

# **SCHATTENWURFGUTACHTEN**

für den Betrieb von

## **3 WINDENERGIEANLAGEN**

**TYP ENERCON E-82 E2 (2,3 MW, TES) MIT 108,4 M NABENHÖHE**

am Standort

**LEHMDEN - LIETHE, 26180 RASTEDE**

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# 1 Einleitung

Der Ausbau der Windenergienutzung zur elektrischen Stromerzeugung wurde in den letzten Jahren stark intensiviert und vorangetrieben.

Durch die Windenergienutzung entsteht jedoch nicht nur der positive Effekt der regenerativen Stromgewinnung, es ergeben sich auch mögliche Beeinträchtigungen durch Windenergieanlagen. Dies ist neben den Schallemissionen der direkte Schattenwurf des Rotors. Der Schatten verursacht Lichtwechsel hinter der Windenergieanlage. Je nach Rotordrehzahl und der Anzahl der Rotorblätter beträgt die Frequenz der Lichtwechsel zwischen ca. 0,4 und 4,0 Hz. Diese Helligkeitsschwankungen können sich auf Menschen störend auswirken und im Falle starker Belastung unzumutbar werden.

Am Standort Lehmden – Liethe in der Gemeinde Rastede ist die Erweiterung eines vorhandenen Windparks um drei Windenergieanlagen (WEA) des Typs Enercon E-82 E2 (2,3 MW) mit einer Nabenhöhe von jeweils 108,4 m geplant. Der Rotordurchmesser der geplanten Anlagen beträgt 82,0 m und die Nennleistung beträgt je WEA 2.300 kW. Die geplante WEA vom Typ Enercon E-82 E2 (2,3 MW) ist an den Rotorblättern mit Serrations ausgestattet (TES – Trailing Edge Serrations).

Im näheren Umfeld zu den geplanten WEA besteht der Windpark Lehmden. Hier werden derzeit neun WEA verschiedener Hersteller und Typen betrieben (8 x NEG Micon NM52 mit 900 kW Nennleistung und 1 x Enercon E-58/10,58 mit 1.000 kW Nennleistung).

Als mögliche Vorbelastung geprüft wurde ein ca. 3,5 km nordöstlich vom Standort Lehmden - Liethe geplanter Windpark bei Delfshausen, welcher jedoch nicht als relevante Vorbelastung zu bewerten ist (vgl. Kap. 5). Dort sind aktuell drei WEA vom Typ Enercon E-82 E2 (2,3 MW, TES) geplant, die zurzeit noch nicht beantragt sind.

Als relevante Vorbelastung auszuschließen sind aufgrund der großen Distanz zum geplanten Windenergie-Standort ein mind. 5,3 km nordwestlich geplanter Windpark bei Rosenberg (Gemeinde Varel) und Heubült (Gemeinde Rastede) sowie der etwa 7 km östlich gelegene, genehmigte Windpark Nordbollenhagen im Landkreis Wesermarsch.

Der Auftraggeber, die Windkonzept Projektentwicklungs GmbH & Co. KG, beauftragte das Ingenieurbüro PLANKon mit der Erstellung einer Schattenwurfprognose für die drei geplanten Windenergieanlagen. Die hier vorgenommene Begutachtung erfolgt im Rahmen des BImSchG-Genehmigungsverfahrens.

Die zur Gemeinde Rastede gehörenden Ortsteile Lehmden, Kleibrok und Liethe liegen im Landkreis Ammerland in Niedersachsen.

Das Gebiet um den Standort stellt sich als hauptsächlich land- und forstwirtschaftlich genutzter Einwirkungsbereich dar. Des Weiteren befindet sich südwestlich des vorhandenen Windparks Lehmden das Industriegebiet Liethe mit gewerblicher Nutzung. Die Ortsteile Hahn-Lehmden etwa 1,7 km westlich der geplanten WEA und Rastede-Kleibrok etwa 2 km weiter südlich sind als nächstgelegene größeren Ortschaften im Umfeld des geplanten Windpark zu nennen. Im näheren Umfeld zu den geplanten WEA befinden sich an den Ortsrändern und im Außenbereich liegende Hofstellen und Wohnhäuser bzw. im Außenbereich liegende Bebauung entlang der Straße K 131 im Westen. Die Anlagen besitzen zu der Wohnbebauung im Außenbereich eine Entfernung von mind. 590 m.

Durch das Schattenwurfgutachten wird der Schattenwurf auf Wohngebäude oder Arbeitsstätten berechnet. Die Grundberechnungen gehen dabei von dem ungünstigsten Fall aus, dass die Sonne immer scheint, der Rotor sich kontinuierlich dreht und, in Bezug auf den betrachteten

Immissionspunkt, senkrecht zu den Sonnenstrahlen steht. Die Berechnungen werden mit der Software WindPRO, Modul „Shadow“ der Firma EMD International A/S durchgeführt.

