
10	08:12 09:26-09:58/32	07:32 16:23-16:37/14	06:33	06:20	05:18	04:43
	16:12	17:06 08:07-08:26/19	17:58	19:53	20:44	21:25
11	08:11 09:27-09:58/31	07:30 16:22-16:39/17	06:30	06:18	05:17	04:42
	16:13	17:08 08:05-08:28/23	18:00	19:55	20:46	21:26
12	08:11 09:27-09:58/31	07:28 16:21-16:41/20	06:28	06:16	05:15	04:42
	16:15	17:10 08:04-08:29/25	18:02	19:56	20:48	21:26
13	08:10 09:28-09:58/30	07:26 16:21-16:43/22	06:26	06:13	05:13	04:42
	16:16	17:12 08:03-08:30/27	18:04	19:58	20:49	21:27
14	08:09 09:28-09:58/30	07:24 16:20-16:43/23	06:23	06:11	05:12	04:41
	16:18	17:14 08:02-08:31/29	18:05	20:00	20:51	21:28
15	08:08 09:29-09:58/29	07:22 16:20-16:43/23	06:21	06:09	05:10	04:41
	16:19	17:16 08:01-08:32/31	18:07	20:01	20:52	21:28
16	08:08 09:30-09:58/28	07:20 16:20-16:43/23	06:19	06:07	05:09	04:41
	16:21	17:18 08:01-08:33/32	18:09	20:03	20:54	21:29
17	08:07 09:31-09:58/27	07:18 16:20-16:43/23	06:16	06:05	05:07	04:41
	16:23	17:20 08:00-08:33/33	18:11	20:05	20:56	21:29
18	08:06 09:32-09:58/26	07:16 16:21-16:43/22	06:14	06:02	05:05	04:41
	16:24	17:21 08:00-08:34/34	18:13	20:07	20:57	21:30
19	08:05 09:33-09:56/23	07:14 16:21-16:43/22	06:12	06:00	05:04	04:41
	16:26	17:23 08:00-08:34/34	18:14	20:08	20:59	21:30
20	08:04 09:34-09:56/22	07:12 16:22-16:42/20	06:09	05:58	05:03	04:41
	16:28	17:25 08:00-08:34/34	18:16	20:10	21:00	21:30
21	08:02 09:36-09:55/19	07:10 16:23-16:40/17	06:07	05:56	05:01	04:41
	16:29	17:27 07:59-08:33/34	18:18	20:12	21:02	21:31
22	08:01 09:38-09:54/16	07:08 16:24-16:38/14	06:05	05:54	05:00	04:41
	16:31	17:29 07:59-08:33/34	18:20	20:14	21:03	21:31
23	08:00 09:40-09:52/12	07:06 16:27-16:36/9	06:02	05:52	04:59	04:42
	16:33	17:31 08:00-08:33/33	18:21	20:15	21:04	21:31
24	07:59 09:45-09:48/3	07:04 08:00-08:33/33	06:00	05:49	04:57	04:42
	16:35	17:33	18:23	20:17	21:06	21:31
25	07:57	07:02 08:01-08:32/31	05:58	05:47	04:56	04:42
	16:36	17:35	18:25	20:19	21:07	21:31
26	07:56	06:59 08:01-08:30/29	05:55	05:45	04:55	04:43
	16:38	17:36	18:27	20:21	21:09	21:31
27	07:55	06:57 08:02-08:29/27	05:53	05:43	04:54	04:43
	16:40	17:38	18:28	20:22	21:10	21:31
28	07:53	06:55 08:03-08:28/25	05:50	05:41	04:53	04:44
	16:42	17:40	18:30	20:24	21:11	21:31
29	07:52		06:48	05:39	04:52	04:44
	16:44		19:32	20:26	21:12	21:31
30	07:50		06:46	05:37	04:51	04:45
	16:45		19:34	20:27	21:14	21:31
31	07:49		06:43		04:50	
	16:47		19:35		21:15	
Sonneneinstrahlung	256	276	367	417	487	502
Anzahl Minuten mit Schatten	767	870	50	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA1 - WEA1, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

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

	Juli	August	September	Oktober	November	Dezember
1	04:45 21:30	05:23 20:58	06:14 19:54	07:04 18:44	06:59 16:37	15:53-16:06/13 07:37-07:55/18
2	04:46 21:30	05:24 20:56	06:15 19:52	07:06 18:41	07:01 16:35	15:54-16:04/10 07:40-07:52/12
3	04:47 21:30	05:26 20:54	06:17 19:50	07:07 18:39	07:02 16:33	15:56-16:02/6 15:54
4	04:48 21:29	05:28 20:52	06:19 19:48	07:09 18:37	07:04 16:31	07:55 09:09-09:42/33 15:53
5	04:48 21:29	05:29 20:51	06:20 19:45	07:11 18:34	07:06 16:29	07:56 09:10-09:43/33 15:53
6	04:49 21:28	05:31 20:49	06:22 19:43	07:12 18:32	07:08 16:27	07:58 09:10-09:43/33 15:52
7	04:50 21:28	05:32 20:47	06:24 19:41	07:14 18:30	07:10 16:26	07:59 13:30-13:36/6 15:52 09:10-09:43/33
8	04:51 21:27	05:34 20:45	06:25 19:38	07:16 18:28	07:12 16:24	08:00 10:15-10:21/6 09:11-09:44/33 15:51 13:29-13:40/11
9	04:52 21:26	05:36 20:43	06:27 19:36	07:18 18:25	07:13 16:22	08:01 10:13-10:23/10 09:11-09:44/33 15:51 13:28-13:41/13
10	04:53 21:25	05:37 20:41	06:29 19:34	07:20 18:23	07:15 16:21	08:03 10:12-10:25/13 09:11-09:44/33 15:51 13:27-13:42/15
11	04:54 21:25	05:39 20:39	06:30 19:31	07:21 18:21	07:17 16:19	08:04 10:12-10:26/14 09:11-09:45/34 15:51 13:26-13:43/17
12	04:55 21:24	05:40 20:37	06:32 19:29	07:23 18:18	07:19 16:17	08:05 10:11-10:27/16 09:12-09:45/33 15:51 13:26-13:44/18
13	04:56 21:23	05:42 20:35	06:34 19:26	07:25 18:16	07:21 16:16	08:06 10:11-10:28/17 09:12-09:46/34 15:50 13:26-13:45/19
14	04:58 21:22	05:44 20:33	06:35 19:24	07:26 18:14	07:23 16:14	08:07 10:11-10:29/18 09:12-09:46/34 15:50 13:26-13:46/20
15	04:59 21:21	05:45 20:31	06:37 19:22	07:28 18:12	07:24 16:13	08:08 10:11-10:30/19 09:13-09:47/34 15:50 13:26-13:47/21
16	05:00 21:20	05:47 20:29	06:39 19:19	07:30 18:10	07:26 16:11	08:09 10:11-10:31/20 09:14-09:47/33 15:51 13:26-13:48/22
17	05:01 21:19	05:49 20:27	06:40 19:17	07:32 18:07	07:28 16:10	08:09 10:12-10:32/20 09:14-09:48/34 15:51 13:27-13:49/22
18	05:03 21:18	05:50 20:25	06:42 19:15	07:33 18:05	07:30 16:09	09:19-09:22/3 08:10 10:12-10:33/21 09:15-09:48/33 15:51 13:27-13:50/23
19	05:04 21:16	05:52 20:23	06:44 19:12	07:35 18:03	07:31 16:07	16:57-17:08/11 09:15-09:27/12 08:11 10:12-10:33/21 09:15-09:48/33 15:51 13:27-13:50/23
20	05:05 21:15	05:54 20:21	06:45 19:10	07:37 18:01	07:33 16:06	16:55-17:10/15 08:30-09:05/35 09:12-09:28/16 08:12 10:13-10:34/21 09:16-09:49/33 15:52 13:28-13:51/23
21	05:07 21:14	05:55 20:19	06:47 19:07	07:39 17:59	07:35 16:05	16:53-17:12/19 08:30-09:05/35 09:11-09:30/19 08:12 10:14-10:35/21 09:17-09:50/33 15:52 13:29-13:52/23
22	05:08 21:13	05:57 20:17	06:49 19:05	07:41 17:57	07:37 16:04	16:51-17:12/21 08:30-09:05/35 09:10-09:32/22 08:13 10:14-10:35/21 09:17-09:50/33 15:52 13:29-13:52/23
23	05:09 21:11	05:59 20:15	06:50 19:03	07:42 17:54	07:38 16:02	16:51-17:12/21 08:29-09:03/34 09:10-09:33/23 08:13 10:14-10:35/21 09:17-09:50/33 15:53 13:29-13:52/23
24	05:11 21:10	06:00 20:12	06:52 19:00	07:44 17:52	07:40 16:01	16:50-17:13/23 08:30-09:03/33 09:09-09:35/26 08:14 10:15-10:36/21 09:18-09:51/33 15:54 13:30-13:53/23
25	05:12 21:09	06:02 20:10	06:54 18:58	07:46 16:50	07:41 16:00	16:50-16:13/23 07:30-08:03/33 09:09-09:36/27 08:14 10:15-10:36/21 09:18-09:51/33 15:54 13:30-13:53/23
26	05:14 21:07	06:04 20:08	06:55 18:56	07:48 16:48	07:43 15:59	16:50-16:13/23 07:30-08:02/32 09:08-09:36/28 08:14 10:16-10:36/20 09:18-09:52/34 15:55 13:31-13:53/22
27	05:15 21:06	06:05 20:06	06:57 18:53	07:50 16:46	07:45 15:58	16:50-16:13/23 07:31-08:02/31 09:08-09:37/29 08:15 10:16-10:36/20 09:18-09:52/34 15:56 13:31-13:53/22
28	05:17 21:04	06:07 20:03	06:59 18:51	07:51 16:44	07:46 15:57	16:50-16:12/22 07:32-08:01/29 09:09-09:38/29 08:15 10:18-10:37/19 09:20-09:53/33 15:56 13:32-13:53/21
29	05:18 21:03	06:09 20:01	07:00 18:49	07:53 16:42	07:48 15:57	16:50-16:12/22 07:33-08:00/27 09:08-09:38/30 08:15 10:19-10:37/18 09:20-09:54/34 15:57 13:34-13:54/20
30	05:20 21:01	06:10 19:59	07:02 18:46	07:55 16:40	07:49 15:56	15:51-16:10/19 07:34-07:58/24 09:08-09:39/31 08:15 10:19-10:36/17 09:20-09:53/33 15:58 13:34-13:53/19
31	05:21 20:59	06:12 19:57	07:03 18:44	07:56 16:38	07:50 15:55	15:52-16:08/16 07:35-07:57/22 09:09-09:39/31 08:15 10:20-10:36/16 09:20-09:54/34 15:59 13:35-13:53/18
	Sonnenscheinstunden	505	455	381	331	264
	Anzahl Minuten mit Schatten	0	0	0	870	354
						1949

**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:  
**R-2-2023-0060**

 Lizenzierter Anwender:  
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 Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
 Berechnet:  
 04.09.2023 13:15/3.6366

**SHADOW - Kalender pro WEA**
**Berechnung:** WEA\_GB **WEA:** WEA2 - WEA2, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

- 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	08:15 08:57-09:20/23	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51 15:06-15:21/15				
	16:01	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44	16:37	15:55 08:42-09:09/27				
2	08:15 08:57-09:21/24	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:06	07:01	07:52 15:06-15:20/14				
	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54 08:42-09:08/26				
3	08:15 15:25-15:27/2	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54 15:08-15:20/12				
	16:03 08:58-09:22/24	16:53	17:46	19:41	20:33	21:18	21:30	20:54	19:50	18:39	16:33	15:54 08:43-09:09/26				
4	08:15 15:25-15:28/5	07:42	06:46	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:04	07:55 15:08-15:18/10				
	16:04 08:58-09:23/24	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:48	18:37	16:31	15:53 08:43-09:09/26				
5	08:14 15:25-15:30/5	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:06	07:56 15:10-15:18/8				
	16:05 08:58-09:23/25	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:53 08:44-09:10/26				
6	08:14 15:24-15:31/7	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58 15:10-15:17/7				
	16:06 08:58-09:23/25	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52 08:44-09:10/26				
7	08:14 15:24-15:33/9	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59 15:11-15:16/5				
	16:08 08:59-09:25/26	17:01	17:53	19:48	20:39	21:22	21:28	20:47	19:41	18:30	16:26	15:52 08:44-09:09/25				
8	08:13 15:24-15:34/10	07:36	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:12	08:00 15:13-15:17/4				
	16:09 08:59-09:25/26	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	16:24	15:51 08:46-09:10/24				
9	08:13 15:24-15:35/11	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:13	08:01 15:14-15:16/2				
	16:10 08:59-09:25/26	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51 08:46-09:10/24				
10	08:12 15:23-15:37/14	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:03 08:46-09:10/24				
	16:12 09:00-09:26/26	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:34	18:23	16:21	15:51				
11	08:11 15:24-15:39/15	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:04 08:47-09:10/23				
	16:13 09:00-09:27/27	17:08	18:00	19:55	20:46	21:26	21:25	20:39	19:31	18:21	16:19	15:51				
12	08:11 15:24-15:41/17	07:28	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05 08:47-09:11/24				
	16:15 09:00-09:27/27	17:10	18:02	19:56	20:48	21:28	21:24	20:37	19:29	18:18	16:17	15:51				
13	08:10 15:24-15:42/18	07:26	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:06 08:48-09:11/23				
	16:16 09:00-09:27/27	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50				
14	08:09 15:24-15:44/20	07:24	06:23	06:11	05:12	04:42	04:58	05:44	06:35	07:26	07:23	08:07 08:49-09:11/22				
	16:18 09:01-09:28/27	17:14	18:05	20:00	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50				
15	08:08 15:24-15:44/20	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	15:06-15:15/9				
	16:19 09:01-09:28/27	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	16:10	08:08 08:49-09-11/22				
16	08:08 15:25-15:45/20	07:20	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:26	15:05-15:17/12				
	16:21 09:01-09:28/27	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:10	16:11	08:04-08:58/14				
17	08:07 15:25-15:45/20	07:18	06:16	06:05	05:07	04:41	05:01	05:49	06:40	07:32	07:28	15:04-15:18/14				
	16:23 09:02-09:29/27	17:20	18:11	20:05	20:56	21:29	21:19	20:27	19:17	18:07	16:10	08:05-09-12/21				
18	08:06 15:25-15:46/21	07:16	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:30	15:03-15:20/17				
	16:24 09:03-09-29/26	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	16:09	08:42-09-01/19				
19	08:05 15:25-15:45/20	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	15:03-15:21/18				
	16:26 09:03-09-29/25	17:23	18:14	20:08	20:59	21:30	21:16	20:23	19:12	18:03	16:07	08:41-09-02/21				
20	08:04 15:26-15:46/20	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	15:02-15:20/18				
	16:28 09:04-09-28/24	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	08:40-09-02/22				
21	08:02 15:27-15:46/19	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35	15:02-15:21/19				
	16:29 09:05-09-28/23	17:27	18:18	20:12	21:02	21:31	21:14	20:19	19:07	17:59	16:05	08:40-09-03/23				
22	08:01 15:27-15:45/18	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:36	15:02-15:22/20				
	16:31 09:06-09-28/22	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	08:40-09-04/24				
23	08:00 15:28-15:46/18	07:06	06:02	05:52	04:59	04:42	05:09	05:59	06:50	07:42	07:38	15:02-15:22/20				
	16:33 09:06-09-27/21	17:31	18:21	20:15	21:04	21:31	21:11	20:15	19:03	17:54	16:02	08:40-09-05/25				
24	07:59 15:29-15:46/17	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	15:02-15:23/21				
	16:35 09:08-09-27/19	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	08:40-09-06/26				
25	07:57 15:30-15:44/14	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	15:03-15:23/20				
	16:36 09:09-09-26/17	17:35	18:25	20:19	21:07	21:31	21:09	20:10	19:00	17:52	16:00	08:40-09-07/27				
26	07:56 15:32-15:44/12	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	15:03-15:23/20				
	16:38 09:11-09-25/14	17:36	18:27	20:21	21:09	21:31	21:07	20:08	18:56	17:48	15:59	08:40-09-06/26				
27	07:55 15:33-15:42/9	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	15:03-15:23/20				
	16:40 09-13-09-22/9	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	17:46	15:58	08:40-09-07/27				
28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	06:51	07:46	15:04-15:24/20				
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	17:44	15:57	08:41-09-08/27				
29	07:52	06:48	05:39	05:32	04:44	04:38	05:18	06:09	07:00	06:53	07:48	15:04-15:22/18				
	16:44	17:42	18:32	20:26	21:12	21:31	21:03	20:01	18:49	17:42	15:57	08:40-09-07/27				
30	07:50	06:46	05:37	05:31	04:51	04:45	05:20	06:10	07:02	06:55	07:49	15:05-15:22/17				
	16:45	17:43	18:33	20:27	21:14	21:31	21:01	19:59	18:46	17:40	15:56	08:41-09-08/27				
31	07:49	06:43	05:34	05:30	04:50	04:45	05:21	06:12	07:04	06:57	07:49	15:05-15:21/17				
	16:47	17:45	18:35	20:29	21:15	21:31	21:01	19:59	18:46	17:40	15:56	08:41-09-08/27				
												15:59				
Sonnenscheinstunden	256	276	0	1417	0	487	0	505	0	455	0	331	0	264	644	785
Anzahl Minuten mit Schatten	997	0	367	0	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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA :** WEA3 - WEA3, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