## 2 Sonnenstand

Für die Ermittlung des Rotorschattenwurfs an einem Beobachtungspunkt bilden neben dem Sonnenstand auch geometrische Größen die Grundlage. Der Stand der Sonne ist im Wesentlichen von der Erdrotation, der Neigung der Erdachse und der elliptischen Laufbahn der Erde um die Sonne abhängig. Weiterhin müssen für jeden Standort die geographischen, jahreszeitlichen, und tageszeitlichen Daten berücksichtigt werden. Mit diesen Daten werden die Deklination  $\delta$ , der Stundenwinkel  $\omega$ , die Sonnenhöhe  $h$ , der Azimut  $\gamma$  und der Sonnenauf- und Untergang berechnet (s. Abbildungen im Anhang). Die Begriffe in den Abbildungen bedeuten:

- **Deklination  $\delta$ :** Jahresgang der Sonne. Winkel, um den die Sonne im Verlauf der Jahreszeiten um den Zenit am Äquator schwankt. (Winteranfang (21.12.)  $-23,45^\circ$ , Sommeranfang (21.6.)  $23,45^\circ$  und Herbst- (23.9.) sowie Frühlingsanfang (21.3.)  $0^\circ$ );
- **Sonnenhöhe  $h$ :** Einfallswinkel der Sonne gegenüber einer horizontalen Fläche;
- **Stundenwinkel  $\omega$ :** Winkel zwischen dem Sonnenhöchststand und dem aktuellen Sonnenstand. Zeitlich vor dem Sonnenhöchststand ist er positiv und danach negativ;
- **Azimut  $\gamma$ :** Winkel zwischen der Südrichtung und dem auf die horizontale Ebene projizierten Sonnenstand. Im Uhrzeigersinn vor der südlichen Richtung positiv und danach negativ;
- **Sonnenaufgang  $t_a$ , Sonnenuntergang  $t_u$ :** Aufgang/Untergang, wenn der Sonnenmittelpunkt über die horizontale Fläche morgens/abends am Horizont sichtbar/verdeckt wird.

Die Berechnungen berücksichtigen die sich verändernde Dauer eines Tages von dem vorherigen Sonnenhöchststand zum nächsten Sonnenhöchststand, die wegen der elliptischen Umlaufbahn der Erde um die Sonne um bis zu 16 Minuten variiert. Da die Ergebnisse nicht nur für ein Jahr gültig sein sollen, wird in den Berechnungen die Tagesanzahl im Jahr auf 365,25 Tage gemittelt. Dadurch verschieben sich aber die Ergebnisse in dem Zeitraum über alle vier Jahre um bis zu einem Tag.

### 3 Schattenwurf

Im Allgemeinen wird beim Schattenwurf zwischen dem Kern- und dem Halbschatten unterschieden. Der Kernschatten entspricht dem Bereich, in dem die direkten Sonnenstrahlen durch das Hindernis vollständig verdeckt werden. Der Halbschatten ist der Bereich, der nur von einem Teil des Sonnenlichts bestrahlt wird. Da Windenergieanlagen schmale Flügel besitzen, ist der Kernschatten nur sehr kurz und deshalb nicht relevant. Bei einer Rotorblattbreite von 2 m beträgt die Länge des Kernschattens 216 m und ist geringer als die Mindestabstände, die zur Wohnbebauung eingehalten werden müssen. Die Intensität des noch relevanten Halbschattens nimmt mit zunehmender Entfernung ab. Bei dem oben erwähnten Rotorblatt beträgt die Schattenintensität in 500 m Entfernung nur noch 43 % gegenüber dem Kernschatten.

Über den Sonnenstand wird der Schattenwurf einer WEA berechnet. Die notwendigen Daten sind:

- die Koordinaten der WEA (Breiten- und Längengrad, Höhe über NN),
- Ausmaße der WEA (Nabenhöhe, Rotordurchmesser, mittlere Blatttiefe),
- minimale Sonnenhöhe, ab welcher der Schattenwurf relevant ist.

Die minimale Sonnenhöhe gibt an, ab welchem Winkel die direkte Sonneneinstrahlung nach dem Sonnenaufgang und vor dem Sonnenuntergang so stark ist, dass der Schattenwurf eine wahrnehmbare Beeinträchtigung darstellt. Theoretisch existiert bei minimaler Sonnenhöhe ein unendlich weiter Schattenwurf, der aber in der Praxis wegen Bewuchs, Bebauung, Dunst und der zu durchdringenden Atmosphärenschichten in ebenem Gelände vernachlässigt werden kann. Daher wird Schattenwurf durch Sonnenstände unter 3 ° nicht berücksichtigt.

Der Beschattungsbereich (maximale Reichweite des Schattenwurfs einer WEA) wird nach dem sog. 20%-Kriterium entsprechend /3/ ermittelt. Der Abstand beinhaltet den Bereich, in welchem die Sonnenfläche gerade zu 20 % durch den Rotor verdeckt wird.

Zur Ermittlung des Schattens auf einen Immissionspunkt wird mit dem Modul „Shadow“ (WindPRO) /1/ die Simulation des Verlaufs der Sonne in 2-Minuten-Schritten über das ganze Jahr durchgeführt. Unter Berücksichtigung der Koordinaten für den jeweiligen Immissionspunkt und den WEA-Daten wird über die Simulation untersucht, ob der Immissionspunkt durch den Schattenwurf einer oder mehrerer Windenergieanlagen beeinträchtigt wird. Tritt eine Störung auf, werden dazu das Datum, der Beginn, das Ende und die Dauer des Schattens für jeden Tag angegeben. Über ein ganzes Jahr wird daraus wiederum die Anzahl der Schattentage und die gesamte Schattenwurfdauer berechnet.

Für die Windenergieanlagen des Typs Enercon E-82 E2 (2,3 MW) mit 108,4 m Nabenhöhe wurde ein max. Einwirkungsbereich des Schattenwurfes von 1.598 m auf die untersuchten vertikalen Flächen (Schattenrezeptoren gem. LAI-Hinweisen /3/) ermittelt.

## 4 Wahrscheinlichkeitsbetrachtungen

Die Berechnungen sind für kontinuierlichen Sonnenschein durchgeführt. Da dies nicht der Fall ist, muss die Sonnenscheinwahrscheinlichkeit berücksichtigt werden, weil mit dieser die Wahrscheinlichkeit für das Auftreten des Schattenwurfes einhergeht. Die Sonnenscheinwahrscheinlichkeit ist von Region zu Region unterschiedlich und basiert auf mehrjährigen Messungen. Als Datengrundlage werden die Angaben aus den „Klimadaten für Deutschland“ [2] verwendet, die vom Deutschen Wetterdienst erstellt wurden. Angegeben wird üblicherweise die durchschnittliche Prozentzahl der Bewölkung je Monat.

Die in dem Gutachten dargestellten Ergebnisse gehen ebenfalls von dem ungünstigsten Fall aus, dass die Windrichtung mit der Richtung der Sonnenstrahlen identisch ist. Berücksichtigt man die Windrichtungsverteilung, so verkürzt sich die Dauer des Schattenwurfs je Tag, da ein Winkel zwischen der Windrichtung und der Sonnenstrahlen einen schmaleren ellipsen- bis linienförmigen Schattenwurf verursacht.

Weiterhin ist die WEA nicht dauernd in Betrieb, wodurch sich die Wahrscheinlichkeit für das Auftreten des Schattenwurfes durch den sich drehenden Rotor zusätzlich reduziert.

Die Windrichtungsverteilung kann den Daten einer nahen Wetterstation entnommen werden. Die Stillstandshäufigkeit kann ebenfalls mit Hilfe dieser Daten und der Leistungskennlinie der WEA angegeben werden. Bei Windgeschwindigkeiten unter 1,0 m/s kann in jedem Fall von einem Stillstand der Windenergieanlage ausgegangen werden.

## 5 Datengrundlage

Die Berechnung des Schattenwurfes basiert auf den geographischen Daten, die aus dem vorliegenden Kartenmaterial graphisch über die Berechnungssoftware ermittelt wurden. Die Berechnungen wurden für die drei geplanten Anlagen vom Typ Enercon E-82 E2 (2,3 MW) durchgeführt. Der geplante WEA-Typ Enercon E-82 E2 (2,3 MW) ist an den Rotorblättern mit Serrations ausgestattet (TES – Trailing Edge Serrations). Die Koordinaten der geplanten WEA wurden vom Auftraggeber vorgegeben. Die Koordinaten der im Windpark Lehmden bestehenden WEA wurden vom Landkreis Ammerland zur Verfügung gestellt (E-Mail Herr Herbers vom 06.07.2016).

Im Vorfeld der Schattenwurfprognose wurde geprüft, ob von einer Planung zur Errichtung von drei WEA vom Typ Enercon E-82 E2 (2,3 MW, TES) nahe des Ortsteils Delfshausen, etwa 3,5 km nordöstlich vom Planungsstandort Lehmden - Liethe, Schattenwurfbelastungen ausgehen, die in der vorliegenden Prognose als relevante Vorbelastung zu berücksichtigen sind. Die Berechnung zur Prüfung der möglichen Vorbelastung durch diese drei geplanten WEA ergibt jedoch, dass die geplanten WEA aufgrund der Entfernung zum geplanten Standort Delfshausen an den betrachteten Immissionspunkten keinen Schattenwurf erzeugen (vgl. Berechnungsergebnisse im Anhang).

Nach aktueller Auskunft vom Landkreis Ammerland (E-Mail Herr Herbers vom 07.07.2016) sind keine weiteren Windenergieanlagen oder sonstige Anlagen, welche zu berücksichtigende Schallquellen darstellen könnten, beantragt oder genehmigt.