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	08:15 09:18-09:33/15 16:01	07:47 17:42 16:49	06:53 17:37 16:51	06:41 19:37 16:39	05:35 20:29 16:39	04:49 21:16 16:30	04:45 21:30 16:24	05:23 20:58 19:54	06:14 18:44 18:44	07:04 16:37 18:44	06:59 16:37 18:44	07:51 15:55 18:44
2	08:15 09:19-09:33/14 16:02	07:46 17:41 16:51	06:51 17:44 16:44	06:39 19:39 16:36	05:33 20:31 16:28	04:48 21:17 16:19	04:46 21:30 16:14	05:24 20:56 19:52	06:15 18:41 18:41	07:06 16:35 18:41	07:01 16:35 18:41	07:52 15:54 18:41
3	08:15 09:21-09:34/13 16:03	07:44 17:46 16:53	06:48 19:41 17:46	06:36 20:33 19:41	05:31 21:18 20:33	04:47 21:30 21:18	04:47 21:30 21:30	05:25 20:54 19:50	06:17 18:39 19:50	07:07 16:33 18:39	07:02 16:33 18:39	07:54 15:54 18:39
4	08:15 09:21-09:33/12 16:04	07:42 17:47 16:55	06:46 19:42 17:47	06:34 20:34 19:42	05:29 21:19 20:34	04:46 21:29 21:19	04:48 21:29 21:29	05:28 20:52 19:48	06:19 18:37 19:48	07:09 16:31 18:37	07:04 16:31 18:37	07:55 15:53 18:37
5	08:14 09:23-09:33/10 16:05	07:41 17:49 16:57	06:44 19:44 17:49	06:32 20:36 19:44	05:27 21:20 20:36	04:46 21:29 21:20	04:48 21:29 21:29	05:29 20:51 19:45	06:20 18:34 19:45	07:11 16:29 18:34	07:06 16:29 18:34	07:56 15:53 18:34
6	08:14 09:23-09:32/9 16:06	07:39 17:51 16:59	06:42 19:46 17:51	06:29 20:38 19:46	05:26 21:21 20:38	04:45 21:28 21:21	04:49 21:28 21:28	05:31 20:49 19:43	06:22 18:32 19:43	07:12 16:27 18:32	07:08 16:27 18:32	07:58 15:52 18:32
7	08:14 09:26-09:32/6 16:08	07:37 17:53 17:01	06:39 19:48 17:53	06:27 20:39 19:48	05:24 21:22 20:39	04:44 21:27 21:22	04:50 21:27 21:27	05:32 20:47 19:41	06:24 18:30 19:41	07:14 16:26 18:30	07:10 16:26 18:30	07:59 15:52 18:30
8	08:13 16:09	07:35 17:55 17:02	06:37 19:49 17:55	06:25 20:41 19:49	05:22 21:23 20:41	04:44 21:27 21:23	04:51 21:27 21:27	05:34 20:45 19:38	06:25 18:28 19:38	07:16 16:24 18:28	07:12 16:24 18:28	08:00 15:51 18:28
9	08:13 16:10	07:34 17:56 17:04	06:35 19:51 17:56	06:23 20:43 19:51	05:20 21:24 20:43	04:43 21:26 21:24	04:52 21:26 21:26	05:36 20:43 19:36	06:27 18:25 19:36	07:18 16:22 18:25	07:13 16:22 18:25	08:01 15:51 18:25
10	08:12 16:12	07:32 17:58 17:06	06:33 19:53 17:58	06:20 20:44 19:53	05:18 21:25 20:44	04:43 21:25 21:25	04:53 21:25 21:25	05:37 20:41 19:34	06:29 18:23 19:34	07:19 16:21 18:23	07:15 16:21 18:23	08:03 15:51 18:23
11	08:11 16:13	07:30 17:58 17:08	06:30 19:55 18:00	06:18 20:46 19:55	05:17 21:26 20:46	04:42 21:26 21:26	04:54 21:26 21:26	05:39 20:39 19:31	06:30 18:21 19:31	07:21 16:19 18:21	07:17 16:19 18:21	08:04 15:51 18:21
12	08:11 16:15	07:28 17:59 17:10	06:28 19:56 18:02	06:16 20:48 19:56	05:15 21:26 20:48	04:42 21:24 21:24	04:55 21:24 21:24	05:41 20:37 19:29	06:32 18:18 19:29	07:23 16:17 18:18	07:19 16:17 18:18	08:05 15:51 18:18
13	08:10 16:16	07:26 17:59 17:12	06:26 19:58 18:04	06:13 20:49 19:58	05:13 21:27 20:49	04:42 21:23 21:23	04:56 21:23 21:23	05:42 20:35 19:26	06:34 18:16 19:26	07:25 16:16 18:16	07:21 16:16 18:16	08:06 15:50 18:16
14	08:09 16:18	07:24 17:59 17:14	06:23 19:58 18:05	06:11 20:00 20:00	05:12 21:28 20:51	04:42 21:28 21:28	04:58 21:28 21:28	05:44 20:33 19:24	06:35 18:14 19:24	07:26 16:14 18:14	07:22 16:14 18:14	08:09 15:50 18:14
15	08:08 16:19	07:22 17:59 17:16	06:21 19:58 18:07	06:09 20:01 20:01	05:10 21:28 20:52	04:41 21:28 21:28	04:59 21:28 21:28	05:45 20:31 19:22	06:37 18:12 19:22	07:28 16:13 18:12	07:24 16:13 18:12	08:08 15:50 18:12
16	08:07 16:21	07:20 17:59 17:18	06:19 19:58 18:09	06:07 20:03 20:03	05:09 21:29 20:54	04:41 21:29 21:29	05:00 21:29 21:29	05:47 20:29 19:19	06:39 18:10 19:19	07:30 16:11 18:10	07:26 16:11 18:10	08:09 15:51 18:10
17	08:07 16:23	07:18 17:59 17:20	06:16 19:58 18:11	06:05 20:05 20:05	05:07 21:29 20:55	04:41 21:29 21:29	05:01 21:29 21:29	05:49 20:27 19:17	06:40 18:07 19:17	07:32 16:10 18:07	07:28 16:10 18:07	08:09 15:51 18:07
18	08:06 16:24	07:16 17:59 17:21	06:14 19:58 18:13	06:02 20:07 20:07	05:05 21:30 20:57	04:41 21:30 21:30	05:03 21:30 21:30	05:50 20:25 19:15	06:42 18:05 19:15	07:33 16:09 18:05	07:30 16:09 18:05	08:10 15:51 18:05
19	08:05 16:26	07:14 17:59 17:23	06:12 19:58 18:14	06:00 20:08 20:08	05:04 21:30 20:59	04:41 21:30 21:30	05:04 21:30 21:30	05:52 20:23 19:12	06:44 18:03 19:12	07:35 16:07 18:03	07:31 16:07 18:03	08:11 15:51 18:03
20	08:03 16:28	07:12 17:59 17:25	06:09 19:58 18:16	05:58 20:10 20:10	05:03 21:30 21:30	04:41 21:30 21:30	05:05 21:30 21:30	05:54 20:21 19:10	06:45 18:01 19:10	07:37 16:06 18:01	07:33 16:06 18:01	08:11 15:51 18:01
21	08:02 16:29	07:10 17:59 17:27	06:07 19:58 18:18	05:56 20:12 20:12	05:01 21:31 21:31	04:41 21:31 21:31	05:07 21:31 21:31	05:55 20:19 19:07	06:47 18:00 19:07	07:39 16:05 18:00	07:35 16:05 18:00	08:12 15:51 18:00
22	08:01 16:31	07:08 17:59 17:29	06:05 19:58 18:20	05:54 20:14 20:14	05:00 21:31 21:31	04:41 21:31 21:31	05:08 21:31 21:31	05:57 20:17 19:05	06:49 18:00 19:05	07:41 16:04 18:00	07:37 16:04 18:00	08:13 15:51 18:00
23	08:00 16:33	07:06 17:59 17:31	06:02 19:58 18:21	05:52 20:15 20:15	04:59 21:31 21:31	04:42 21:31 21:31	05:09 21:31 21:31	05:59 20:15 19:03	06:50 18:00 17:54	07:42 16:03 18:00	07:38 16:03 18:00	08:14 15:51 18:00
24	07:59 16:35	07:04 17:59 17:33	06:00 19:58 18:23	05:49 20:17 20:17	04:57 21:31 21:31	04:42 21:31 21:31	05:11 21:31 21:31	06:00 20:12 19:00	06:52 18:00 17:52	07:44 16:01 18:00	07:40 16:01 18:00	08:14 15:51 18:00
25	07:57 16:36	07:02 17:59 17:35	05:58 19:58 18:25	05:47 20:19 20:19	04:56 21:31 21:31	04:42 21:31 21:31	05:12 21:31 21:31	06:02 20:10 18:58	06:54 18:00 16:50	07:41 16:00 18:00	07:41 16:00 18:00	08:14 15:51 18:00
26	07:56 16:38	06:59 17:59 17:36	05:55 19:58 18:27	05:45 20:21 20:21	04:55 21:31 21:31	04:43 21:31 21:31	05:14 21:31 21:31	06:04 20:08 18:56	06:55 18:00 16:48	07:43 16:00 18:00	07:43 16:00 18:00	08:14 15:51 18:00
27	07:55 16:40	06:57 17:59 17:38	05:53 19:58 18:28	05:43 20:22 20:22	04:54 21:31 21:31	04:43 21:31 21:31	05:15 21:31 21:31	06:05 20:06 18:53	06:57 18:00 16:46	07:45 16:00 18:00	07:45 16:00 18:00	08:15 15:51 18:00
28	07:53 16:42	06:55 17:59 17:40	05:50 19:58 18:30	05:41 20:24 20:24	04:53 21:31 21:31	04:44 21:31 21:31	05:17 21:31 21:31	06:07 20:03 18:51	06:59 18:00 16:44	07:46 16:00 18:00	07:46 16:00 18:00	08:15 15:51 18:00
29	07:52 16:44	06:48 17:59 19:32	05:48 19:58 20:26	05:39 20:26 20:26	04:52 21:31 21:31	04:44 21:31 21:31	05:18 21:31 21:31	06:09 20:01 18:49	07:00 18:00 16:42	07:48 16:00 18:00	07:48 16:00 18:00	08:15 15:51 18:00
30	07:50 16:45	06:46 17:59 19:34	05:46 19:58 20:27	05:37 20:27 20:27	04:51 21:31 21:31	04:45 21:31 21:31	05:20 21:31 21:31	06:10 20:00 18:46	07:02 18:00 16:40	07:50 16:00 18:00	07:50 16:00 18:00	08:15 15:51 18:00
31	07:49 16:47	06:43 17:59 19:35	05:43 19:58 20:35	05:35 20:27 20:27	04:50 21:31 21:31	04:50 21:31 21:31	05:21 21:31 21:31	06:12 20:59 19:57	18:46 18:00 16:38	07:57 16:00 18:00	07:57 16:00 18:00	08:15 15:51 18:00
	257	276	367	417	487	502	505	455	381	331	264	241
Sonnenscheinstunden												
Anzahl Minuten mit Schatten	79		0	0	0	0	0	0	0	0	0	413

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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+49 5971 9710-31  
Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

### SHADOW - Kalender pro WEA

**Berechnung:** WEA\_GB WEA: WEA4 - WEA4, Enron Wind EW 1.5 sl

#### Annahmen für Schattenwurfberechnung

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	08:15	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51
	16:01	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44	16:37	15:55
2	08:15	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:06	07:01	07:52
	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54
3	08:15	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54
	16:03	16:53	17:46	19:41	20:33	21:18	21:30	20:54	19:50	18:39	16:33	15:54
4	08:14	07:42	06:46	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:04	07:55
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53
5	08:14	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:06	07:56
	16:05	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:53
6	08:14	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58
	16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52
7	08:13	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59
	16:08	17:01	17:53	19:48	20:39	21:22	21:27	20:47	19:41	18:30	16:26	15:52
8	08:13	07:35	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:12	08:00
	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	16:24	15:51
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:13	08:01
	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51
10	08:12	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:03
	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:21	15:51
11	08:11	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:04
	16:13	17:08	18:00	19:55	20:46	21:26	21:25	20:39	19:31	18:21	16:19	15:51
12	08:11	07:28	06:28	06:16	05:15	04:42	04:55	05:41	06:32	07:23	07:19	08:05
	16:15	17:10	18:02	19:56	20:48	21:26	21:24	20:37	19:29	18:18	16:17	15:51
13	08:10	07:26	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:06
	16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50
14	08:09	07:24	06:23	06:11	05:12	04:42	04:58	05:44	06:35	07:26	07:22	08:07
	16:18	17:14	18:05	20:00	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50
15	08:08	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:08
	16:19	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	16:13	15:50
16	08:07	07:20	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:26	08:09
	16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:10	16:11	15:51
17	08:07	07:18	06:16	06:05	05:07	04:41	05:01	05:49	06:40	07:32	07:28	08:09
	16:23	17:20	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51
18	08:06	07:16	06:14	06:02	05:06	04:41	05:03	05:50	06:42	07:33	07:30	08:10
	16:24	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	16:09	15:51
19	08:05	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	08:11
	16:26	17:23	18:14	20:08	20:59	21:30	21:16	20:23	19:12	18:03	16:07	15:51
20	08:03	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	08:11
	16:28	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:52
21	08:02	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35	08:12
	16:29	17:27	18:18	20:12	21:01	21:31	21:14	20:19	19:07	17:59	16:05	15:52
22	08:01	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:36	08:13
	16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	15:53
23	08:00	07:06	06:02	05:52	04:59	04:42	05:09	05:59	06:50	07:42	07:38	08:13
	16:33	17:31	18:21	20:15	21:04	21:31	21:11	20:15	19:03	17:54	16:02	15:53
24	07:59	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:14
	16:35	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:54
25	07:57	07:02	05:58	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:14
	16:36	17:35	18:25	20:19	21:07	21:31	21:09	20:10	18:58	16:50	16:00	15:54
26	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14
	16:38	17:36	18:27	20:21	21:09	21:31	21:07	20:08	18:56	16:48	15:59	15:55
27	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	08:15
	16:40	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	16:46	15:58	15:56
28	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:58	15:56
29	07:52		06:48	05:39	04:52	04:44	05:18	06:09	07:00	07:53	07:48	08:15
	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:49	16:42	15:57	15:57
30	07:50		06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:15
	16:45		19:34	20:27	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:58
31	07:49		06:43		04:50		05:21	06:12		06:57		08:15
	16:47		19:35		21:15		20:59	19:57		16:38		15:59
Sonnenscheinstunden	257	276	367	417	487	502	505	455	381	331	264	241
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)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA5 - WEA5, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

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	08:15 09:05-09:23/18	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:5907:35-07:52/17	07:5108:55-09:06/11
2	16:0108:47-08:56/7	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44	16:36	15:5308:29-08:45/16
3	08:1309:05-09:23/18	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:06	07:0107:35-07:52/17	07:5208:54-09:06/12
4	16:0208:47-08:55/8	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:5408:29-08:45/16
5	08:1309:06-09:24/18	07:4408:11-08:16/5	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:0207:35-07:52/17	07:5408:54-09:08/14
6	16:0308:47-08:57/10	16:53	17:46	19:41	20:33	21:18	21:30	20:54	19:50	18:39	16:33	15:5408:30-08:45/15
7	08:1309:06-09:24/18	07:4208:09-08:19/10	06:46	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:0407:36-07:52/16	07:5508:54-09:08/14
8	16:0408:46-08:57/11	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:5308:30-08:45/15
9	08:1409:08-09:24/16	07:4108:08-08:21/13	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:0607:37-07:51/14	07:5608:54-09:10/16
10	16:0508:46-08:58/12	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:5308:31-08:45/14
11	08:1409:08-09:24/16	07:3908:07-08:21/14	06:42	06:29	05:26	04:45	04:49	05:21	06:22	07:12	07:0008:38-07:50/12	07:5808:54-09:10/16
12	16:0608:46-08:59/13	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:5208:32-08:45/13
13	08:1309:09-09:25/16	07:3708:06-08:22/16	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:1007:39-07:49/10	07:5908:54-09:10/16
14	16:0808:46-09:00/14	17:01	17:53	19:48	20:39	21:22	21:27	20:47	19:41	18:30	16:26	15:5208:32-08:45/13
15	08:1309:10-09:24/14	07:3508:06-08:23/17	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:1207:42-07:46/4	08:0008:55-09:12/17
16	16:0908:46-09:01/15	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	16:24	15:5108:34-08:45/11
17	08:1308:10-09:24/14	07:3408:05-08:23/18	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:13	08:0108:55-09:12/17
18	16:1008:46-09:01/15	17:04	17:56	19:51	20:43	21:34	21:36	20:43	19:36	18:25	16:20	15:5108:35-08-45/10
19	08:1209:12-09:24/12	07:3208:05-08:23/18	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:0308:55-09-12/17
20	16:1108:47-09:03/16	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:21	15:5108:36-08-44/8
21	08:1109:13-09:24/11	07:3008:06-08-22/16	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:0408:55-09-13/18
22	16:1308:47-09-03/16	17:08	18:00	19:54	20:46	21:26	21:25	20:39	19:31	18:21	16:19	15:5108:37-08-44/7
23	08:1109:14-09-23/9	07:2808:06-08-22/16	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19	08:0508:55-09-13/18
24	16:1508:47-09-04/17	17:10	18:02	19:56	20:48	21:26	21:24	20:37	19:29	18:18	16:17	15:5008:38-08-43/5
25	08:1009:17-09-21/4	07:2608:07-08-21/14	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:21	08:0608:55-09-14/19
26	16:1608:47-09-04/17	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:5008:40-08-42/2
27	08:0908:47-09-04/17	07:2408:08-08-20/12	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22	08:0708:56-09-14/18
28	16:18	17:14	18:05	20:00	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50
29	15:0808:47-09-05/18	07:2208:10-08-18/8	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24	08:0808:56-09-15/19
30	16:19	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	16:13	15:50
31	08:0708:48-09-05/17	07:20	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:26	08:0908:57-09-15/18
32	16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:10	16:11	15:51
33	08:0708:48-09-06/18	07:18	06:16	06:05	05:07	04:41	05:01	05:49	06:40	07:32	07:28	08:0908:57-09-16/19
34	16:22	17:20	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51
35	08:0808:49-09-06/17	07:16	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:30	08:1008:58-09-17/19
36	16:24	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	16:09	15:51
37	08:0508:49-09-05/16	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31	08:1108:58-09-17/19
38	16:26	17:23	18:14	20:08	20:59	21:30	21:16	20:23	19:12	18:03	16:07	15:51
39	08:0308:50-09-05/15	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33	08:1108:59-09-17/18
40	16:28	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:52
41	08:0208:51-09-05/14	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35	08:1209:00-09-18/18
42	16:29	17:27	18:18	20:12	21:02	21:31	21:14	20:19	19:07	17:59	16:05	15:52
43	08:0108:53-09-05/12	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:36	08:1309:00-09-18/18
44	16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	15:52
45	08:0008:53-09-03/10	07:06	06:02	05:52	04:59	04:42	05:09	05:59	06:50	07:42	07:38	08:1309:00-09-18/18
46	16:33	17:31	18:24	20:17	21:06	21:33	21:11	20:15	19:03	17:54	16:02	15:53
47	07:5908:56-09-02/6	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40	08:1409:01-09-20/19
48	16:35	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:54
49	07:57	07:02	06:57	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:1408:56-09-04/8
50	16:36	17:34	18:25	20:19	21:07	21:31	21:09	20:10	18:58	16:50	16:00	15:54
51	07:56	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:1409:01-09-20/19
52	16:38	17:36	18:27	20:21	21:09	21:31	21:07	20:08	18:56	16:48	16:00	15:55
53	07:55	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	08:1509:02-09-20/18
54	16:40	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	16:46	16:00	15:56
55	07:53	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:53	07:48	08:1509:03-09-22/19
56	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	16:00	15:56
57	07:52	06:54	06:48	05:39	04:52	04:44	05:18	06:09	07:00	07:53	07:48	08:1509:04-09-22/18
58	16:44	17:42	18:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	16:00	15:57
59	07:50	06:52	06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:1509:03-09-21/18
60	16:45	17:43	18:34	20:27	21:14	21:31	21:01	19:59	18:46	16:40	16:00	15:58
61	07:49	06:51	06:43	05:32	04:50	04:44	05:21	06:12	07:04	07:57	07:51	08:1509:04-09-22/18
62	16:47	17:45	18:35	20:29	21:15	21:31	21:00	19:57	18:44	16:38	16:00	15:59
63	Sonnenscheinstunden	256										
64	Anzahl Minuten mit Schatten	515	177	0	0	0	0	0	381	0	311	241

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Berechnet:  
04.09.2023 13:15/3.6366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB WEA : WEA6 - WEA6, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

- 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	08:15 09:00-09:11/11	07:47	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51			
	16:01	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44	16:36	15:55			
2	08:15 09:01-09:11/10	07:46	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:06	07:01	07:52			
	16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	16:35	15:54			
3	08:15 09:02-09:11/9	07:44	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54			
	16:03	16:53	17:46	19:41	20:33	21:18	21:30	20:54	19:50	18:39	16:33	15:54			
4	08:14 09:02-09:11/9	07:42	06:46	06:34	05:29	04:46	04:48	05:28	06:19	07:09	07:04	07:55			
	16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	16:31	15:53			
5	08:14 09:04-09:11/7	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:06	07:56			
	16:05	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	16:29	15:53			
6	08:14 09:05-09:09/4	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58 08:51-08:55/4			
	16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	16:27	15:52			
7	08:13	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59 08:50-08:57/7			
	16:08	17:01	17:53	19:48	20:39	21:22	21:27	20:47	19:41	18:30	16:26	15:52			
8	08:13	07:35	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:12	08:00 08:50-08:59/9			
	16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	16:24	15:51			
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:13	08:01 08:50-08:59/9			
	16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:25	16:22	15:51			
10	08:12	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:15	08:03 08:50-09:00/10			
	16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	16:21	15:51			
11	08:11	07:30	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:17	08:04 08:50-09:01/11			
	16:13	17:08	18:00	19:54	20:46	21:26	21:25	20:39	19:31	18:21	16:19	15:51			
12	08:11	07:28	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:19 08:04-08:12/8	08:05 08:50-09:01/11			
	16:15	17:10	18:02	19:56	20:48	21:28	21:24	20:37	19:29	18:18	16:17	15:50			
13	08:10	07:26	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:21 08:03-08:13/10	08:06 08:50-09:02/12			
	16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	16:16	15:50			
14	08:09	07:24	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:22 08:02-08:14/12	08:07 08:50-09:03/13			
	16:18	17:14	18:05	20:00	20:51	21:28	21:22	20:33	19:24	18:14	16:14	15:50			
15	08:08	07:22	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:24 08:02-08:15/13	08:08 08:51-09:03/12			
	16:19	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	16:13	15:50			
16	08:07	07:20	06:19	06:07	05:09	04:41	05:00	05:47	06:39	07:30	07:26 08:02-08:16/14	08:09 08:51-09:04/13			
	16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:10	16:11	15:51			
17	08:07	07:18	06:16	06:05	05:07	04:41	05:01	05:49	06:40	07:32	07:28 08:02-08:16/14	08:09 08:52-09:05/13			
	16:22	17:20	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	16:10	15:51			
18	08:06 08:35-08:37/2	07:16	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:30 08:02-08:16/14	08:10 08:52-09:05/13			
	16:24	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	16:09	15:51			
19	08:05 08:33-08:38/5	07:14	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:31 08:03-08:17/14	08:11 08:52-09:05/13			
	16:26	17:23	18:14	20:08	20:59	21:30	21:16	20:23	19:12	18:03	16:07	15:51			
20	08:03 08:32-08:39/7	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:33 08:04-08:16/12	08:11 08:53-09:06/13			
	16:28	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	16:06	15:52			
21	08:02 08:31-08:41/10	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:35 08:06-08:16/10	08:12 08:54-09:07/13			
	16:29	17:27	18:18	20:12	21:01	21:31	21:14	20:19	19:07	17:59	16:05	15:52			
22	08:01 08:30-08:42/12	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:36 08:08-08:16/8	08:13 08:54-09:07/13			
	16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	15:52			
23	08:00 08:28-08:42/14	07:06	06:02	05:52	04:59	04:42	05:09	05:59	06:50	07:42	07:38 08:10-08:15/5	08:13 08:54-09:07/13			
	16:33	17:31	18:21	20:15	21:04	21:31	21:11	20:14	19:03	17:54	16:02	15:53			
24	07:59 08:28-08:42/14	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:44	07:40 08:12-08:15/3	08:14 08:55-09:08/13			
	16:35	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:54			
25	07:57 08:28-08:42/14	07:02	05:57	05:47	04:56	04:42	05:12	06:02	06:54	07:46	07:41	08:14 08:55-09:08/13			
	16:36	17:34	18:25	20:19	21:07	21:31	21:09	20:10	18:58	17:50	16:00	15:54			
26	07:56 08:29-08:43/14	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:48	07:43	08:14 08:56-09:09/13			
	16:38	17:36	18:27	20:21	21:09	21:31	21:07	20:08	18:56	17:48	15:59	15:55			
27	07:55 08:29-08:42/13	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:50	07:45	08:15 08:56-09:09/13			
	16:40	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	17:46	15:58	15:56			
28	07:53 08:30-08:42/12	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:51	07:46	08:15 08:57-09:10/13			
	16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	17:44	15:57	15:57			
29	07:52 08:31-08:41/10		06:48	05:39	04:52	04:44	05:18	06:09	07:00	07:53	07:48	08:15 08:58-09:10/12			
	16:44		19:32	20:26	21:12	21:31	21:02	20:01	18:48	17:42	15:57	15:57			
30	07:50 08:32-08:40/8		06:46	05:37	04:51	04:45	05:20	06:10	07:02	07:55	07:49	08:15 08:58-09:10/12			
	16:45		19:34	20:27	21:14	21:31	21:01	19:59	18:46	17:40	15:56	15:58			
31	07:49		06:43		04:50		05:21	06:12			06:57				
	16:47		19:35		21:15		20:59	19:57			16:38				
Sonnenscheinstunden	257	276	0	417	0	487	0	505	455	0	331	0	264	137	241
Anzahl Minuten mit Schatten	185	0	367	0	487	0	505	455	0	331	0	264	137	241	303

**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:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Kalender pro WEA**

**Berechnung:** WEA\_GB **WEA:** WEA7 - WEA7, Enron Wind EW 1.5 sl

**Annahmen für Schattenwurfberechnung**

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	08:15	07:4708:22-08:32/10	06:53	06:41	05:35	04:49	04:45	05:23	06:14	07:04	06:59	07:51			
16:00	16:49	17:42	19:37	20:29	21:16	21:30	20:58	19:54	18:44	17:36	16:36	15:35			
2	08:15	07:4608:23-08:31/8	06:51	06:39	05:33	04:48	04:46	05:24	06:15	07:05	07:01	07:52			
16:02	16:51	17:44	19:39	20:31	21:17	21:30	20:56	19:52	18:41	17:35	16:35	15:34			
3	08:15	07:4408:25-08:28/3	06:48	06:36	05:31	04:47	04:47	05:26	06:17	07:07	07:02	07:54			
16:03	16:53	17:46	19:41	20:33	21:18	21:30	20:54	19:50	18:39	17:33	16:33	15:34			
4	08:14	07:42	06:46	06:34	05:29	04:46	04:48	05:27	06:19	07:09	07:04	07:55			
16:04	16:55	17:47	19:42	20:34	21:19	21:29	20:52	19:47	18:37	17:31	16:31	15:33			
5	08:14	07:41	06:44	06:32	05:27	04:46	04:48	05:29	06:20	07:11	07:06	07:56			
16:05	16:57	17:49	19:44	20:36	21:20	21:29	20:51	19:45	18:34	17:28	16:29	15:33			
6	08:14	07:39	06:42	06:29	05:26	04:45	04:49	05:31	06:22	07:12	07:08	07:58			
16:06	16:59	17:51	19:46	20:38	21:21	21:28	20:49	19:43	18:32	17:27	16:27	15:32			
7	08:13	07:37	06:39	06:27	05:24	04:44	04:50	05:32	06:24	07:14	07:10	07:59			
16:08	17:00	17:53	19:48	20:39	21:22	21:27	20:47	19:40	18:30	17:26	16:26	15:32			
8	08:13	07:35	06:37	06:25	05:22	04:44	04:51	05:34	06:25	07:16	07:1207:56-08:00/4	08:00			
16:09	17:02	17:55	19:49	20:41	21:23	21:27	20:45	19:38	18:28	17:24	16:24	15:31			
9	08:13	07:34	06:35	06:23	05:20	04:43	04:52	05:36	06:27	07:18	07:1307:54-08:02/8	08:01			
16:10	17:04	17:56	19:51	20:43	21:24	21:26	20:43	19:36	18:29	17:22	16:22	15:31			
10	08:12	07:32	06:33	06:20	05:18	04:43	04:53	05:37	06:29	07:19	07:1507:53-08:03/10	08:03			
16:12	17:06	17:58	19:53	20:44	21:25	21:25	20:41	19:33	18:23	17:17	16:21	15:31			
11	08:11	07:3007:55-07:57/2	06:30	06:18	05:17	04:42	04:54	05:39	06:30	07:21	07:1707:52-08:04/12	08:04			
16:13	17:08	18:00	19:54	20:46	21:26	21:25	20:39	19:31	18:21	17:16	16:19	15:31			
12	08:11	07:2807:53-07:59/6	06:28	06:16	05:15	04:42	04:55	05:40	06:32	07:23	07:1907:52-08:05/13	08:05			
16:15	17:10	18:02	19:56	20:48	21:26	21:24	20:37	19:29	18:18	17:14	16:17	15:30			
13	08:10	07:2607:51-07:59/8	06:26	06:13	05:13	04:42	04:56	05:42	06:34	07:25	07:2107:52-08:05/13	08:0609:14-09:19/5			
16:16	17:12	18:04	19:58	20:49	21:27	21:23	20:35	19:26	18:16	17:11	16:14	15:30			
14	08:0908:39-08:41/2	07:2407:49-08:00/11	06:23	06:11	05:12	04:41	04:58	05:44	06:35	07:26	07:2207:53-08:05/12	08:0709:14-09:20/6			
16:18	17:14	18:05	20:00	20:51	21:28	21:22	20:33	19:24	18:14	17:10	16:14	15:30			
15	08:0808:38-08:43/5	07:2207:47-08:00/13	06:21	06:09	05:10	04:41	04:59	05:45	06:37	07:28	07:2408:11-08:17/6	08:0809:14-09:21/7			
16:19	17:16	18:07	20:01	20:52	21:28	21:21	20:31	19:22	18:12	17:10	16:1707:55-08:05/10	15:50			
16	08:0708:37-08:44/7	07:2007:48-08:00/12	06:19	06:07	05:08	04:41	05:00	05:47	06:39	07:30	07:2608:10-08-20/11	08:0909:14-09:22/8			
16:21	17:18	18:09	20:03	20:54	21:29	21:20	20:29	19:19	18:09	17:10	16:1107:57-08-05/8	15:51			
17	08:0708:36-08-45/9	07:1807:48-07:59/11	06:16	06:04	05:07	04:41	05:01	05:49	06:40	07:32	07:2808:09-08-20/11	08:0909:14-09:23/9			
16:22	17:19	18:11	20:05	20:55	21:29	21:19	20:27	19:17	18:07	17:11	16:1007:59-08-04/5	15:51			
18	08:0608:35-08-46/11	07:1607:49-07:58/9	06:14	06:02	05:05	04:41	05:03	05:50	06:42	07:33	07:3008:09-08-21/12	08:1009:15-09-24/9			
16:24	17:21	18:13	20:07	20:57	21:30	21:18	20:25	19:15	18:05	17:10	16:0908:01-08-04/3	15:51			
19	08:0508:33-08-45/12	07:1407:52-07:55/3	06:12	06:00	05:04	04:41	05:04	05:52	06:44	07:35	07:3108:09-08-22/13	08:1109:14-09-24/10			
16:26	17:23	18:14	20:08	20:59	21:30	21:16	20:23	19:12	18:03	17:07	16:07	15:51			
20	08:0308:32-08-46/14	07:12	06:09	05:58	05:03	04:41	05:05	05:54	06:45	07:37	07:3308:08-08-21/13	08:1109:15-09-25/10			
16:27	17:25	18:16	20:10	21:00	21:30	21:15	20:21	19:10	18:01	17:06	16:06	15:52			
21	08:0208:33-08-47/14	07:10	06:07	05:56	05:01	04:41	05:07	05:55	06:47	07:39	07:3508:08-08-22/14	08:1209:16-09-26/10			
16:29	17:27	18:18	20:12	21:01	21:31	21:14	20:19	19:07	17:59	16:05	15:05	15:52			
22	08:0108:34-08-47/13	07:08	06:05	05:54	05:00	04:41	05:08	05:57	06:49	07:41	07:3608:08-08-22/14	08:1309:16-09-26/10			
16:31	17:29	18:20	20:14	21:03	21:31	21:13	20:17	19:05	17:57	16:04	15:04	15:52			
23	08:0008:34-08-47/13	07:06	06:02	05:51	04:59	04:42	05:09	05:59	06:50	07:4208:21-08-26/5	07:3808:10-08-23/13	08:1309:16-09-26/10			
16:33	17:31	18:23	20:15	21:04	21:31	21:11	20:15	19:03	17:54	16:02	15:02	15:53			
24	07:5908:35-08-47/12	07:04	06:00	05:49	04:57	04:42	05:11	06:00	06:52	07:4408:19-08-28/9	07:4008:12-08-23/11	08:1409:17-09-27/10			
16:3408:27-08-30/3	17:33	18:23	20:17	21:06	21:31	21:10	20:12	19:00	17:52	16:01	15:01	15:54			
25	07:5708:35-08-46/11	07:02	05:57	05:47	04:56	04:42	05:12	06:02	06:54	07:4607:17-07-29/12	07:4108:14-08-23/9	08:1409:18-09-27/9			
16:3608:25-08-30/5	17:34	18:25	20:19	21:07	21:31	21:08	20:10	18:58	16:50	16:00	15:00	15:54			
26	07:5608:37-08-46/9	06:59	05:55	05:45	04:55	04:43	05:14	06:04	06:55	07:4807:17-07-29/12	07:4308:15-08-22/7	08:1409:18-09-27/9			
16:3808:24-08-32/8	17:36	18:27	20:21	21:09	21:31	21:07	20:08	18:56	16:48	15:59	15:05	15:55			
27	07:5508:38-08-44/6	06:57	05:53	05:43	04:54	04:43	05:15	06:05	06:57	07:5007:17-07-29/12	07:4508:17-08-22/5	08:1509:19-09-27/8			
16:4008:22-08-32/10	17:38	18:28	20:22	21:10	21:31	21:06	20:06	18:53	16:46	15:58	15:06	15:56			
28	07:5308:21-08-33/12	06:55	05:50	05:41	04:53	04:44	05:17	06:07	06:59	07:5208:19-07-29/10	07:4608:19-08-21/2	08:1509:20-09-27/7			
16:42	17:40	18:30	20:24	21:11	21:31	21:04	20:03	18:51	16:44	15:57	15:06	15:56			
29	07:5208:20-08-33/13	06:53	05:48	05:39	04:52	04:44	05:18	06:09	07:00	07:5307:21-07-29/8	07:48	08:1509:22-09-28/6			
16:44	17:42	18:32	20:26	21:12	21:31	21:02	20:01	18:48	16:42	15:57	15:07	15:57			
30	07:5008:20-08-33/13	06:51	05:46	05:37	04:51	04:45	05:20	06:10	07:02	07:5507:23-07-28/5	07:49	08:1509:22-09-27/5			
16:45	17:45	18:34	20:27	21:14	21:31	21:01	19:59	18:46	16:40	15:56	15:07	15:58			
31	07:4908:21-08-33/12	06:51	05:46	05:37	04:51	04:45	05:21	06:12	07:04	07:5707:25-07-26/1	07:49	08:1509:24-09-26/2			
16:47	17:47	18:35	20:31	21:15	21:31	20:59	19:57	18:44	16:38	15:55	15:09	15:59			
Sonnenscheinstunden 256															
Anzahl Minuten mit Schatten															
214	96	0	0	417	0	487	0	502	0	455	0	381	0	331	241
74	237														150

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

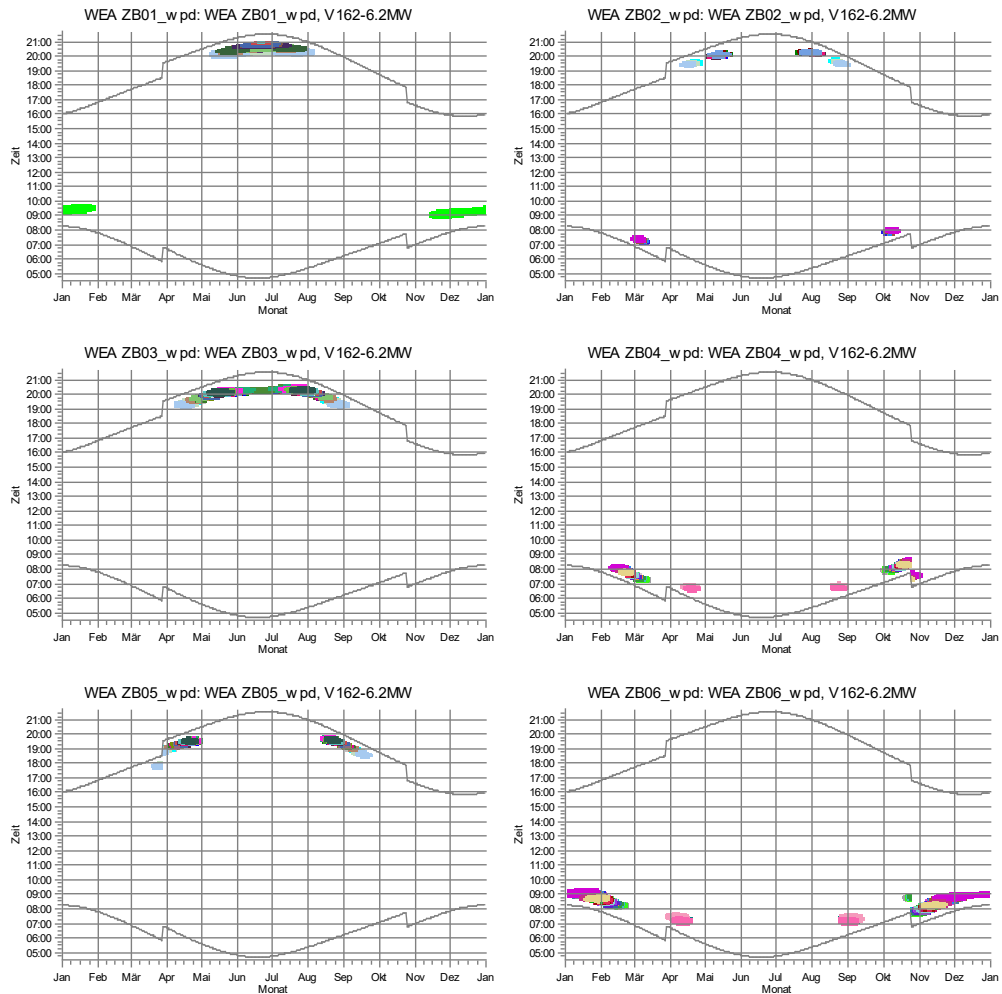
Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Zeitpunkt (SS:MM)	Schattenanfang-Zeitpunkt (SS:MM)	Schattenende/Minuten mit Schatten
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Anlage A6: SHADOW-Grafischer Kalender pro WEA mit Darstellung der Beschattungszeiten je WEA an den Immissionsorten über das ganze Jahr