**Tabelle 1: Darstellung der bautechnischen Daten der berücksichtigten WEA**

| Parameter                  | 3 gepl. WEA 01 bis 03 | vorh. WEA 01 bis 08 | vorh. WEA 09       |
|----------------------------|-----------------------|---------------------|--------------------|
| <b>WEA - Typ</b>           | Enercon E-82 E2 (TES) | NEG Micon NM52      | Enercon E-58/10.58 |
| <b>Nennleistung</b>        | 2.300 kW              | 900 kW              | 1.000 kW           |
| <b>Rotordurchmesser</b>    | 82,0 m                | 52,2 m              | 58,0 m             |
| <b>Anzahl Rotorblätter</b> | 3                     | 3                   | 3                  |
| <b>Nabenhöhe</b>           | 108,4 m               | 73,8 m              | 70,5 m             |

Die Standortdaten der berücksichtigten WEA und der berücksichtigten Immissionspunkte sind den Berechnungsausdrucken im Anhang zu entnehmen. Als Schattenrezeptor wird je betrachtetem Immissionspunkt gem. den WEA-Schattenwurf-Hinweisen /3/ ein Schattenrezeptor mit den Abmessungen von 0,1 \* 0,1 m und einer Brüstungshöhe von 2,0 m angesetzt.

Die Bezeichnungen und Lagebeschreibungen für die untersuchten Immissionspunkte sind der folgenden Tabelle zu entnehmen.

**Tabelle 2: Untersuchte Immissionspunkte (Schattenrezeptoren nach LAI-Schattenwurfhinweisen /3/)**

| <b>Immissionspunkt</b> | <b>Lagebeschreibung</b>          |
|------------------------|----------------------------------|
| A                      | Lehmder Str. 99a, Lehmden        |
| B                      | Lehmder Str. 103, Lehmden        |
| C                      | Lemder Str. 109, Lehmden         |
| D                      | Lehmder Str. 109a, Lehmden       |
| E                      | Lehmder Str. 121, Lehmden        |
| F                      | Lehmder Str. 125, Lehmden        |
| G                      | Lehmder Str. 143, Lehmden        |
| H                      | Lehmder Str. 145, Lehmden        |
| I                      | Dwowed 1, Lehmden                |
| J                      | Dwowed 11, Lehmden               |
| K                      | Dwowed 39, Lehmden               |
| L                      | Dwowed 70, Lehmden               |
| M                      | Dwowed 38, Lehmden               |
| N                      | Dwowed 156, Lehmden              |
| O                      | Dwowed 190, Lehmden              |
| P                      | Weidenstr. 73, Kleibrok          |
| Q                      | Strothweg 20, Kleibrok           |
| R                      | Hohe Looe 2-8 (BÜFA GmbH)        |
| S                      | Wilhelmshavener Str. 88a, Liethe |

**Anmerkung:** Den Schattenberechnungen liegen Sichtbarkeitsanalysen zugrunde, d.h., es wird überprüft, ob eine Sichtbeziehung zwischen WEA und Immissionspunkt besteht. Berücksichtigt wird dabei das Gelände der Umgebung. Hindernisse, die z.B. durch Baumbestand etc. entstehen könnten, werden in den Berechnungen nicht berücksichtigt. Windenergieanlagen, die zu den Immissionspunkten keine Sichtbeziehung haben, erzeugen keinen Schattenwurf. Bei Einschränkung der Sichtbarkeit (z.B. nur halber Rotorfläche) entsteht auch eine Minderung des Schattenwurfes.

Die Schattenrezeptoren, d.h. hier untersuchten Immissionspunkte, sind nach dem sog. „Gewächshaus-Modus“ ausgerichtet, sie registrieren also Beschattungen aus allen Himmelsrichtungen.

Es werden insgesamt 20 Gebäude in der näheren Umgebung zu den geplanten Windenergieanlagen als Immissionspunkte untersucht. Bei den Immissionspunkten handelt es sich größtenteils um die nächstgelegene Wohnbebauung mit Lage im Außenbereich. Alle Immissionspunkte wurden im Zuge einer Ortsbegehung am 04.07.2016 in Augenschein genommen.

Bei Immissionspunkt R handelt es sich nicht um ein Wohnhaus, sondern um das Werksgebäude der BÜFA GmbH (Hohe Looe 2-8). Bei der Ortsbegehung wurde festgestellt, dass an einer Gebäudeseite in Richtung des Planungsstandortes ausgerichtete Fenster vorhanden sind. Da gem. Hinweisen des LAI /3/ auch Arbeitsplätze als schutzwürdig gelten, wurde hier ein zusätzlicher Immissionspunkt berücksichtigt.

## 6 Ergebnisse

### Theoretische Schattenwurfzeiten (worst case)

Die Ergebnisse der Berechnung sind in der Gesamtübersichtstabelle und präziser in einem Schattenwurfskalender zu jedem Immissionspunkt im Anhang wiedergegeben. Es wurde eine Berechnung für die drei geplanten WEA (Zusatzbelastung) durchgeführt und dokumentiert. Weiterhin wurde die Vorbelastung durch die neun bestehenden WEA im Windpark Lehmden durchgeführt, sowie eine Berechnung in der die Gesamtbelastung aus insgesamt 12 vorhandenen und geplanten WEA dargestellt ist.