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB



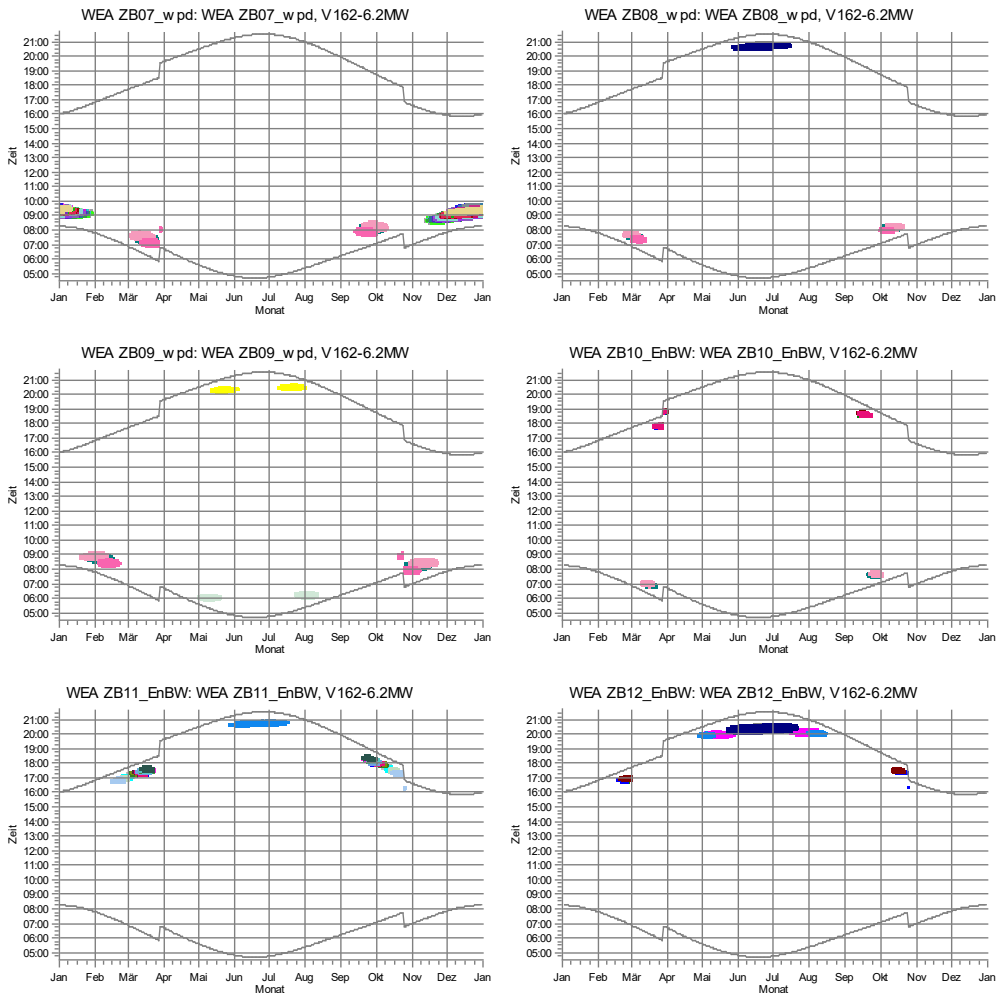
Schattenmappe

SR-00: SR-00, Neumühler Straße 6, 15518 Steinhöfde	SR-23: SR-23, Wilhelm-Maa Weg 21, 15374 Mindeberg	SR-41: SR-41, Wilhelm-Maa Weg 12, 15374 Mindeberg	SR-59: SR-59, Neue Mühle 1 (Helmgebläse), 15518 Steinhöfde	SR-77: SR-77, Eggendorfer Straße 50, 15518 Steinhöfde
SR-01: SR-01, Neumühler Straße 9a, 15518 Steinhöfde	SR-24: SR-24, Wilhelm-Maa Weg 20, 15374 Mindeberg	SR-42: SR-42, Wilhelm-Maa Weg 11, 15374 Mindeberg	SR-60: SR-60, Neue Mühle 2, 15518 Steinhöfde	SR-78: SR-78, Neumühler Straße 57/58, 15518 Steinhöfde
SR-02: SR-02, Neumühler Straße 9, 15518 Steinhöfde	SR-25: SR-25, Wilhelm-Maa Weg 28, 15374 Mindeberg	SR-43: SR-43, Wilhelm-Maa Weg 10, 15374 Mindeberg	SR-61: SR-61, Neumühler Straße 21, 15518 Steinhöfde	SR-79: SR-79, Neumühler Straße 59, 15518 Steinhöfde
SR-03: SR-03, Am Maae 4, 15374 Mindeberg	SR-26: SR-26, Wilhelm-Maa Weg 27, 15374 Mindeberg	SR-44: SR-44, Rahweg 1, 15374 Mindeberg	SR-62: SR-62, Neumühler Straße 24, 15518 Steinhöfde	SR-80: SR-80, Neumühler Straße 55/56, 15518 Steinhöfde
SR-04: SR-04, Neumühler Straße 19, 15518 Steinhöfde	SR-27: SR-27, Wilhelm-Maa Weg 26, 15374 Mindeberg	SR-45: SR-45, Rahweg 2, 15374 Mindeberg	SR-63: SR-63, Neumühler Straße 23, 15518 Steinhöfde	SR-81: SR-81, Neumühler Straße 24, 15518 Steinhöfde
SR-05: SR-05, Neumühler Straße 18, 15518 Steinhöfde	SR-28: SR-28, Wilhelm-Maa Weg 25/26, 15374 Mindeberg	SR-46: SR-46, Wilhelm-Maa Weg 1, 15374 Mindeberg	SR-64: SR-64, Neumühler Straße 22, 15518 Steinhöfde	SR-82: SR-82, Neumühler Straße 21/22, 15518 Steinhöfde
SR-06: SR-06, Neumühler Straße 17, 15518 Steinhöfde	SR-29: SR-29, Wilhelm-Maa Weg 24, 15374 Mindeberg	SR-47: SR-47, Rahweg 17, 15374 Mindeberg	SR-65: SR-65, Neumühler Straße 16/17, 15518 Steinhöfde	SR-83: SR-83, Neumühler Straße 19, 15518 Steinhöfde
SR-07: SR-07, Neumühler Straße 20, 15518 Steinhöfde	SR-30: SR-30, Wilhelm-Maa Weg 23, 15374 Mindeberg	SR-48: SR-48, Wilhelm-Maa Weg 24/25/26/27, 15374 Mindeberg	SR-66: SR-66, Neumühler Straße 15, 15518 Steinhöfde	SR-84: SR-84, Neumühler Straße 18, 15518 Steinhöfde
SR-08: SR-08, Neumühler Straße 21, 15518 Steinhöfde	SR-31: SR-31, Wilhelm-Maa Weg 22a, 15374 Mindeberg	SR-49: SR-49, Wilhelm-Maa Weg 1, 15374 Mindeberg	SR-67: SR-67, Neumühler Straße 14, 15518 Steinhöfde	SR-85: SR-85, Neumühler Straße 17, 15518 Steinhöfde
SR-09: SR-09, Neumühler Straße 22, 15518 Steinhöfde	SR-32: SR-32, Wilhelm-Maa Weg 22b, 15374 Mindeberg	SR-50: SR-50, Wilhelm-Maa Weg 1, 15374 Mindeberg	SR-68: SR-68, Neumühler Straße 13, 15518 Steinhöfde	SR-86: SR-86, Neumühler Straße 16, 15518 Steinhöfde
SR-10: SR-10, Am Fuhbau 9, 15374 Mindeberg	SR-33: SR-33, Wilhelm-Maa Weg 21/22a, 15374 Mindeberg	SR-51: SR-51, Wilhelm-Maa Weg 1, 15374 Mindeberg	SR-69: SR-69, Neumühler Straße 12, 15518 Steinhöfde	SR-87: SR-87, Neumühler Straße 15, 15518 Steinhöfde
SR-11: SR-11, Am Fuhbau 7, 15374 Mindeberg	SR-34: SR-34, Wilhelm-Maa Weg 20/20a, 15374 Mindeberg	SR-52: SR-52, Neumühler Straße 14, 15374 Mindeberg	SR-70: SR-70, Eggendorfer Straße 50, 15518 Steinhöfde	SR-88: SR-88, Neumühler Straße 14, 15518 Steinhöfde
SR-12: SR-12, Am Fuhbau 9, 15374 Mindeberg	SR-35: SR-35, Wilhelm-Maa Weg 17a, 15374 Mindeberg	SR-53: SR-53, Neumühler Straße 11, 15374 Mindeberg	SR-71: SR-71, Eggendorfer Straße 51, 15518 Steinhöfde	SR-89: SR-89, Neumühler Straße 13, 15518 Steinhöfde
SR-13: SR-13, Am Fuhbau 7, 15374 Mindeberg	SR-36: SR-36, Wilhelm-Maa Weg 16b, 15374 Mindeberg	SR-54: SR-54, Neumühler Straße 10, 15374 Mindeberg	SR-72: SR-72, Eggendorfer Straße 52, 15518 Steinhöfde	SR-90: SR-90, Neumühler Straße 12, 15518 Steinhöfde
SR-14: SR-14, Am Fuhbau 5/5a, 15374 Mindeberg	SR-37: SR-37, Wilhelm-Maa Weg 16/16a, 15374 Mindeberg	SR-55: SR-55, Neumühler Straße 9, 15374 Mindeberg	SR-73: SR-73, Eggendorfer Straße 53, 15518 Steinhöfde	SR-91: SR-91, Neumühler Straße 11, 15518 Steinhöfde
SR-15: SR-15, Am Fuhbau 4/4a, 15374 Mindeberg	SR-38: SR-38, Wilhelm-Maa Weg 15, 15374 Mindeberg	SR-56: SR-56, Neumühler Straße 8, 15374 Mindeberg	SR-74: SR-74, Eggendorfer Straße 54, 15518 Steinhöfde	SR-92: SR-92, Neumühler Straße 10, 15518 Steinhöfde
SR-16: SR-16, Am Fuhbau 2/2a, 15374 Mindeberg	SR-39: SR-39, Wilhelm-Maa Weg 14, 15374 Mindeberg	SR-57: SR-57, Neumühler Straße 7, 15374 Mindeberg	SR-75: SR-75, Eggendorfer Straße 55, 15518 Steinhöfde	SR-93: SR-93, Neumühler Straße 9, 15518 Steinhöfde
SR-17: SR-17, Am Fuhbau 1, 15374 Mindeberg	SR-40: SR-40, Wilhelm-Maa Weg 13, 15374 Mindeberg	SR-58: SR-58, Wilhelm-Maa Weg 6, 15374 Mindeberg	SR-76: SR-76, Eggendorfer Straße 56/55, 15518 Steinhöfde	SR-94: SR-94, Neumühler Straße 8, 15518 Steinhöfde
		SR-59: SR-59, Wilhelm-Maa Weg 5, 15374 Mindeberg	SR-77: SR-77, Eggendorfer Straße 57, 15518 Steinhöfde	SR-95: SR-95, Neumühler Straße 7, 15518 Steinhöfde

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB



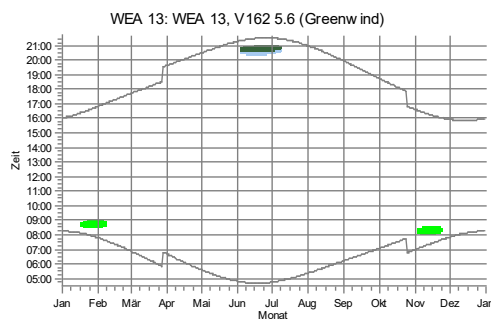
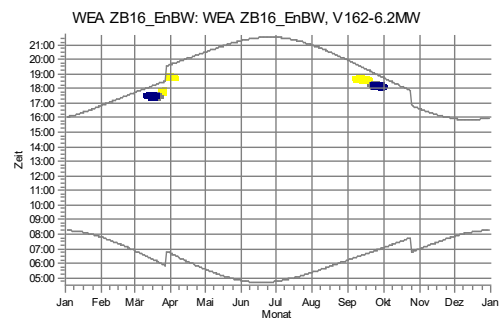
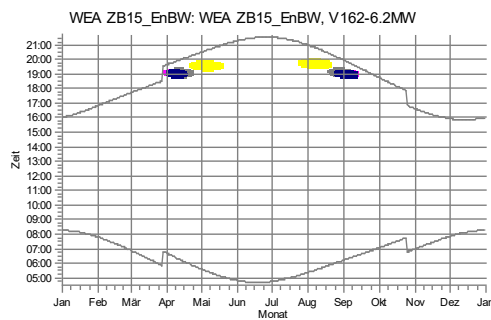
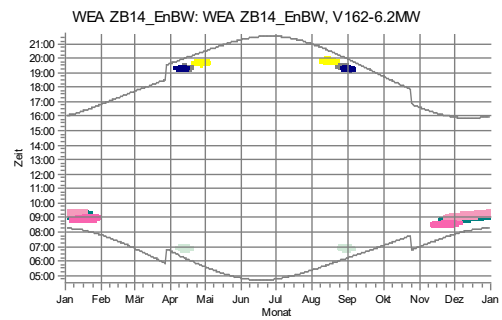
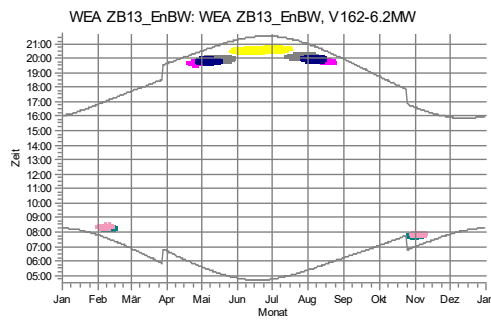
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SR-07: SR-07, Neumühler Straße 18, 15518 Steinhöfel	SR-26: SR-26, Wilhelm-Muaweg 27, 15374 Mindeberg	SR-45: SR-45, Rehweg 2, 15374 Mindeberg	SR-64: SR-64, Auhau Schiefelder Weg 3, 15518 Jänke	SR-83: SR-83, Neumühler Straße 5, 15518 Steinhöfel
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SR-09: SR-09, Neumühler Straße 20, 15518 Steinhöfel	SR-28: SR-28, Wilhelm-Muaweg 21/21a, 15374 Mindeberg	SR-47: SR-47, Rehweg 2, 15374 Mindeberg	SR-66: SR-66, Auhau Schiefelder Weg 3, 15518 Jänke	SR-85: SR-85, Neumühler Straße 3a, 15518 Steinhöfel
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SR-14: SR-14, Neumühler Straße 22, 15518 Steinhöfel	SR-33: SR-33, Wilhelm-Muaweg 22a, 15374 Mindeberg	SR-52: SR-52, Havelweg 1a, 15374 Mindeberg	SR-71: SR-71, Auhau Schiefelder Weg 3, 15518 Jänke	SR-90: SR-90, Neumühler Straße 1, 15518 Steinhöfel
SR-15: SR-15, Am Fuhbau 9, 15374 Mindeberg	SR-34: SR-34, Wilhelm-Muaweg 21/21a, 15374 Mindeberg	SR-53: SR-53, Havelweg 1, 15374 Mindeberg	SR-72: SR-72, Auhau Schiefelder Weg 3, 15518 Jänke	SR-91: SR-91, Neumühler Straße 1, 15518 Steinhöfel
SR-16: SR-16, Am Fuhbau 8, 15374 Mindeberg	SR-35: SR-35, Wilhelm-Muaweg 20/20a, 15374 Mindeberg	SR-54: SR-54, Havelweg 1a, 15374 Mindeberg	SR-73: SR-73, Auhau Schiefelder Weg 3, 15518 Jänke	SR-92: SR-92, Neumühler Straße 1, 15518 Steinhöfel
SR-17: SR-17, Am Fuhbau 7, 15374 Mindeberg	SR-36: SR-36, Wilhelm-Muaweg 17a, 15374 Mindeberg	SR-55: SR-55, Havelweg 3a, 15374 Mindeberg	SR-74: SR-74, Auhau Schiefelder Weg 3, 15518 Jänke	SR-93: SR-93, Neumühler Straße 1, 15518 Steinhöfel
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			SR-95: SR-95, Auhau Schiefelder Weg 3, 15518 Jänke	

Projekt:  
**R-2-2023-0060**

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**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB

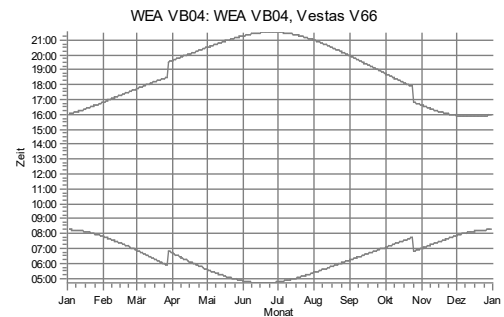
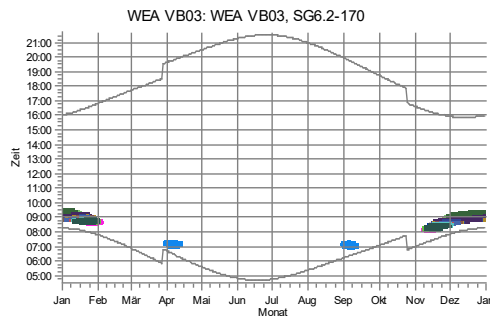
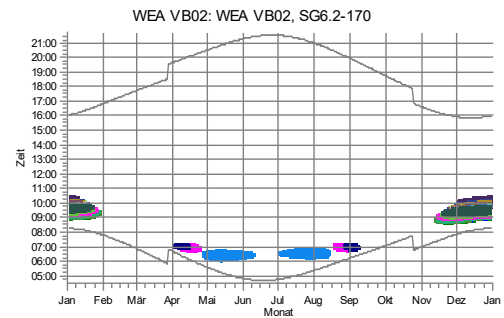
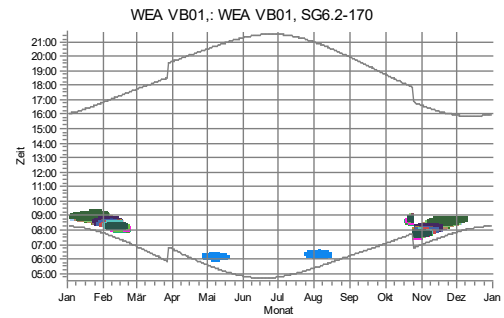


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SR-05: SR-05, Baufelder Ausbau 3, 15518 Steinhöf.	SR-15: SR-15, Am Mewe 4, 15374 Münzberg	SR-01b: SR-01b, Neue Mühle 1 (Nebengebäude), 15518	SR-43: SR-43, Poppegarter Straße 24, 15518 Schönf.	

Projekt:  
**R-2-2023-0060**

 Lizenzierter Anwender:  
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Schattenmappe

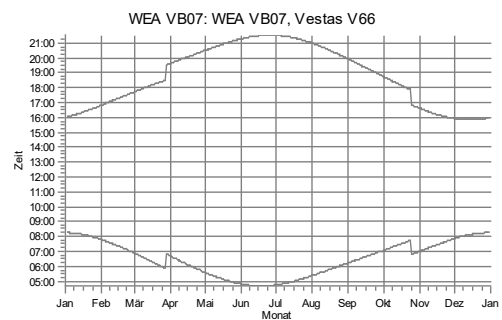
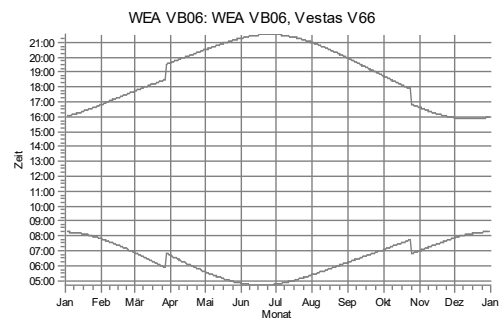
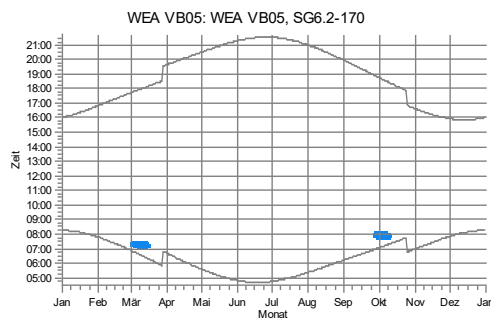
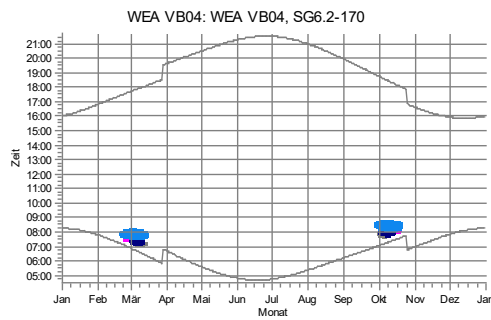
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SR-07: SR-07, Heppgartenier Staße 19, 15518 Steinhöfen	SR-40: SR-40, Heppgartenier Staße 1617, 15518 Steinhöfen	SR-76: SR-76, Eggenendorfer Staße 53, 15518 Steinhöfen	SR-86: SR-86, Neumühler Staße 9, 15518 Steinhöfen	SR-99: SR-99, Neumühler Staße 11, 15518 Steinhöfen
SR-08: SR-08, Heppgartenier Staße 20, 15518 Steinhöfen	SR-41: SR-41, Günterstraße 26, 15518 Steinhöfen	SR-77: SR-77, Eggenendorfer Staße 54/55, 15518 Steinhöfen	SR-87: SR-87, Neumühler Staße 8, 15518 Steinhöfen	
SR-09: SR-09, Heppgartenier Staße 20a, 15518 Steinhöfen	SR-42: SR-42, Günterstraße 27, 15518 Steinhöfen	SR-78: SR-78, Eggenendorfer Staße 58, 15518 Steinhöfen	SR-88: SR-88, Neumühler Staße 7, 15518 Steinhöfen	



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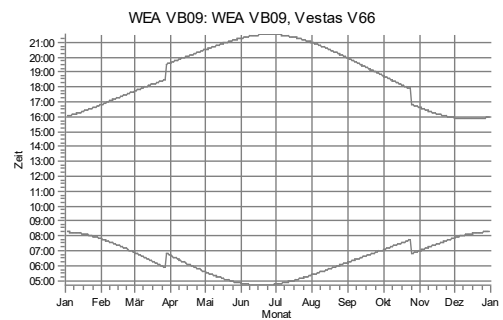
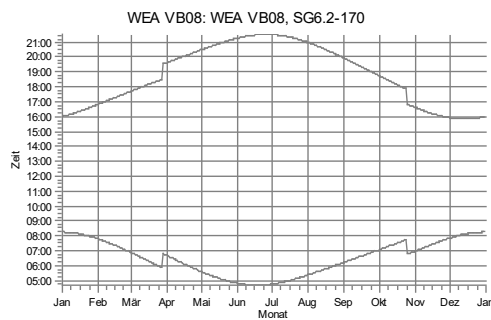
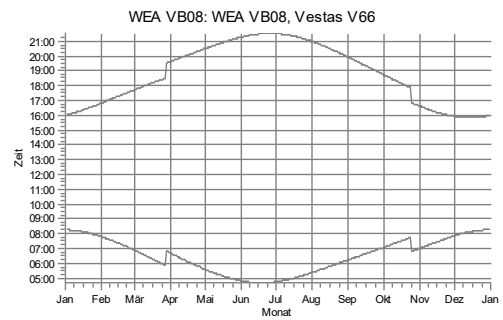
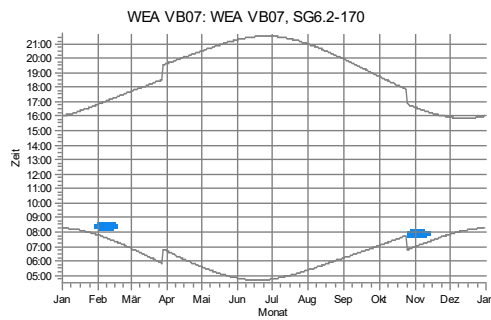


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 SK-06: SK-06, Beefelde Ausbau 2, 15518 Steinke

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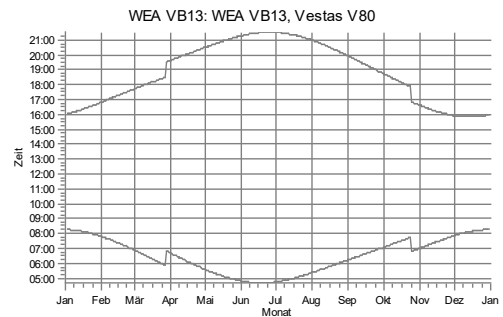
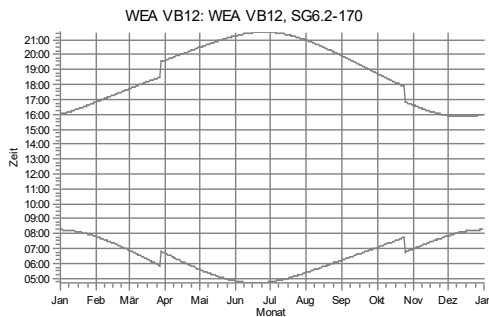
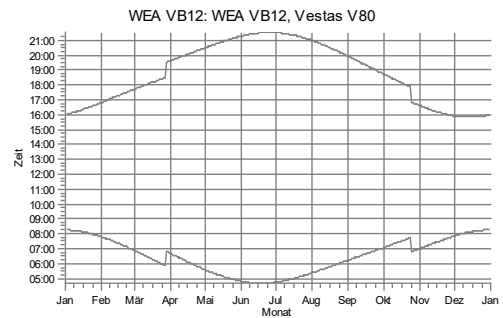
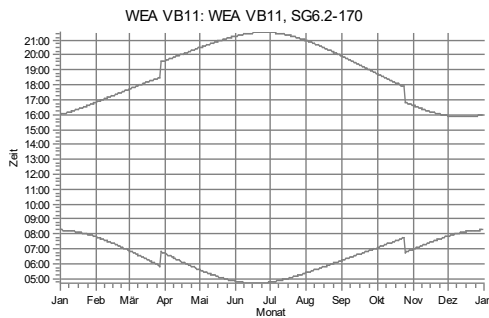
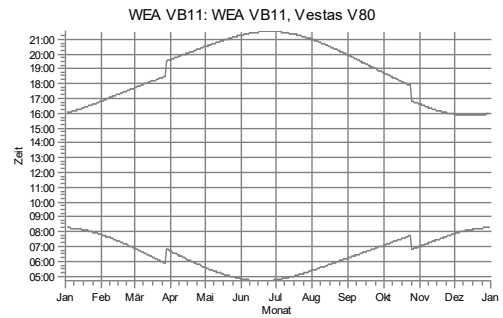
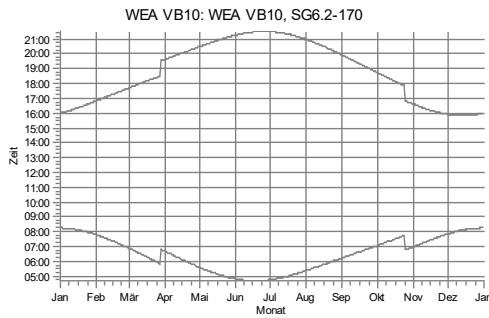


Shadowmapoptionen  
 SK-60: SK-60, Baueffekte Anbau 2, 15018 Steinhöflet

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Berechnung: WEA\_GB

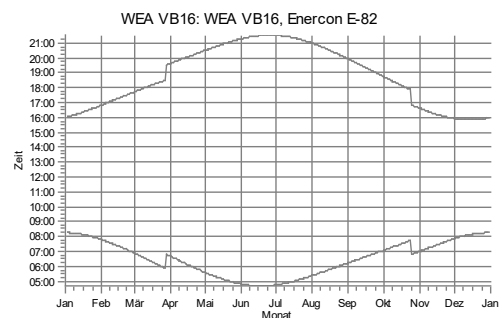
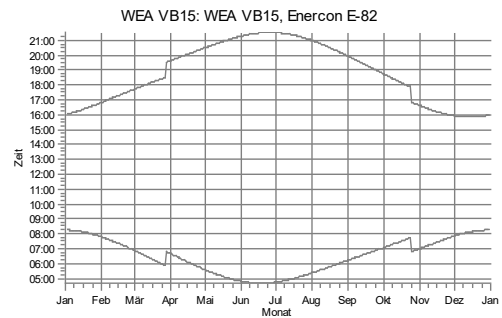
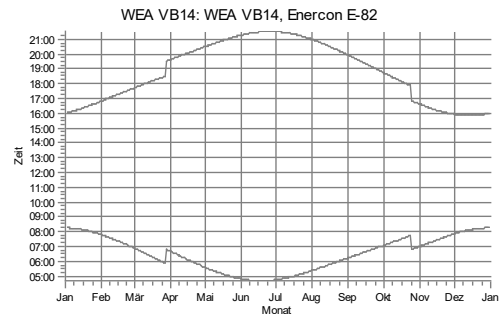


Skalieren

Projekt:  
**R-2-2023-0060**

Lizenzierter Anwender:  
**KÖTTER Consulting Engineers GmbH & Co. KG**  
Bonifatiusstr. 400  
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Robert Müller-Rhein / r.mueller-rhein@koetter-consulting.com  
Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB

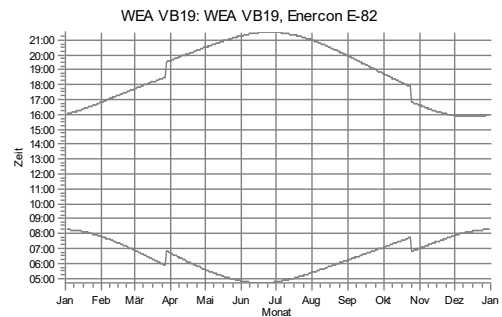
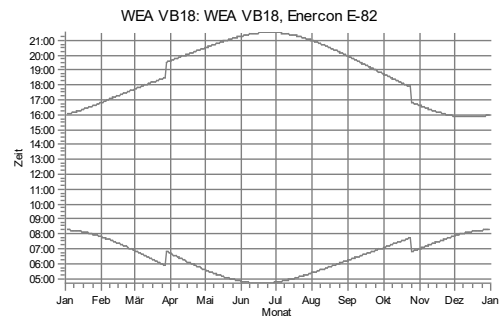
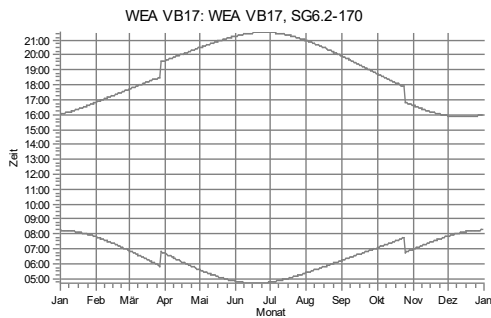
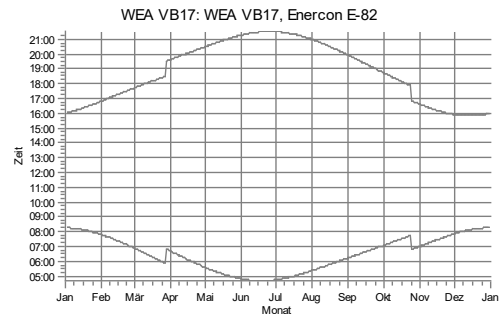


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Berechnung: WEA\_GB

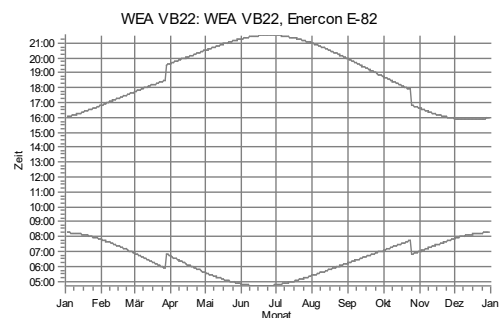
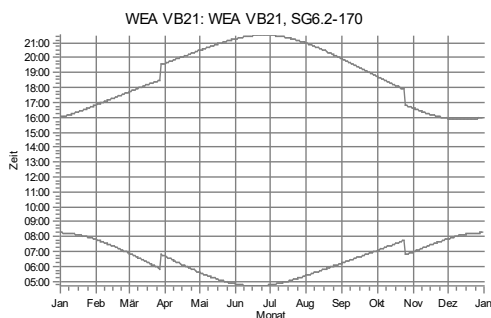
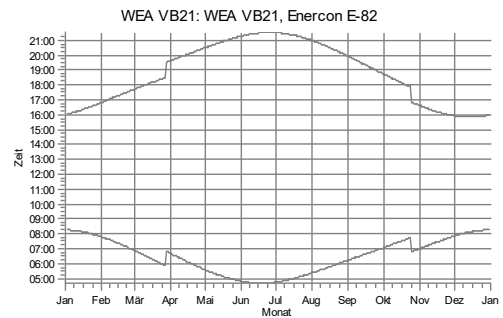
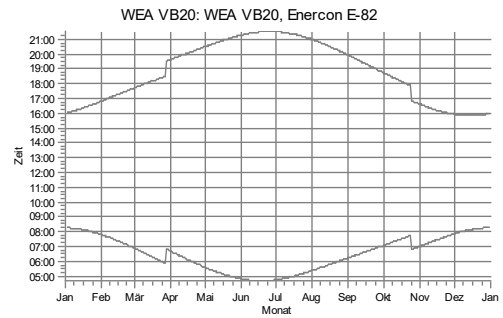


Skalieren anpassen

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Berechnet:  
04.09.2023 13:15/3.6.366

**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB

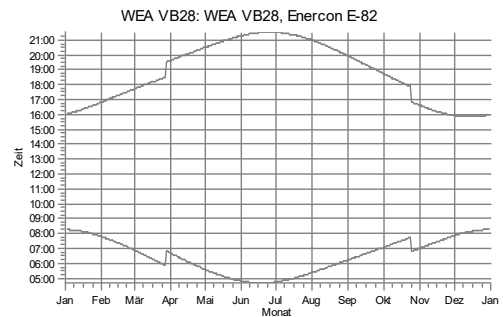
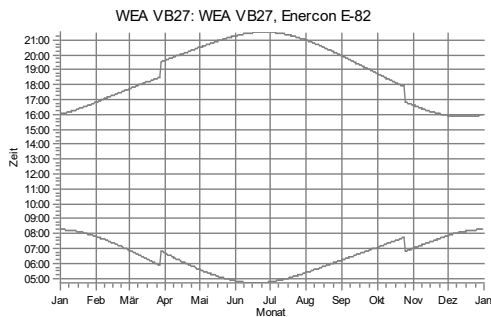
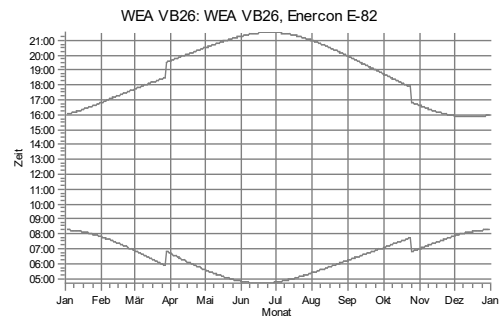
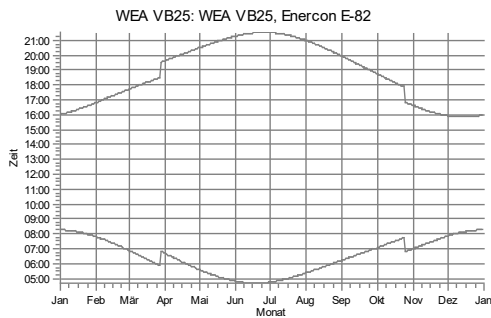
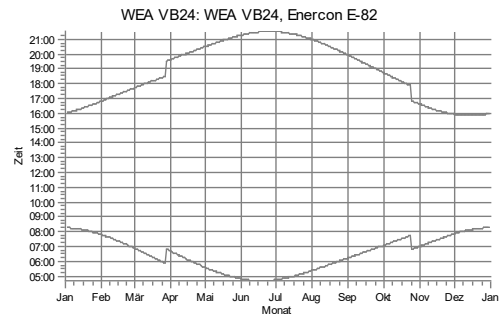
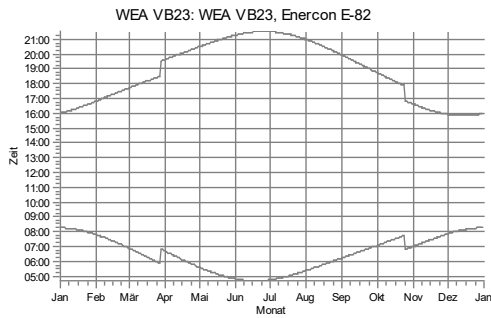


Shadowtimeoptionen

Projekt:  
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**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB



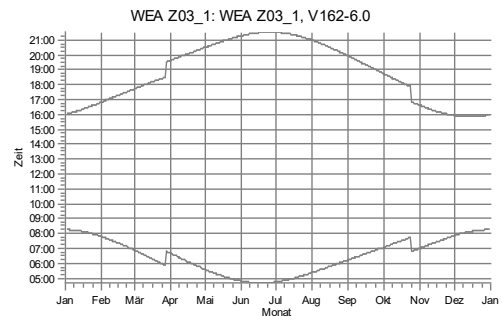
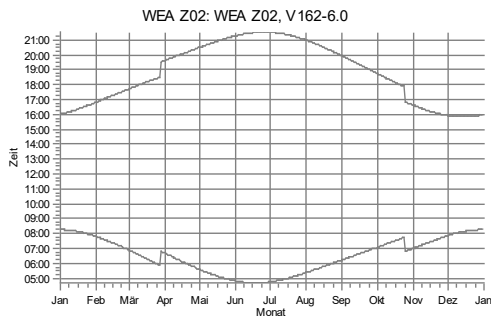
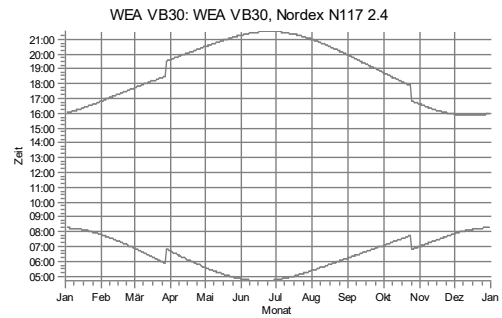
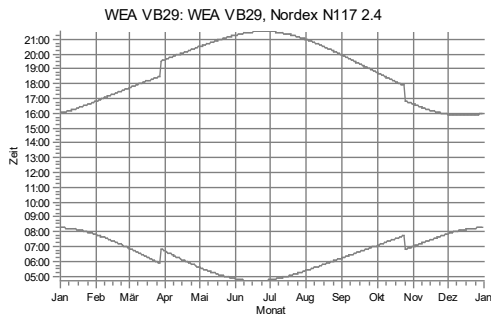
Skalieren anpassen



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Berechnung: WEA\_GB

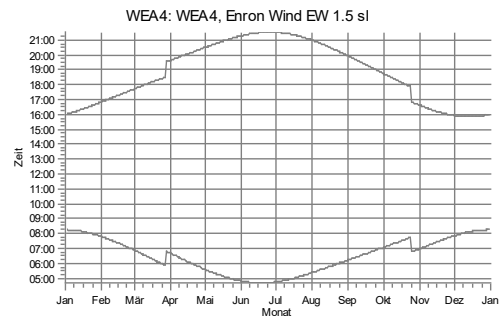
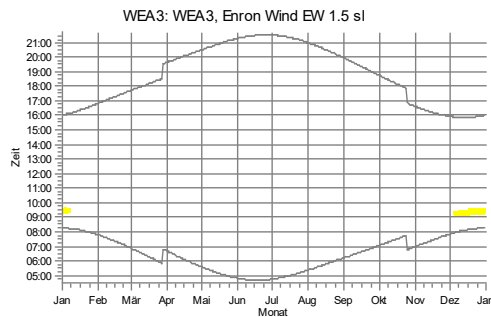
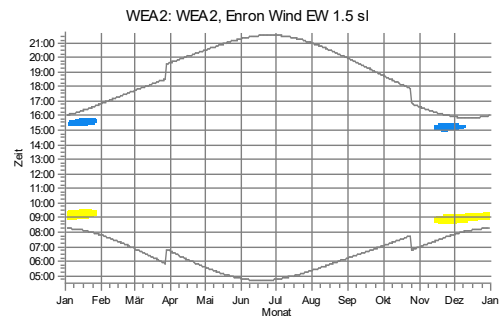
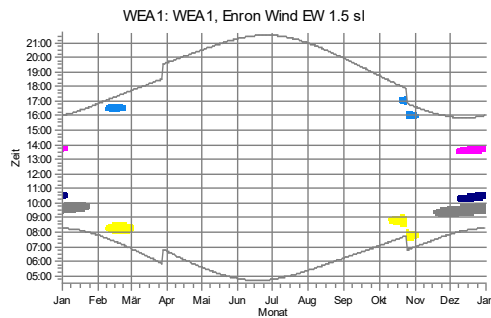
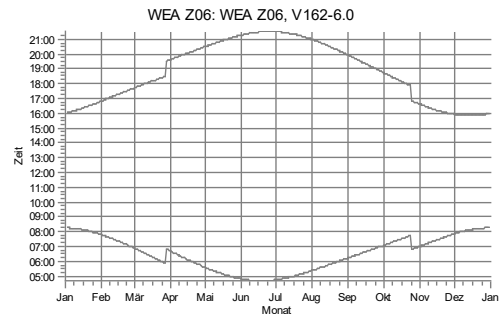


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Berechnung: WEA\_GB

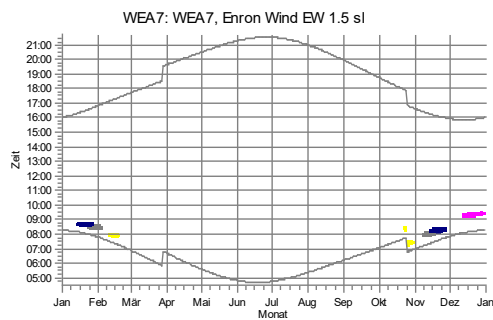
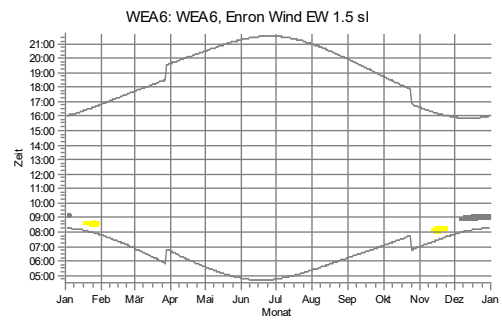
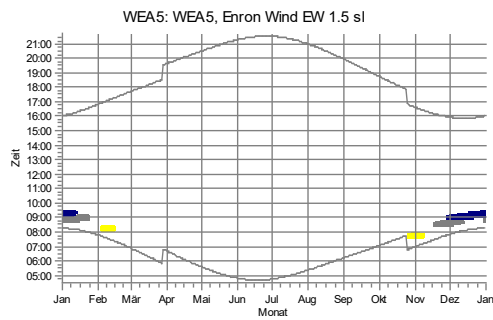


Schattenoptionen  
■ SK-02: Aurbau Schönfelder Weg 1, 15518 Jänick  
■ SK-03: SK-03, Aurbau Schönfelder Weg 2, 15518 Jänick  
■ SK-05: SK-05, Beerfelder Aurbau 3, 15518 Steinhöfel  
■ SK-04: SK-04, Aurbau Schönfelder Weg 3, 15518 Jänick  
■ SK-06: SK-06, Beerfelder Aurbau 2, 15518 Steinhöfel

Projekt:  
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**SHADOW - Grafischer Kalender pro WEA**  
Berechnung: WEA\_GB



Schattenoptionen  
■ SR-02: SR-02, Aulbau Schönfelder Weg 1, 15518 Jänick  
■ SR-03: SR-03, Aulbau Schönfelder Weg 2, 15518 Jänick  
■ SR-05: SR-05, Beerfelder Aulbau 3, 15518 Sternhöfel  
■ SR-04: SR-04, Aulbau Schönfelder Weg 3, 15518 Jänickendörf