Es ist sicherzustellen, dass der Immissionsrichtwert nach Empfehlungen des LAI /3/ für die astronomisch maximal mögliche Beschattungsdauer von 30 Stunden im Kalenderjahr nicht überschritten wird. Für die tägliche Beschattungsdauer beträgt der Richtwert 30 Minuten.

### Theoretische Schattenwurfzeiten (worst case) für die Vorbelastung

Die theoretischen Schattenwurfzeiten bezogen auf die untersuchten Immissionspunkte sind in der nachfolgenden Tabelle aufgeführt. In den Berechnungsausdrücken im Anhang sind die Berechnungsergebnisse dokumentiert.

**Tabelle 3: Berechnungsergebnisse der Vorbelastung**

| <b>Immissionspunkt</b> | <b>Tage/Jahr [d/a]<br/>Worst Case</b> | <b>max. Dauer/Tag [h/d]<br/>Worst Case</b> | <b>max. Dauer/Jahr [h/a]<br/>Worst Case</b> |
|------------------------|---------------------------------------|--------------------------------------------|---------------------------------------------|
| A                      | 62                                    | 00:28                                      | 16:47                                       |
| B                      | 43                                    | <b>00:33</b>                               | 18:22                                       |
| C                      | 49                                    | <b>00:37</b>                               | 23:42                                       |
| D                      | 53                                    | <b>00:40</b>                               | 27:13                                       |
| E                      | 57                                    | <b>00:42</b>                               | <b>30:46</b>                                |
| F                      | 88                                    | <b>00:42</b>                               | <b>45:29</b>                                |
| G                      | 64                                    | <b>00:38</b>                               | <b>34:34</b>                                |
| H                      | 50                                    | <b>00:33</b>                               | 22:35                                       |
| I                      | 0                                     | 00:00                                      | 00:00                                       |
| J                      | 0                                     | 00:00                                      | 00:00                                       |
| K                      | 64                                    | 00:23                                      | 21:37                                       |
| L                      | 44                                    | 00:19                                      | 10:26                                       |
| M                      | 25                                    | 00:19                                      | 06:07                                       |
| N                      | 59                                    | 00:12                                      | 07:30                                       |
| O                      | 81                                    | 00:11                                      | 08:32                                       |
| P                      | 51                                    | 00:07                                      | 03:17                                       |
| Q                      | 147                                   | 00:16                                      | 21:56                                       |
| R                      | 97                                    | 00:16                                      | 12:49                                       |
| S                      | 59                                    | 00:09                                      | 04:31                                       |

Bei Betrachtung der Vorbelastung durch die vorhandenen WEA im Windpark Lehmden ergibt sich, dass der Richtwert für die zulässige Jahresgesamstundenzahl (30 h/a) an den Immissionspunkten E bis G überschritten wird. An den Immissionspunkten B bis H wird der Richtwert für die zulässige Tagesminutenzahl (30 min/d) für Schattenwurf überschritten. An allen übrigen Immissionspunkten, A und I bis S, werden die Richtwerte für Schattenwurf pro Jahr und pro Tag eingehalten.

An den Immissionspunkten I und J erzeugen die vorhandenen WEA keinen Schattenwurf.

### Theoretische Schattenwurfzeiten (worst case) für die Zusatzbelastung

Die theoretischen Schattenwurfzeiten bezogen auf die untersuchten Immissionspunkte sind in der nachfolgenden Tabelle aufgeführt. In den Berechnungsausdrücken im Anhang sind die Berechnungsergebnisse dokumentiert.

**Tabelle 4: Berechnungsergebnisse der Zusatzbelastung**

| <b>Immissionspunkt</b> | <b>Tage/Jahr [d/a]<br/>Worst Case</b> | <b>max. Dauer/Tag [h/d]<br/>Worst Case</b> | <b>max. Dauer/Jahr [h/a]<br/>Worst Case</b> |
|------------------------|---------------------------------------|--------------------------------------------|---------------------------------------------|
| A                      | 76                                    | 00:25                                      | 22:02                                       |
| B                      | 81                                    | 00:30                                      | 27:30                                       |
| C                      | 89                                    | <b>00:37</b>                               | <b>33:48</b>                                |
| D                      | 95                                    | <b>00:40</b>                               | <b>37:25</b>                                |
| E                      | 109                                   | <b>00:46</b>                               | <b>44:05</b>                                |
| F                      | 110                                   | <b>00:53</b>                               | <b>51:47</b>                                |
| G                      | 92                                    | <b>00:54</b>                               | <b>49:16</b>                                |
| H                      | 86                                    | <b>00:53</b>                               | <b>49:25</b>                                |
| I                      | 64                                    | <b>00:51</b>                               | <b>44:28</b>                                |
| J                      | 50                                    | <b>00:50</b>                               | <b>30:32</b>                                |
| K                      | 22                                    | 00:17                                      | 04:50                                       |
| L                      | 30                                    | 00:20                                      | 07:50                                       |
| M                      | 92                                    | <b>00:40</b>                               | <b>40:52</b>                                |
| N                      | 90                                    | <b>00:43</b>                               | <b>34:29</b>                                |
| O                      | 74                                    | 00:28                                      | 23:12                                       |
| P                      | 55                                    | 00:28                                      | 14:08                                       |
| Q                      | 0                                     | 00:00                                      | 00:00                                       |
| R                      | 52                                    | 00:15                                      | 06:34                                       |
| S                      | 34                                    | 00:13                                      | 04:53                                       |