Anlage B: Schattenausbreitung der Vor- und Zusatzbelastung

Anlage B1: SHADOW-Hauptergebnis mit Darstellung der Vorbelastung, Immissionssorte SR-01 bis SR-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Projekt:  
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04.09.2023 13:32/3.6.366

### SHADOW - Hauptergebnis

**Berechnung:** WEA\_VB

#### Annahmen für Schattenwurfberechnung

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

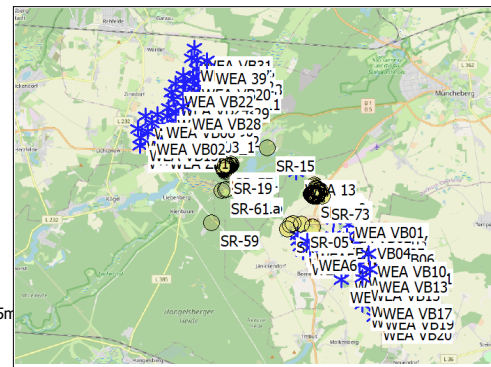
Eine WEA wird nicht berücksichtigt, wenn sie von keinem Teil der  
Rezeptorfläche aus sichtbar ist. Die Sichtbarkeitsberechnung basiert auf  
den folgenden Annahmen:  
Verwendete Höhenlinien: German Brandenburg Elevation Model (DGMS - S  
Rasterauflösung: 1,0 m

Alle Koordinatangaben in:  
UTM (North)-ETRS89 Zone: 33

#### WEA

WEA	Ost	Nord	Z	Beschreibung	WEA-Typ		Typ	Nennleistung	Rotor-durchmesser	Nabenhöhe	Schattendaten	
					Aktuell	Hersteller					Beschatt.-Bereich	U/min
			[m]				[kW]	[m]	[m]	[m]	[U/min]	
WEA 13	434.325	5.813.918	60,4	WEA 13, V162 ...Ja	VESTAS	V162-5.600	5.600	162,0	166,0	2.037	0,0	
WEA 39	430.344	5.819.016	72,7	WEA 39, V162...Ja	VESTAS	V162-5.600	5.600	162,0	169,0	2.037	0,0	
WEA VB01	427.137	5.815.996	55,8	WEA VB01, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB01	436.613	5.811.968	67,4	WEA VB01, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB02	427.585	5.815.878	57,5	WEA VB02, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB02	436.046	5.811.734	66,4	WEA VB02, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB03	436.764	5.811.503	65,5	WEA VB03, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB04	436.011	5.811.008	62,0	WEA VB04, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB04	428.258	5.816.142	56,0	WEA VB04, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB05	428.492	5.816.537	60,7	WEA VB05, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB05	436.622	5.810.990	63,1	WEA VB05, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB06	428.062	5.816.627	58,6	WEA VB06, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB06	437.078	5.810.728	65,7	WEA VB06, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB07	436.401	5.810.489	63,9	WEA VB07, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB07	427.785	5.816.247	59,0	WEA VB07, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB08	427.518	5.816.583	56,2	WEA VB08, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB08	437.153	5.810.244	75,9	WEA VB08, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB09	436.545	5.809.967	68,4	WEA VB09, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB09	428.583	5.816.928	61,1	WEA VB09, Ve...Nein	VESTAS	V66-2.0MW-2.000	2.000	66,0	78,0	1.238	19,0	
WEA VB10	429.759	5.817.950	61,4	WEA VB10, Ve...Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7	
WEA VB10	437.602	5.810.171	78,2	WEA VB10, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB11	436.541	5.809.511	78,3	WEA VB11, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB11	430.146	5.817.851	64,6	WEA VB11, Ve...Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7	
WEA VB12	437.204	5.809.644	79,8	WEA VB12, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB12	429.853	5.818.660	63,3	WEA VB12, Ve...Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7	
WEA VB13	430.226	5.818.513	66,4	WEA VB13, Ve...Nein	VESTAS	V80-2.0MW-2.000	2.000	80,0	100,0	1.581	16,7	
WEA VB13	437.676	5.809.465	80,3	WEA VB13, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB14	427.251	5.815.229	54,8	WEA VB14, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB14	436.353	5.809.010	65,5	WEA VB14, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB15	427.264	5.815.578	54,5	WEA VB15, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB15	437.299	5.809.090	74,9	WEA VB15, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB16	437.307	5.808.344	79,1	WEA VB16, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB16	427.612	5.815.391	55,1	WEA VB16, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB17	437.832	5.808.252	77,3	WEA VB17, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB17	429.639	5.819.176	67,5	WEA VB17, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB18	437.315	5.807.882	72,7	WEA VB18, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB18	429.897	5.819.085	68,4	WEA VB18, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB19	437.915	5.807.770	76,1	WEA VB19, SG...Ja	Siemens Gamesa	SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB19	429.251	5.818.393	61,2	WEA VB19, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB20	429.696	5.818.298	62,5	WEA VB20, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	

(Fortsetzung nächste Seite)...



Maßstab 1:250.000  
\* Existierende WEA    \* Schattenrezeptor

Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 13:32/3.6.366

**SHADOW - Hauptergebnis**

**Berechnung: WEA\_VB**

...(Fortsetzung von vorheriger Seite)

	Ost	Nord	Z	Beschreibung	WEA-Typ			Nennleistung	Rotordurchmesser	Nabenhöhe	Schattendaten	
					Aktuell	Hersteller	Typ				Beschatt.-Bereich	U/min
	[m]	[m]	[m]				[kW]	[m]	[m]	[m]	[U/min]	
WEA VB20	437.848	5.807.292	73,3	WEA VB20, SG...Ja	Siemens	Gamesa SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB21	430.079	5.818.169	62,9	WEA VB21, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB21	437.903	5.809.855	84,1	WEA VB21, SG...Ja	Siemens	Gamesa SG 6.2-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA VB22	428.888	5.818.012	59,8	WEA VB22, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB23	429.345	5.818.022	61,0	WEA VB23, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB24	428.692	5.817.620	58,4	WEA VB24, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB25	429.234	5.817.540	58,9	WEA VB25, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB26	428.777	5.817.311	57,6	WEA VB26, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB27	429.246	5.817.247	58,8	WEA VB27, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB28	429.228	5.816.987	58,2	WEA VB28, En...Nein	ENERCON	E-82-2.000	2.000	82,0	108,0	1.550	19,5	
WEA VB29	429.630	5.817.456	60,1	WEA VB29, No...Ja	NORDEX	N117/2400-2.400	2.400	116,8	140,6	1.486	11,8	
WEA VB30	428.883	5.816.661	57,7	WEA VB30, No...Ja	NORDEX	N117/2400-2.400	2.400	116,8	140,6	1.486	11,8	
WEA VB31	429.786	5.819.608	70,8	WEA VB31, V1...Ja	VESTAS	V162-5.600	5.600	162,0	169,0	2.037	0,0	
WEA Z01	428.166	5.815.226	60,1	WEA Z01, SG 6...Nein	Siemens	Gamesa SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8	
WEA Z02	428.438	5.815.677	57,6	WEA Z02, V16...Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0	
WEA Z03_1	428.680	5.815.924	56,6	WEA Z03_1, V...Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0	
WEA Z03_2	428.886	5.816.197	56,7	WEA Z03_2, V...Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0	
WEA Z06	429.209	5.816.608	58,3	WEA Z06, V16...Ja	VESTAS	V162-6.0-6.000	6.000	162,0	169,0	2.041	0,0	
WEA1	434.379	5.811.062	55,9	WEA1, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA2	434.387	5.810.798	59,4	WEA2, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA3	434.497	5.810.540	70,1	WEA3, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA4	434.607	5.810.283	65,8	WEA4, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA5	434.819	5.810.763	71,6	WEA5, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA6	434.933	5.810.497	70,2	WEA6, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	
WEA7	435.200	5.810.671	72,9	WEA7, Enron ... Nein	ENRONWIND	EW 1.5s1-1.500	1.500	77,0	80,0	2.500	18,0	

**Schattenrezeptor-Eingabe**

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe	Neigung	Ausrichtungsmodus	Augenhöhe
		[m]	[m]	[m]	[m]	[m]	[m]	(°)		(ZVI) u.Gr.
								Fenster		[m]
SR-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	431.106	5.813.145	40,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	431.170	5.813.181	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	433.938	5.811.330	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	434.068	5.811.536	55,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	434.184	5.811.569	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	434.584	5.811.549	58,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	435.103	5.812.854	60,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	435.067	5.812.891	61,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	435.042	5.812.883	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	435.315	5.813.074	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	435.300	5.813.111	70,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	435.289	5.813.136	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	435.265	5.813.193	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	435.240	5.813.247	71,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	435.192	5.813.315	71,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-15	SR-15, Am Fuchssee 4, 15374 Müncheberg	433.047	5.815.033	41,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-16	SR-16, Am Fuchssee 9, 15374 Müncheberg	431.144	5.813.955	53,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-17	SR-17, Am Fuchssee 8, 15374 Müncheberg	431.136	5.813.975	57,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-18	SR-18, Am Fuchssee 7, 15374 Müncheberg	431.118	5.813.987	56,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-19	SR-19, Am Fuchssee 5/5a, 15374 Müncheberg	431.097	5.814.031	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-20	SR-20, Am Fuchssee 4/4a, 15374 Müncheberg	431.075	5.814.057	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-21	SR-21, Am Fuchssee 2/2a, 15374 Müncheberg	431.073	5.814.102	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-22	SR-22, Am Fuchssee 1, 15374 Müncheberg	431.039	5.814.112	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	431.056	5.814.129	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	431.105	5.814.127	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	431.117	5.814.138	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	431.130	5.814.147	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	431.146	5.814.156	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	431.178	5.814.160	54,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	431.184	5.814.193	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	431.196	5.814.204	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	431.221	5.814.206	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	431.211	5.814.222	56,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	431.244	5.814.210	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	431.260	5.814.222	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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04.09.2023 13:32/3.6.366

## SHADOW - Hauptergebnis

### Berechnung: WEA\_VB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr. [m]
		[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	431.305	5.814.241	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	431.340	5.814.234	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	431.322	5.814.263	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	431.343	5.814.267	54,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	431.361	5.814.273	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	431.374	5.814.284	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	431.389	5.814.307	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	430.998	5.814.164	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	431.005	5.814.192	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	430.988	5.814.208	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	430.965	5.814.215	55,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	431.033	5.814.184	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	431.018	5.814.228	53,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	431.053	5.814.194	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.041	5.814.299	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	431.065	5.814.232	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.084	5.814.237	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	431.113	5.814.255	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	431.076	5.814.255	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	431.097	5.814.285	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-55	SR-55, Hasenweg 3A, 15374 Müncheberg	431.087	5.814.310	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	431.142	5.814.258	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.156	5.814.273	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.174	5.814.289	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-59	SR-59, Am Höllengrund 3, 15537 Kienbaum	430.462	5.811.645	52,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	435.063	5.811.423	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	430.960	5.813.095	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	435.392	5.813.063	70,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	435.444	5.813.070	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	435.373	5.813.016	67,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	435.389	5.812.979	65,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	435.344	5.812.970	65,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	435.393	5.812.918	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	435.434	5.812.920	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	435.455	5.812.922	62,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	435.530	5.812.945	64,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	435.601	5.812.953	63,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	435.652	5.812.955	64,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	435.549	5.812.814	64,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	435.458	5.812.804	62,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	435.418	5.812.800	62,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	435.377	5.812.798	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	435.417	5.812.836	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	435.383	5.812.836	62,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	435.349	5.812.849	61,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	435.323	5.812.855	61,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	435.332	5.812.903	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	435.306	5.812.912	63,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	435.273	5.812.888	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	435.225	5.812.883	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	435.189	5.812.890	62,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	435.163	5.812.884	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	435.147	5.812.895	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	435.123	5.812.883	61,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	435.139	5.812.849	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	435.136	5.812.806	60,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	435.177	5.812.797	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	435.247	5.812.783	61,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	435.296	5.812.793	61,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	435.330	5.812.825	61,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	435.337	5.812.786	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

### Berechnungsergebnisse

Schattenrezeptor

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr [h/a]	Schattentage/Jahr [d/a]	Max.Schattendauer/Tag [h/d]
SR-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	0:00	0	0:00
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	0:00	0	0:00

(Fortsetzung nächste Seite)...



Projekt:  
**R-2-2023-0060**

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04.09.2023 13:32/3.6.366

## SHADOW - Hauptergebnis

**Berechnung:** WEA\_VB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	66:39	139	0:45
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	65:46	139	0:53
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	39:05	128	0:40
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	35:56	101	0:33
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	40:15	108	0:29
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	38:00	105	0:28
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	37:36	108	0:28
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	14:20	55	0:24
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	13:09	46	0:24
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	13:00	46	0:23
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	12:56	48	0:23
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	16:19	70	0:22
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	22:54	84	0:24
SR-15	SR-15, Am Maxsee 4, 15374 Müncheberg	12:21	42	0:23
SR-16	SR-16, Am Fuchsbau 9, 15374 Müncheberg	0:00	0	0:00
SR-17	SR-17, Am Fuchsbau 8, 15374 Müncheberg	0:00	0	0:00
SR-18	SR-18, Am Fuchsbau 7, 15374 Müncheberg	0:00	0	0:00
SR-19	SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg	0:00	0	0:00
SR-20	SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg	0:00	0	0:00
SR-21	SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg	0:00	0	0:00
SR-22	SR-22, Am Fuchsbau 1, 15374 Müncheberg	0:00	0	0:00
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	0:00	0	0:00
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	0:00	0	0:00
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	0:00	0	0:00
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	0:00	0	0:00
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	0:00	0	0:00
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	0:00	0	0:00
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	0:00	0	0:00
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	0:00	0	0:00
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	0:00	0	0:00
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	0:00	0	0:00
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	0:00	0	0:00
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	0:00	0	0:00
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	0:00	0	0:00
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	0:00	0	0:00
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	0:00	0	0:00
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	0:00	0	0:00
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	0:00	0	0:00
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	0:00	0	0:00
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	0:00	0	0:00
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	0:00	0	0:00
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	0:00	0	0:00
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	0:00	0	0:00
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	0:00	0	0:00
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	0:00	0	0:00
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	0:00	0	0:00
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	0:00	0	0:00
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	0:00	0	0:00
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	0:00	0	0:00
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	0:00	0	0:00
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	0:00	0	0:00
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	0:00	0	0:00
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	0:00	0	0:00
SR-55	SR-55, Hasenweg 3A, 15374 Müncheberg	0:00	0	0:00
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	0:00	0	0:00
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	0:00	0	0:00
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	0:00	0	0:00
SR-59	SR-59, Am Höllgrund 3, 15537 Kienbaum	0:00	0	0:00
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	124:52	266	0:59
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	0:00	0	0:00
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	15:28	50	0:25
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	19:26	69	0:26
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	18:08	66	0:25
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	39:11	102	0:31

(Fortsetzung nächste Seite)...

Projekt:  
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## SHADOW - Hauptergebnis

**Berechnung:** WEA\_VB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	24:54	78	0:25
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	45:17	108	0:35
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	45:00	106	0:36
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	44:56	105	0:37
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	38:17	98	0:29
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	41:48	113	0:34
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	48:07	124	0:36
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	56:04	113	0:45
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	55:05	118	0:43
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	55:27	120	0:42
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	55:34	122	0:42
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	52:04	116	0:41
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	51:46	118	0:39
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	50:43	118	0:39
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	50:18	118	0:38
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	45:35	112	0:35
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	44:40	112	0:33
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	47:21	116	0:35
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	38:03	98	0:30
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	37:59	99	0:30
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	38:44	100	0:29
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	38:07	100	0:29
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	39:03	104	0:29
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	40:54	105	0:29
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	42:34	112	0:30
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	44:16	110	0:31
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	55:42	126	0:41
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	55:38	124	0:40
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	52:48	121	0:39
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	56:16	123	0:41

Gesamtdauer Beschattung an Rezeptoren pro WEA		
Nr.	Name	Maximal
		[h/a]
WEA 13	WEA 13, V162 5.6 (Greenwind)	27:03
WEA 39	WEA 39, V162-5.6	0:00
WEA VB01	WEA VB01, Vestas V66	0:00
WEA VB01	WEA VB01, SG6.2-170	87:52
WEA VB02	WEA VB02, Vestas V66	0:00
WEA VB02	WEA VB02, SG6.2-170	153:10
WEA VB03	WEA VB03, SG6.2-170	65:18
WEA VB04	WEA VB04, SG6.2-170	35:55
WEA VB04	WEA VB04, Vestas V66	0:00
WEA VB05	WEA VB05, Vestas V66	0:00
WEA VB05	WEA VB05, SG6.2-170	9:35
WEA VB06	WEA VB06, Vestas V66	0:00
WEA VB06	WEA VB06, SG6.2-170	0:00
WEA VB07	WEA VB07, SG6.2-170	12:08
WEA VB07	WEA VB07, Vestas V66	0:00
WEA VB08	WEA VB08, Vestas V66	0:00
WEA VB08	WEA VB08, SG6.2-170	0:00
WEA VB09	WEA VB09, SG6.2-170	0:00
WEA VB09	WEA VB09, Vestas V66	0:00
WEA VB10	WEA VB10, Vestas V80	0:00
WEA VB10	WEA VB10, SG6.2-170	0:00
WEA VB11	WEA VB11, SG6.2-170	0:00
WEA VB11	WEA VB11, Vestas V80	0:00
WEA VB12	WEA VB12, SG6.2-170	0:00
WEA VB12	WEA VB12, Vestas V80	0:00
WEA VB13	WEA VB13, Vestas V80	0:00
WEA VB13	WEA VB13, SG6.2-170	0:00
WEA VB14	WEA VB14, Enercon E-82	0:00
WEA VB14	WEA VB14, SG6.2-170	0:00

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Projekt:  
**R-2-2023-0060**

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## SHADOW - Hauptergebnis

**Berechnung:** WEA\_VB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA VB15	WEA VB15, Enercon E-82	0:00
WEA VB15	WEA VB15, SG6.2-170	0:00
WEA VB16	WEA VB16, SG6.2-170	0:00
WEA VB16	WEA VB16, Enercon E-82	0:00
WEA VB17	WEA VB17, SG6.2-170	0:00
WEA VB17	WEA VB17, Enercon E-82	0:00
WEA VB18	WEA VB18, SG6.2-170	0:00
WEA VB18	WEA VB18, Enercon E-82	0:00
WEA VB19	WEA VB19, SG6.2-170	0:00
WEA VB19	WEA VB19, Enercon E-82	0:00
WEA VB20	WEA VB20, Enercon E-82	0:00
WEA VB20	WEA VB20, SG6.2-170	0:00
WEA VB21	WEA VB21, Enercon E-82	0:00
WEA VB21	WEA VB21, SG6.2-170	0:00
WEA VB22	WEA VB22, Enercon E-82	0:00
WEA VB23	WEA VB23, Enercon E-82	0:00
WEA VB24	WEA VB24, Enercon E-82	0:00
WEA VB25	WEA VB25, Enercon E-82	0:00
WEA VB26	WEA VB26, Enercon E-82	0:00
WEA VB27	WEA VB27, Enercon E-82	0:00
WEA VB28	WEA VB28, Enercon E-82	0:00
WEA VB29	WEA VB29, Nordex N117 2.4	0:00
WEA VB30	WEA VB30, Nordex N117 2.4	0:00
WEA VB31	WEA VB31, V162-5.6	0:00
WEA Z01	WEA Z01, SG 6.0-170	0:00
WEA Z02	WEA Z02, V162-6.0	0:00
WEA Z03_1	WEA Z03_1, V162-6.0	0:00
WEA Z03_2	WEA Z03_2, V162-6.0	0:00
WEA Z06	WEA Z06, V162-6.0	0:00
WEA1	WEA1, Enron Wind EW 1.5 sl	81:00
WEA2	WEA2, Enron Wind EW 1.5 sl	40:26
WEA3	WEA3, Enron Wind EW 1.5 sl	8:12
WEA4	WEA4, Enron Wind EW 1.5 sl	0:00
WEA5	WEA5, Enron Wind EW 1.5 sl	29:22
WEA6	WEA6, Enron Wind EW 1.5 sl	10:25
WEA7	WEA7, Enron Wind EW 1.5 sl	12:51

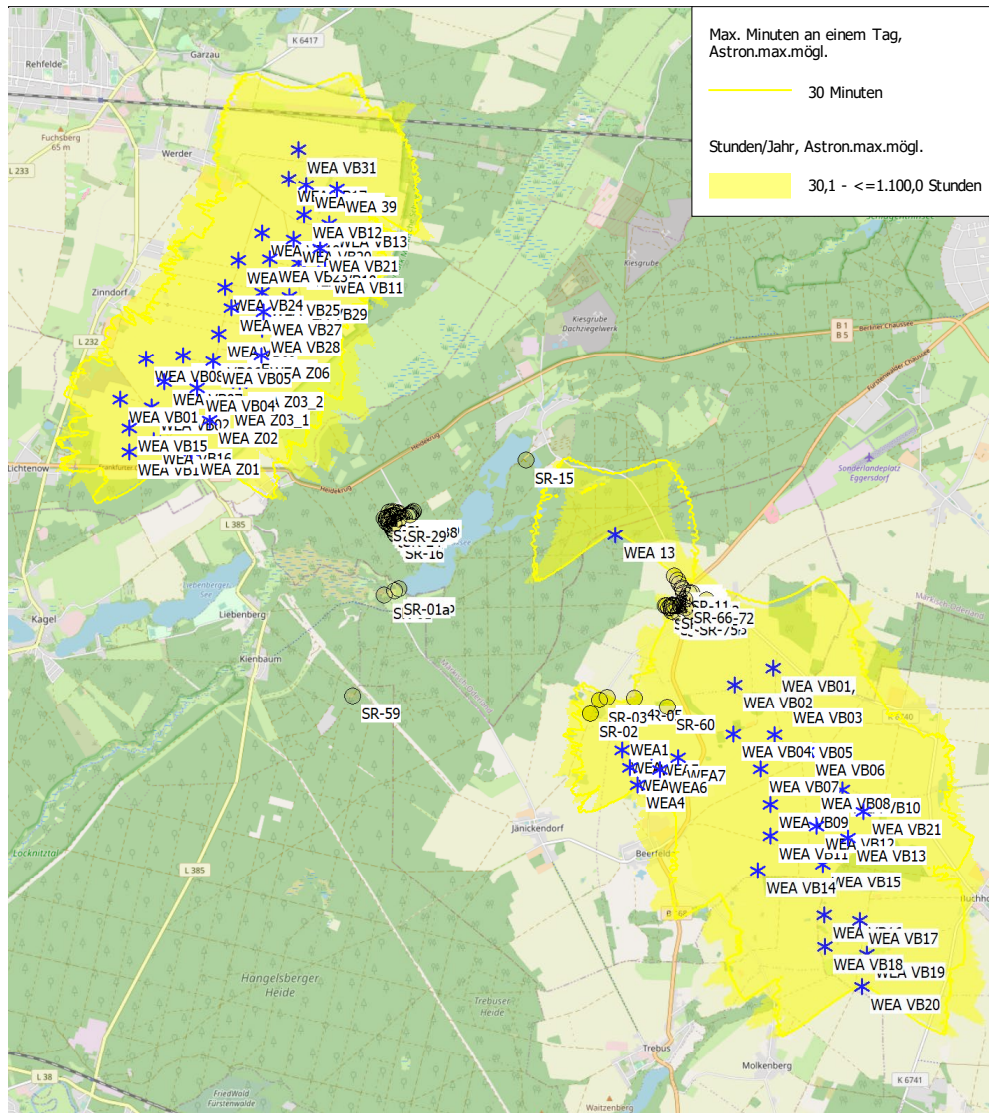
Summen in Rezeptortabelle und WEA-Tabelle können sich unterscheiden, da eine WEA gleichzeitig an zwei oder mehr Rezeptoren Beschattung verursachen kann und/oder ein Rezeptor gleichzeitig von zwei oder mehr WEA beschattet werden kann.

Anlage B2: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Vorbelastung unterteilt in Minuten / Tag und Stunden / Jahr

Projekt:  
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**SHADOW - Karte**  
Berechnung: WEA\_VB



Karte: EMD OpenStreetMap, Maßstab 1:80.000, Mitte: UTM (north)-ETRS89 Zone: 33 Ost: 432.740 Nord: 5.813.680  
 \* Existierende WEA    ☀ Schattenrezeptor  
 Höhe der Schattenkarte: German Brandenburg Elevation Model (DGMS - 5m grid)  
 Zeitschritt: 3 Minuten, Schrittweite: 7 Tag(e), Kartenaufösung: 20 m, Sichtbarkeit Auflösung: 10 m, Augenhöhe: 1,5 m

Anlage B3: SHADOW-Hauptergebnis mit Darstellung der Zusatzbelastung, Immissionsorte SR-01 bis SR-95, Berechnungsergebnisse Stunden / Jahr, Schattentage / Jahr und maximalen Stunden / Tag

Projekt:  
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### SHADOW - Hauptergebnis

**Berechnung:** WEA\_ZB

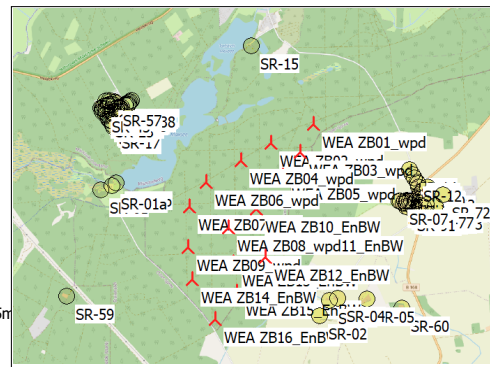
#### Annahmen für Schattenwurfberechnung

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 Sonneneinstrahlungsrichtung  
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: German Brandenburg Elevation Model (DGMS - 5m)  
Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:  
UTM (north)-ETRS89 Zone: 33



#### WEA

WEA	Ost	Nord	Z	Beschreibung	WEA-Typ			Nennleistung	Rotor-durchmesser	Nabenhöhe	Schattendaten	
					Aktuell	Hersteller	Typ				Beschatt.-Bereich	U/min
WEA ZB01_wpd	433.877	5.813.954	61,3	WEA ZB01_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB02_wpd	433.298	5.813.695	60,3	WEA ZB02_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB03_wpd	433.697	5.813.566	60,1	WEA ZB03_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB04_wpd	432.884	5.813.457	59,6	WEA ZB04_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB05_wpd	433.453	5.813.239	58,7	WEA ZB05_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB06_wpd	432.407	5.813.176	58,2	WEA ZB06_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB07_wpd	432.168	5.812.845	55,8	WEA ZB07_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB08_wpd	432.700	5.812.559	57,0	WEA ZB08_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB09_wpd	432.140	5.812.295	55,9	WEA ZB09_wpd, V... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB10_EnBW	433.085	5.812.811	57,4	WEA ZB10_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB11_EnBW	433.401	5.812.542	57,8	WEA ZB11_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB12_EnBW	433.205	5.812.138	55,9	WEA ZB12_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB13_EnBW	432.765	5.812.083	53,2	WEA ZB13_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB14_EnBW	432.200	5.811.858	51,5	WEA ZB14_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB15_EnBW	432.805	5.811.676	51,5	WEA ZB15_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0
WEA ZB16_EnBW	432.508	5.811.297	51,9	WEA ZB16_EnBW, ... Ja	Ja	VESTAS	V162-6.2-6.200	6.200	162,0	169,0	2,041	0,0

#### Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Neigung	Ausrichtungsmodus	Augenhöhe
		[m]	[m]	[m]	[m]	[m]	des Fensters	[°]	(ZVI) ü.Gr. [m]
SR-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	431.106	5.813.145	40,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	431.170	5.813.181	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	433.938	5.811.330	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	434.068	5.811.536	55,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	434.184	5.811.569	56,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	434.584	5.811.549	58,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	435.103	5.812.854	60,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	435.067	5.812.891	61,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	435.042	5.812.883	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	435.315	5.813.074	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	435.300	5.813.111	70,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	435.289	5.813.136	69,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	435.265	5.813.193	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	435.240	5.813.247	71,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	435.192	5.813.315	71,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-15	SR-15, Am Maxsee 4, 15374 Müncheberg	433.047	5.815.033	41,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-16	SR-16, Am Fuchsbad 9, 15374 Müncheberg	431.144	5.813.955	53,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"
SR-17	SR-17, Am Fuchsbad 8, 15374 Müncheberg	431.136	5.813.975	57,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"

(Fortsetzung nächste Seite)...



Projekt:  
**R-2-2023-0060**

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Berechnet:  
04.09.2023 12:52/3.6.366

### SHADOW - Hauptergebnis

#### Berechnung: WEA\_ZB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
		[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
SR-18	SR-18, Am Fuchsbau 7, 15374 Müncheberg	431.118	5.813.987	56,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-19	SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg	431.097	5.814.031	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-20	SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg	431.075	5.814.057	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-21	SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg	431.073	5.814.102	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-22	SR-22, Am Fuchsbau 1, 15374 Müncheberg	431.039	5.814.112	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	431.056	5.814.129	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	431.105	5.814.127	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	431.117	5.814.138	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	431.130	5.814.147	55,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	431.146	5.814.156	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	431.178	5.814.160	54,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	431.184	5.814.193	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	431.196	5.814.204	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	431.221	5.814.206	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	431.211	5.814.222	56,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	431.244	5.814.210	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	431.260	5.814.222	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	431.305	5.814.241	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	431.340	5.814.234	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	431.322	5.814.263	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	431.343	5.814.267	54,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	431.361	5.814.273	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	431.374	5.814.284	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	431.389	5.814.307	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	430.998	5.814.164	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	431.005	5.814.192	54,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	430.988	5.814.208	54,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	430.965	5.814.215	55,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	431.033	5.814.184	54,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	431.018	5.814.228	53,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	431.053	5.814.194	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.041	5.814.299	55,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	431.065	5.814.232	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	431.084	5.814.237	54,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	431.113	5.814.255	53,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	431.076	5.814.255	54,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	431.097	5.814.285	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-55	SR-55, Hasenweg 3a, 15374 Müncheberg	431.087	5.814.310	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	431.142	5.814.258	54,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.156	5.814.273	54,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	431.174	5.814.289	55,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-59	SR-59, Am Hüllengrund 3, 15374 Kienbaum	430.462	5.811.645	52,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	435.063	5.811.423	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	430.960	5.813.095	40,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	435.392	5.813.063	70,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	435.444	5.813.070	69,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	435.373	5.813.016	67,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	435.389	5.812.979	65,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	435.344	5.812.970	65,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	435.393	5.812.918	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	435.434	5.812.920	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	435.455	5.812.922	62,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	435.530	5.812.945	64,1	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	435.601	5.812.953	63,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	435.652	5.812.955	64,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	435.549	5.812.814	64,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	435.458	5.812.804	63,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	435.418	5.812.800	62,3	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	435.377	5.812.798	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	435.417	5.812.836	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	435.383	5.812.836	62,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	435.349	5.812.849	61,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	435.323	5.812.855	61,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	435.332	5.812.903	62,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	435.306	5.812.912	63,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	435.273	5.812.888	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	435.225	5.812.883	62,5	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	435.189	5.812.890	62,9	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	435.163	5.812.884	62,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	435.147	5.812.895	62,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	435.123	5.812.883	61,6	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	435.139	5.812.849	60,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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04.09.2023 12:52/3.6.366

## SHADOW - Hauptergebnis

### Berechnung: WEA\_ZB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr. [m]
					[m]	[m]	[m]	[°]		
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	435.136	5.812.806	60,2	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	435.177	5.812.797	60,7	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	435.247	5.812.783	61,0	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	435.296	5.812.793	61,4	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	435.330	5.812.825	61,8	0,1	0,1	2,0	90,0	"Gewächshaus-Modus"	2,1
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	435.337	5.812.786	62,4	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-01a	SR-01a, Neue Mühle 1, 15518 Jänickendorf	100:23	230	0:52
SR-01b	SR-01b, Neue Mühle 1 (Nebengebäude), 15518 Jänickendorf	104:11	231	0:53
SR-02	SR-02, Ausbau Schönfelder Weg 1, 15518 Jänickendorf	66:45	159	0:34
SR-03	SR-03, Ausbau Schönfelder Weg 2, 15518 Jänickendorf	55:16	150	0:42
SR-04	SR-04, Ausbau Schönfelder Weg 3, 15518 Jänickendorf	80:24	170	0:49
SR-05	SR-05, Beerfelde Ausbau 3, 15518 Steinhöfel	32:00	107	0:26
SR-06	SR-06, Neumühler Straße 5, 15518 Schönfelde	53:03	195	0:25
SR-07	SR-07, Neumühler Straße 5a, 15518 Schönfelde	53:55	194	0:26
SR-08	SR-08, Neumühler Straße 6, 15518 Schönfelde	60:32	208	0:27
SR-09	SR-09, Hoppegartener Straße 18, 15518 Schönfelde	43:55	151	0:24
SR-10	SR-10, Hoppegartener Straße 19, 15518 Schönfelde	45:48	155	0:24
SR-11	SR-11, Hoppegartener Straße 20, 15518 Schönfelde	46:54	156	0:25
SR-12	SR-12, Hoppegartener Straße 20a, 15518 Schönfelde	49:43	163	0:27
SR-13	SR-13, Hoppegartener Straße 21, 15518 Schönfelde	49:44	169	0:28
SR-14	SR-14, Hoppegartener Straße 22, 15518 Schönfelde	49:12	158	0:31
SR-15	SR-15, Am Maxsee 4, 15374 Müncheberg	31:43	76	0:29
SR-16	SR-16, Am Fuchsbau 9, 15374 Müncheberg	44:20	143	0:26
SR-17	SR-17, Am Fuchsbau 8, 15374 Müncheberg	45:01	141	0:26
SR-18	SR-18, Am Fuchsbau 7, 15374 Müncheberg	43:46	140	0:26
SR-19	SR-19, Am Fuchsbau 5/5a, 15374 Müncheberg	42:51	136	0:25
SR-20	SR-20, Am Fuchsbau 4/4a, 15374 Müncheberg	41:31	134	0:25
SR-21	SR-21, Am Fuchsbau 2/2a, 15374 Müncheberg	40:49	129	0:24
SR-22	SR-22, Am Fuchsbau 1, 15374 Müncheberg	39:32	131	0:24
SR-23	SR-23, Wilhelm-Maass weg 31, 15374 Müncheberg	39:49	126	0:24
SR-24	SR-24, Wilhelm-Maass weg 29, 15374 Müncheberg	40:37	127	0:24
SR-25	SR-25, Wilhelm-Maass weg 28, 15374 Müncheberg	40:19	124	0:24
SR-26	SR-26, Wilhelm-Maass weg 27, 15374 Müncheberg	39:39	122	0:25
SR-27	SR-27, Wilhelm-Maass weg 26, 15374 Müncheberg	39:11	120	0:25
SR-28	SR-28, Wilhelm-Maass weg 25/25a, 15374 Müncheberg	38:56	122	0:25
SR-29	SR-29, Wilhelm-Maass weg 24, 15374 Müncheberg	36:39	118	0:24
SR-30	SR-30, Wilhelm-Maass weg 23, 15374 Müncheberg	35:59	117	0:25
SR-31	SR-31, Wilhelm-Maass weg 23a, 15374 Müncheberg	35:28	116	0:25
SR-32	SR-32, Wilhelm-Maass weg 22a, 15374 Müncheberg	34:02	113	0:25
SR-33	SR-33, Wilhelm-Maass weg 21/21a, 15374 Müncheberg	34:46	114	0:25
SR-34	SR-34, Wilhelm-Maass weg 20/20a, 15374 Müncheberg	33:42	112	0:25
SR-35	SR-35, Wilhelm-Maass weg 17a, 15374 Müncheberg	31:42	110	0:26
SR-36	SR-36, Wilhelm-Maass weg 16b, 15374 Müncheberg	37:09	133	0:26
SR-37	SR-37, Wilhelm-Maass weg 16/16a, 15374 Müncheberg	30:09	106	0:26
SR-38	SR-38, Wilhelm-Maass weg 15, 15374 Müncheberg	35:09	129	0:26
SR-39	SR-39, Wilhelm-Maass weg 14, 15374 Müncheberg	35:18	120	0:26
SR-40	SR-40, Wilhelm-Maass weg 13, 15374 Müncheberg	37:30	130	0:26
SR-41	SR-41, Wilhelm-Maass weg 12, 15374 Müncheberg	40:46	133	0:26
SR-42	SR-42, Wilhelm-Maass-Weg 1, 15374 Müncheberg	37:20	125	0:23
SR-43	SR-43, Wilhelm-Maass-Weg 1b, 15374 Müncheberg	36:35	124	0:22
SR-44	SR-44, Rehweg 1, 15374 Müncheberg	36:01	122	0:23
SR-45	SR-45, Rehweg 2, 15374 Müncheberg	30:03	98	0:22
SR-46	SR-46, Wilhelm-Maass-Weg 2, 15374 Müncheberg	37:22	124	0:23
SR-47	SR-47, Rehweg 17, 15374 Müncheberg	35:33	119	0:23
SR-48	SR-48, Wilhelm-Maass-Weg 2a/2b/2c/2d, 15374 Müncheberg	37:09	122	0:23
SR-49	SR-49, Wilhelm-Maass-Weg 4, 15374 Müncheberg	31:38	113	0:22
SR-50	SR-50, Wilhelm-Maass-Weg 3, 15374 Müncheberg	35:24	117	0:23

(Fortsetzung nächste Seite)...