Bei Betrachtung der Zusatzbelastung durch die drei geplanten WEA ergibt sich, dass der Richtwert für die zulässige Jahresgesamstundenzahl (30 h/a) an den Immissionspunkten C bis J, M und N überschritten wird. An den Immissionspunkten C bis J, M und N wird der Richtwert für die zulässige Tagesminutenzahl (30 min/d) für Schattenwurf überschritten, während er am Immissionspunkt B erreicht wird. An allen übrigen Immissionspunkten, A, K, L und O bis S, werden die Richtwerte für Schattenwurf pro Jahr und pro Tag eingehalten.

An dem Immissionspunkt Q erzeugen die geplanten WEA keinen Schattenwurf.

### Theoretische Schattenwurfzeiten (worst case) für die Gesamtbelastung

Die theoretischen Schattenwurfzeiten bezogen auf die untersuchten Immissionspunkte sind in der nachfolgenden Tabelle aufgeführt. In den Berechnungsausdrücken im Anhang sind die Berechnungsergebnisse dokumentiert.

**Tabelle 5: Berechnungsergebnisse der Gesamtbelastung**

| <b>Immissionspunkt</b> | <b>Tage/Jahr [d/a]<br/>Worst Case</b> | <b>max. Dauer/Tag [h/d]<br/>Worst Case</b> | <b>max. Dauer/Jahr [h/a]<br/>Worst Case</b> |
|------------------------|---------------------------------------|--------------------------------------------|---------------------------------------------|
| A                      | 114                                   | 00:29                                      | 31:59                                       |
| B                      | 94                                    | 00:33                                      | 35:41                                       |
| C                      | 99                                    | 00:54                                      | 49:06                                       |
| D                      | 105                                   | 01:04                                      | 57:56                                       |
| E                      | 122                                   | 01:21                                      | 73:08                                       |
| F                      | 120                                   | 01:29                                      | 92:24                                       |
| G                      | 92                                    | 01:07                                      | 83:50                                       |
| H                      | 86                                    | 01:00                                      | 72:00                                       |
| I                      | 64                                    | 00:51                                      | 44:28                                       |
| J                      | 50                                    | 00:50                                      | 30:32                                       |
| K                      | 64                                    | 00:38                                      | 26:27                                       |
| L                      | 74                                    | 00:20                                      | 18:16                                       |
| M                      | 117                                   | 00:40                                      | 46:59                                       |
| N                      | 131                                   | 00:49                                      | 41:59                                       |
| O                      | 145                                   | 00:28                                      | 31:44                                       |
| P                      | 106                                   | 00:28                                      | 17:25                                       |
| Q                      | 147                                   | 00:16                                      | 21:56                                       |
| R                      | 139                                   | 00:16                                      | 19:08                                       |
| S                      | 93                                    | 00:13                                      | 09:24                                       |

Bei Betrachtung der Gesamtbelastung ergibt sich, dass der Richtwert für die zulässige Jahresgesamstundenzahl (30 h/a) an den Immissionspunkten A bis J und M bis O überschritten wird. An den Immissionspunkten B bis K, M und N wird der Richtwert für die zulässige Tagesminutenzahl (30 min/d) für Schattenwurf überschritten. An den übrigen Immissionspunkten, L und P bis S, werden die Richtwerte für Schattenwurf pro Jahr und pro Tag eingehalten.

### **Wahrscheinlichkeiten der Schattenwurf mindernden Ereignisse**

Die den Schattenwurf reduzierenden Ereignisse, wie tatsächliche Sonnenscheindauer, tatsächliche Windverteilung und Betriebsdauer, ergeben die Wahrscheinlichkeiten für das Ereignis des Schattenwurfes.

Bei der Betrachtung der Wahrscheinlichkeiten ergibt sich, dass an dem untersuchten Standort damit zu rechnen ist, dass nur in durchschnittlich 28 % der Tages-Zeiten die Sonne scheint. In 72 % der Zeit ist mit Bewölkung zu rechnen. Für die Berechnung der Sonnenscheinwahrscheinlichkeit wurde die ca. 12 km südlich gelegene Referenzstation Oldenburg aus den „Klimadaten für Deutschland“ /2/ verwendet.

Die Wahrscheinlichkeit der verschiedenen Schattenwurf erzeugenden Rotorstellungen, bedingt durch die Häufigkeitsverteilung der verschiedenen Windrichtungen und die damit entstehenden Schattenwurf erzeugenden Flächen in Bezug auf die Immissionspunkte, kann durch das Berechnungsprogramm ausführlich untersucht werden, ist aber in den Berechnungsergebnissen im Anhang nicht enthalten.

Die theoretische Schattenwurfzeit reduziert sich auch durch die generelle Betriebsdauer der Windenergieanlage, die leider im Sinne der Stromgewinnung auch Perioden der Windstille beinhaltet.