Projekt:  
**R-2-2023-0060**

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04.09.2023 12:52/3.6.366

## SHADOW - Hauptergebnis

**Berechnung:** WEA\_ZB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer		
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag
		[h/a]	[d/a]	[h/d]
SR-51	SR-51, Wilhelm-Maass-Weg 4, 15374 Müncheberg	35:05	118	0:23
SR-52	SR-52, Hasenweg 1a, 15374 Müncheberg	33:45	114	0:23
SR-53	SR-53, Hasenweg 1, 15374 Müncheberg	34:07	116	0:23
SR-54	SR-54, Hasenweg 2a, 15374 Müncheberg	32:04	112	0:23
SR-55	SR-55, Hasenweg 3A, 15374 Müncheberg	30:33	110	0:22
SR-56	SR-56, Wilhelm-Maass-Weg 5, 15374 Müncheberg	33:13	113	0:24
SR-57	SR-57, Wilhelm-Maass-Weg 6, 15374 Müncheberg	31:49	111	0:24
SR-58	SR-58, Wilhelm-Maass-Weg 6, 15374 Müncheberg	30:36	110	0:24
SR-59	SR-59, Am Höllegrund 3, 15537 Kienbaum	19:16	70	0:22
SR-60	SR-60, Beerfelde Ausbau 2, 15518 Steinhöfel	21:14	85	0:21
SR-61	SR-61, Neue Mühle 2, 15518 Jänickendorf	68:36	201	0:38
SR-62	SR-62, Hoppegartener Straße 23, 15518 Schönfelde	36:42	131	0:23
SR-63	SR-63, Hoppegartener Straße 24, 15518 Schönfelde	33:34	131	0:22
SR-64	SR-64, Hoppegartener Straße 23a, 15518 Schönfelde	40:17	144	0:23
SR-65	SR-65, Hoppegartener Straße 25, 15518 Schönfelde	38:15	142	0:23
SR-66	SR-66, Hoppegartener Straße 16/17, 15518 Schönfelde	36:58	138	0:23
SR-67	SR-67, Grünstraße 26, 15518 Steinhöfel	34:08	134	0:22
SR-68	SR-68, Grünstraße 27, 15518 Steinhöfel	30:10	113	0:22
SR-69	SR-69, Grünstraße 28, 15518 Steinhöfel	30:50	114	0:22
SR-70	SR-70, Grünstraße 30/31, 15518 Steinhöfel	26:29	98	0:21
SR-71	SR-71, Grünstraße 32/32a, 15518 Steinhöfel	23:39	102	0:20
SR-72	SR-72, Grünstraße 33, 15518 Steinhöfel	12:34	55	0:20
SR-73	SR-73, Eggersdorfer Straße 50, 15518 Steinhöfel	20:34	84	0:20
SR-74	SR-74, Eggersdorfer Straße 51, 15518 Steinhöfel	15:41	73	0:20
SR-75	SR-75, Eggersdorfer Straße 52/52a, 15518 Steinhöfel	24:24	116	0:21
SR-76	SR-76, Eggersdorfer Straße 53, 15518 Steinhöfel	23:14	107	0:21
SR-77	SR-77, Eggersdorfer Straße 54/55, 15518 Steinhöfel	27:26	124	0:21
SR-78	SR-78, Eggersdorfer Straße 58, 15518 Steinhöfel	26:06	120	0:21
SR-79	SR-79, Neumühler Straße 57/58, 15518 Steinhöfel	26:01	116	0:22
SR-80	SR-80, Neumühler Straße 59, 15518 Steinhöfel	26:00	113	0:22
SR-81	SR-81, Neumühler Straße 15/15a, 15518 Steinhöfel	30:26	127	0:22
SR-82	SR-82, Neumühler Straße 14, 15518 Steinhöfel	30:15	125	0:23
SR-83	SR-83, Neumühler Straße 12/13, 15518 Steinhöfel	26:52	112	0:23
SR-84	SR-84, Neumühler Straße 11/11a, 15518 Steinhöfel	27:50	101	0:23
SR-85	SR-85, Neumühler Straße 10, 15518 Steinhöfel	29:41	105	0:24
SR-86	SR-86, Neumühler Straße 9, 15518 Steinhöfel	33:39	120	0:25
SR-87	SR-87, Neumühler Straße 8, 15518 Steinhöfel	34:07	118	0:25
SR-88	SR-88, Neumühler Straße 7, 15518 Steinhöfel	42:03	152	0:25
SR-89	SR-89, Neumühler Straße 4a, 15518 Steinhöfel	37:57	131	0:25
SR-90	SR-90, Neumühler Straße 4, 15518 Steinhöfel	41:07	140	0:25
SR-91	SR-91, Neumühler Straße 3/3a, 15518 Steinhöfel	35:40	129	0:24
SR-92	SR-92, Neumühler Straße 2, 15518 Steinhöfel	29:40	111	0:23
SR-93	SR-93, Neumühler Straße 1, 15518 Steinhöfel	26:25	104	0:22
SR-94	SR-94, Neumühler Straße 1b, 15518 Steinhöfel	24:08	101	0:22
SR-95	SR-95, Neumühler Straße 1a, 15518 Steinhöfel	24:21	98	0:22

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal
		[h/a]
WEA ZB01_wpd	WEA ZB01_wpd, V162-6.2MW	89:05
WEA ZB02_wpd	WEA ZB02_wpd, V162-6.2MW	32:12
WEA ZB03_wpd	WEA ZB03_wpd, V162-6.2MW	72:46
WEA ZB04_wpd	WEA ZB04_wpd, V162-6.2MW	43:45
WEA ZB05_wpd	WEA ZB05_wpd, V162-6.2MW	36:13
WEA ZB06_wpd	WEA ZB06_wpd, V162-6.2MW	97:33
WEA ZB07_wpd	WEA ZB07_wpd, V162-6.2MW	93:12
WEA ZB08_wpd	WEA ZB08_wpd, V162-6.2MW	34:00
WEA ZB09_wpd	WEA ZB09_wpd, V162-6.2MW	61:46
WEA ZB10_EnBW	WEA ZB10_EnBW, V162-6.2MW	14:45
WEA ZB11_EnBW	WEA ZB11_EnBW, V162-6.2MW	43:16
WEA ZB12_EnBW	WEA ZB12_EnBW, V162-6.2MW	58:51
WEA ZB13_EnBW	WEA ZB13_EnBW, V162-6.2MW	64:44
WEA ZB14_EnBW	WEA ZB14_EnBW, V162-6.2MW	71:17

(Fortsetzung nächste Seite)...

Projekt:  
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### SHADOW - Hauptergebnis

**Berechnung:** WEA\_ZB

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Maximal [h/a]
WEA ZB15_EnBW	WEA ZB15_EnBW, V162-6.2MW	43:21
WEA ZB16_EnBW	WEA ZB16_EnBW, V162-6.2MW	21:00

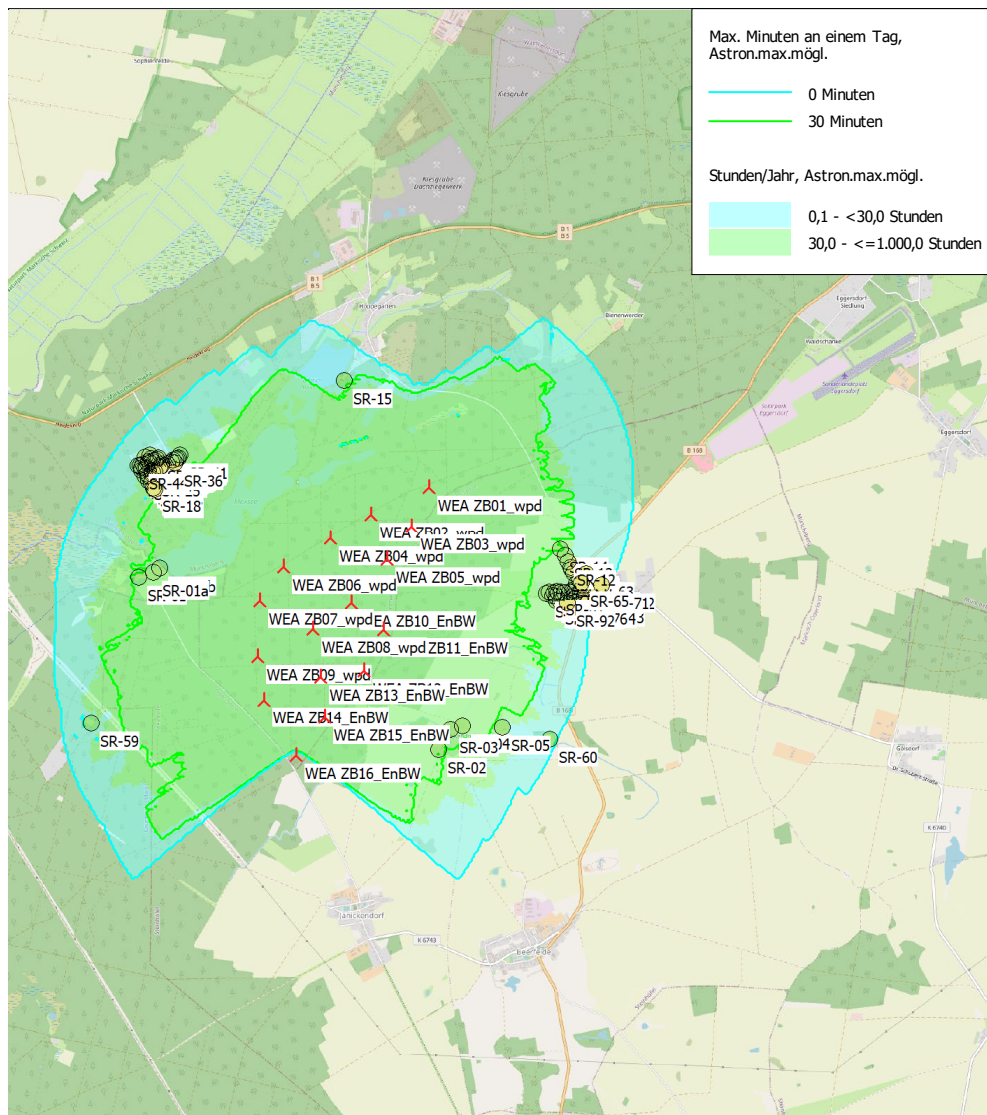
*Summen in Rezeptortabelle und WEA-Tabelle können sich unterscheiden, da eine WEA gleichzeitig an zwei oder mehr Rezeptoren Beschattung verursachen kann und/oder ein Rezeptor gleichzeitig von zwei oder mehr WEA beschattet werden kann.*



Anlage B4: SHADOW-Karte mit Darstellung des Lageplanes und der Schattenausbreitung der Zusatzbelastung unterteilt in Minuten / Tag und Stunden / Jahr

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**SHADOW - Karte**  
Berechnung: WEA\_ZB



Karte: EMD OpenStreetMap , Maßstab 1:55.000, Mitte: UTM (north)-ETRS89 Zone: 33 Ost: 434.640 Nord: 5.813.260  
 Neue WEA  Schattenrezeptor   
 Höhe der Schattenkarte: German Brandenburg Elevation Model (DGMS - 5m grid)  
 Zeitschritt: 3 Minuten, Schrittweite: 7 Tag(e), Kartenaufösung: 20 m, Sichtbarkeit Auflösung: 10 m, Augenhöhe: 1,5 m

Anlage C: Bilder der untersuchten Immissionsorte





Bild 1: Schattenrezeptor SR-01



Bild 2: Schattenrezeptor SR-02





Bild 3: Schattenrezeptor SR-03

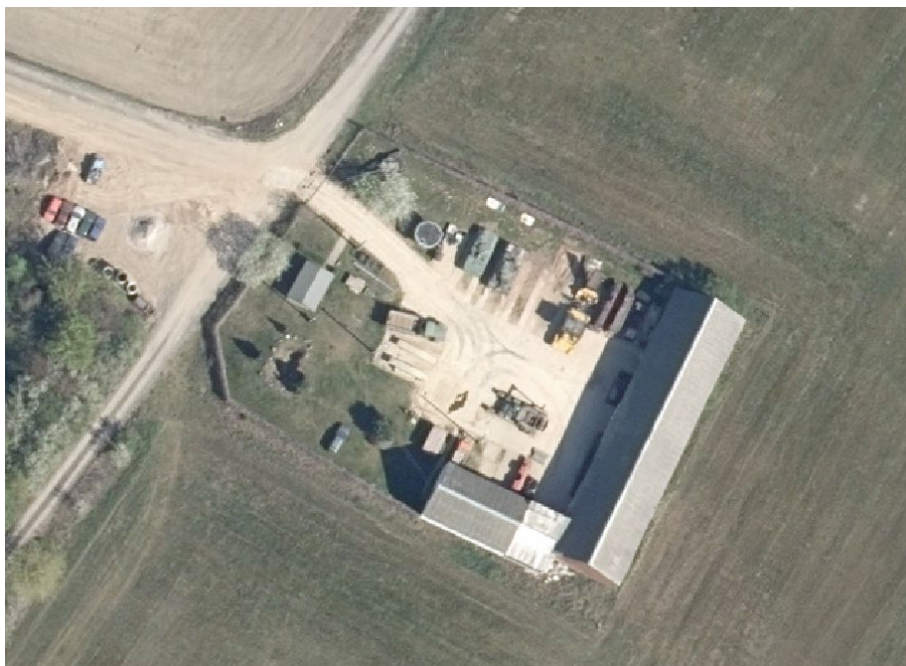


Bild 4: Schattenrezeptor SR-04 © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2020



Bild 5: Schattenrezeptor SR-05 © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2020



Bild 6: Schattenrezeptor SR-06 © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2020





Bild 7: Schattenrezeptor SR-07



Bild 8: Schattenrezeptor SR-08

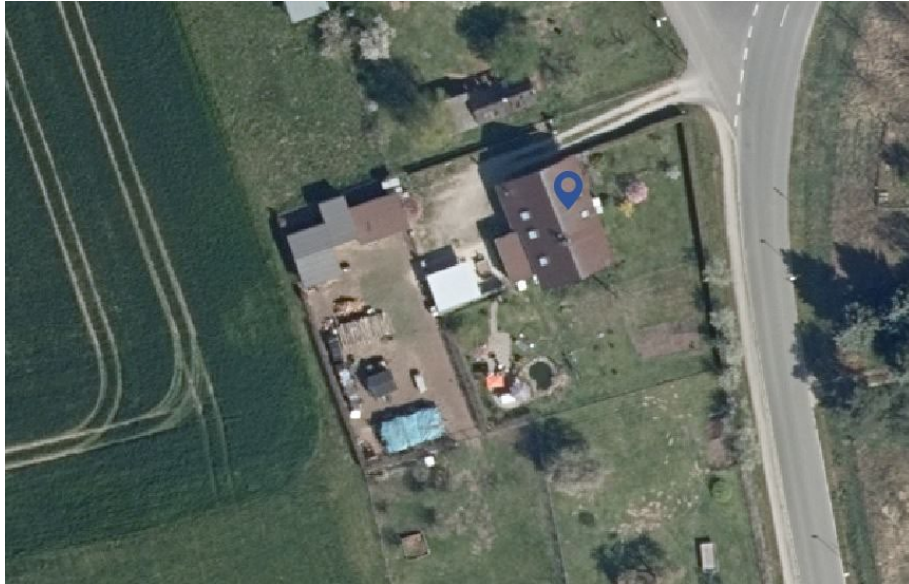


Bild 9: Schattenrezeptor SR-09, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021

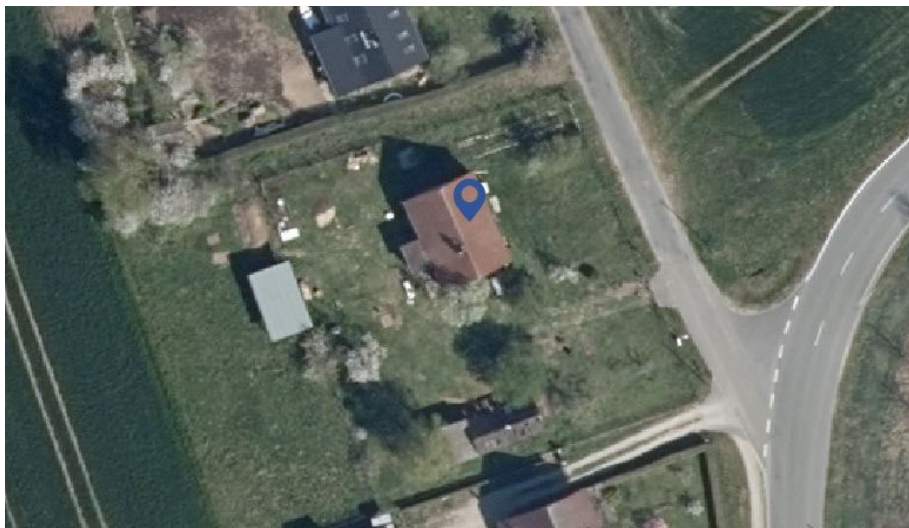


Bild 10: Schattenrezeptor SR-10, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021





Bild 11: Schattenrezeptor SR-11, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021

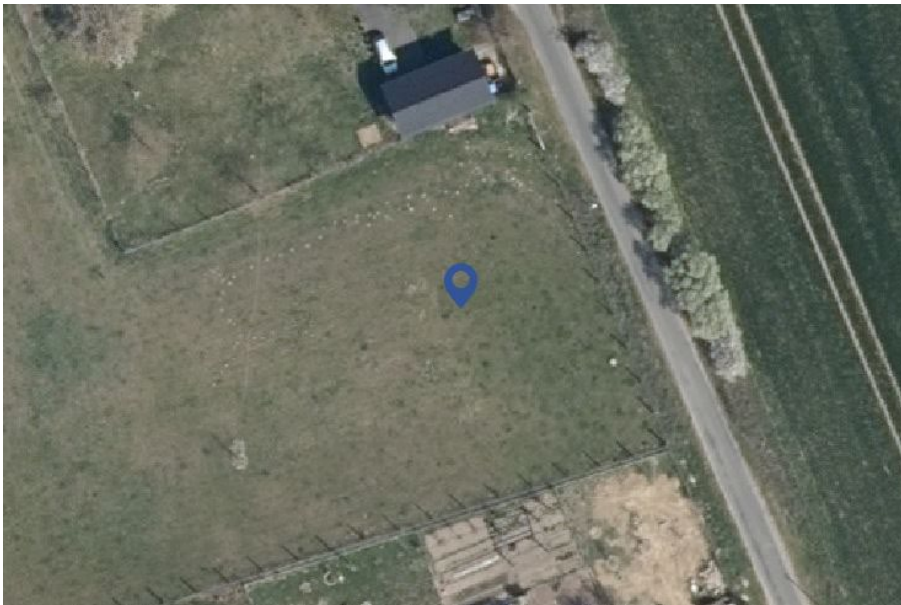


Bild 12: Schattenrezeptor SR-12, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021

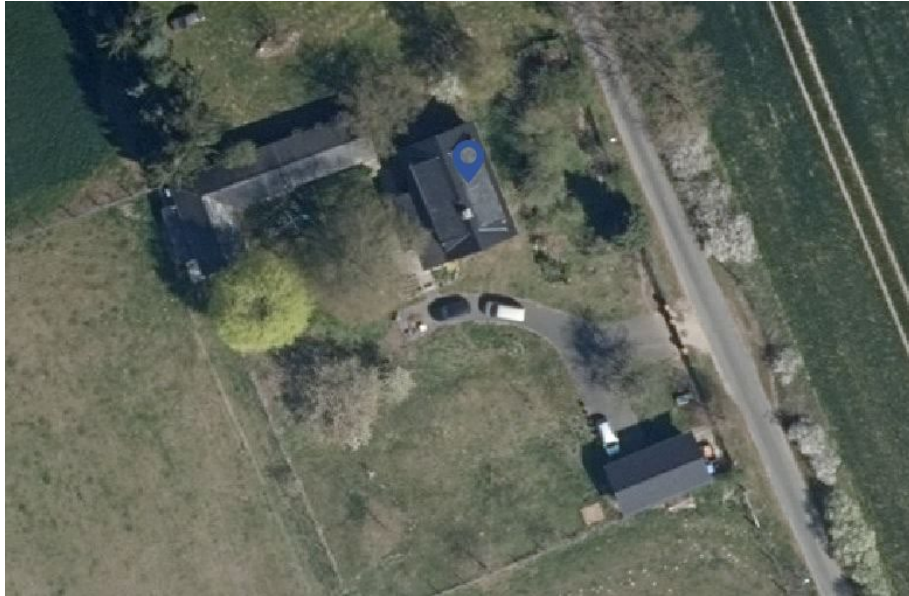


Bild 13: Schattenrezeptor SR-13, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021

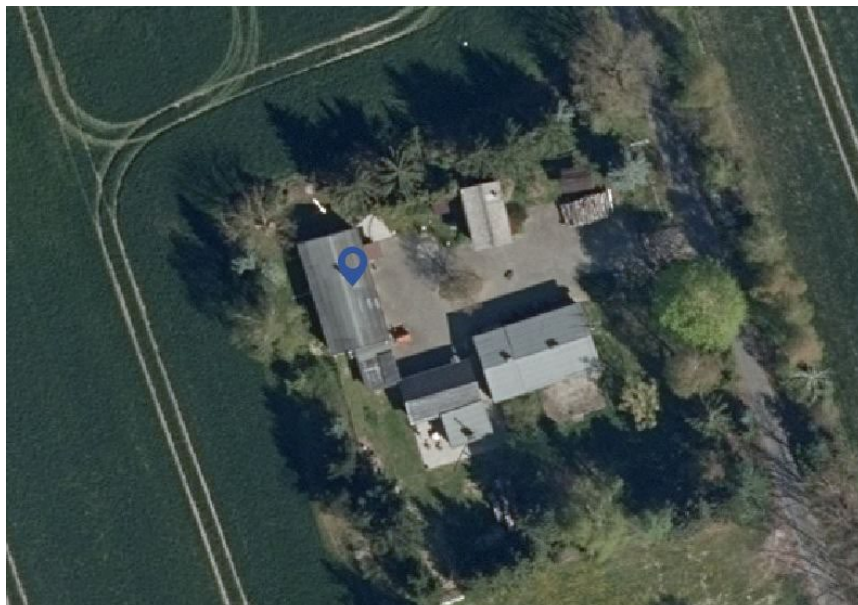


Bild 14: Schattenrezeptor SR-14, © LGB (Landesvermessung und Geobasisinformation Brandenburg) 2021





**Bild 15:** Schattenrezeptor SR-15



**Bild 16:** Schattenrezeptor SR-16 bis SR-58, © GDI-BB (Geodateninfrastruktur Brandenburg 2022)





**Bild 17:** Schattenrezeptor SR-59 © GDI-BB (Geodateninfrastruktur Brandenburg 2022)



**Bild 18:** Schattenrezeptor SR-60 © GDI-BB (Geodateninfrastruktur Brandenburg 2022)



**Bild 19:** Schattenrezeptor SR-61, SR-01a bis SR-01b © GDI-BB (Geodateninfrastruktur Brandenburg 2022)



**Bild 20:** Schattenrezeptor SR-62 bis SR-95 © GDI-BB (Geodateninfrastruktur Brandenburg 2022)