## 7 Schlussbetrachtung

Bei diesen Berechnungen wurden Immissionspunkte untersucht, die zwischen ca. 590 m und ca. 950 m von den geplanten Windenergieanlagen entfernt liegen. Unter Berücksichtigung der Drehzahl des Rotors von 6 bis 18 U/min (Enercon E-82 E2 mit 2,3 MW Nennleistung) und der Anzahl der Rotorblätter ergibt sich eine Lichtwechselfrequenz des Schattenwurfes von 0,30 Hz bis 0,90 Hz.

Die theoretischen Schattenwurfzeiten werden sich durch die in Kap. 6 genannten Reduzierungen (Windgeschehen, wahrscheinliche Sonnenscheindauer) vermindern. Eine exakte Berechnung dieser Reduzierungen ist jedoch nicht möglich. Es können nur Wahrscheinlichkeitsbetrachtungen angestellt werden, da sich nicht ermitteln lässt, ob das Schattenwurf reduzierende Ereignis immer in der jahresdurchschnittlichen Häufigkeit während des errechneten Zeitraums des Schattenwurfs stattfindet.

Entsprechend den Empfehlungen des LAI /3/ soll die astronomisch maximal mögliche Schattenwurfdauer pro Tag 30 Minuten und pro Kalenderjahr 30 Stunden nicht überschreiten.

Bei Betrachtung der Gesamtbelastung durch die neun vorhandenen und drei geplanten WEA werden die Richtwerte gem. LAI-Hinweisen /3/ an den Immissionspunkten A bis K, M bis O überschritten. Der Richtwert für die zulässige Jahresgesamstundenzahl (30 h/a) wird an den Immissionspunkten A bis J und M bis O überschritten, während an den Immissionspunkten B bis K, M und N der Richtwert für die zulässige Tagesminutenzahl (30 min/d) für Schattenwurf überschritten wird. An den übrigen Immissionspunkten, L und P bis S, werden die Richtwerte für Schattenwurf pro Jahr und pro Tag eingehalten.

Die vorhandenen WEA im Windpark Lehmden verursachen an den Immissionspunkten B bis H Überschreitungen der Richtwerte, während in der Zusatzbelastung an den Immissionspunkten C bis J, M und N Richtwert-Überschreitungen auftreten. Die Richtwertüberschreitungen an den Immissionspunkten I und J sind allein auf den Einfluss der Zusatzbelastung zurückzuführen, da die Vorbelastung dort keinerlei Schattenwurf erzeugt. Die Überschreitung an den Immissionspunkten A, K und M bis O ist sowohl durch die Bestandsanlagen als auch die geplanten WEA bedingt. An den Immissionspunkten, an denen sich in der Schattenwurfprognose in der Gesamtbelastung Überschreitungen der Richtwerte ergeben, muss die von den geplanten WEA verursachte Schattenwurfbelastung auf das zulässige Maß reduziert werden. Dies muss durch die Einrichtung einer Schattenabschaltung für die geplanten Anlagen gewährleistet werden, da für die bestehenden WEA Bestandsschutz gilt.

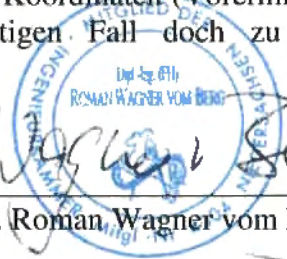
Aufgrund der ermittelten möglichen Überschreitung der maximalen Schattenwurfdauer werden nach Aufbau der Windenergieanlagen die maßgeblich Schattenwurf erzeugenden WEA (s. auch Kalender) mit einer entsprechenden Regeltechnik versehen, um den tatsächlichen Schattenwurf durch zeitweise Abschaltung auf das zulässige Maß zu reduzieren. Bei Einsatz einer Abschaltautomatik, die keine meteorologischen Parameter berücksichtigt, ist durch diese der Schattenwurf auf die astronomisch maximal mögliche Beschattungsdauer von 30 Stunden pro Kalenderjahr zu begrenzen. Wird eine Abschaltautomatik eingesetzt, die meteorologische Parameter (Schattenwurf mindernde Ereignisse) berücksichtigt, ist gem. /3/ auf die tatsächliche Beschattungsdauer von 8 Stunden pro Jahr zu begrenzen.

Dieses Schattenwurfgutachten dient zum Nachweis, ob in den dem Windpark nahegelegenen Ortslagen die zulässigen Grenzwerte für Schattenwurf eingehalten oder überschritten werden. Es werden je Ortslage die nahegelegensten Gebäude (mit Wohn- oder Arbeitsnutzung) als

Immissionspunkte berücksichtigt, da ein Gutachten mit einer großen Anzahl an Immissionspunkten schnell unübersichtlich wird und für die Programmierung einer Schattenwurfschaltung weitergehende Untersuchungen erforderlich sind. Dabei ist zu berücksichtigen, dass neben den untersuchten Immissionspunkten in der jeweiligen Ortslage auch weitere Gebäude von Überschreitungen betroffen sein können. Für die Einschätzung von Betroffenheiten können die den Gutachten beiliegenden Schattenwurfkarten genutzt werden. Bei Programmierung einer Schattenwurfschaltung müssen die genauen Koordinaten der Immissionspunkte berücksichtigt werden. Dazu werden i.d.R. die Wandecken oder Fensterecken bei Gebäuden, sowie deren Höhenlage eingemessen. Es ist bei der Einmessung sehr ratsam auch die Gebäude bei Einmessung und Programmierung zu berücksichtigen, bei denen gem. den Vorermittlungen die Grenzwerte nur knapp eingehalten werden, da die Ermittlungen ohne eingemessene Koordinaten (Vorermittlungen) immer gewisse Unsicherheiten bergen, die dann im ungünstigen Fall doch zu leichten Überschreitungen an einem Gebäude führen könnten.

Oldenburg, den 12. Juli 2016

  
Dipl.-Ing. Roman Wagner vom Berg



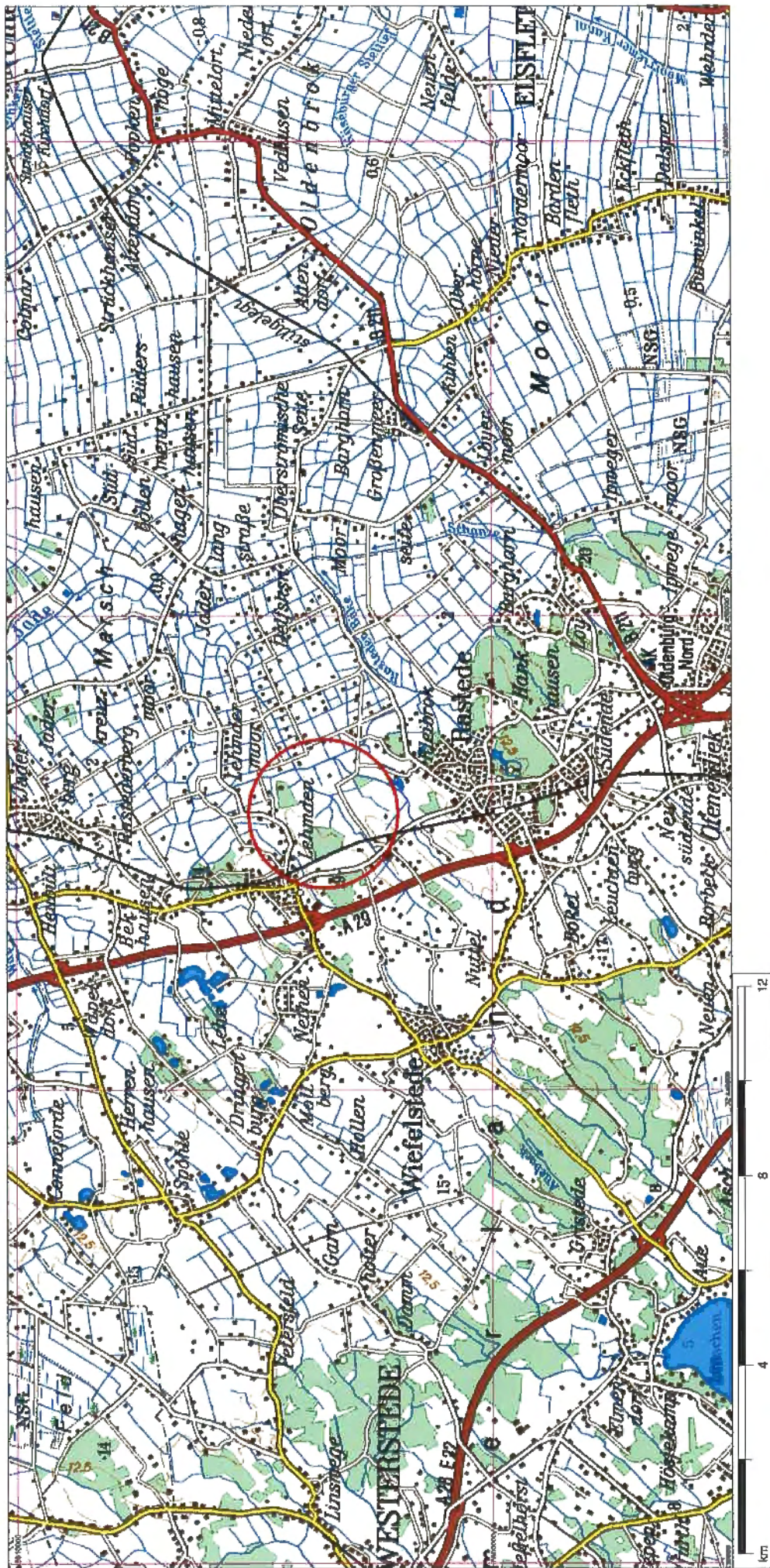
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## 8 Literatur

- /1/ Programmbeschreibung der Berechnungssoftware WindPRO, Modul „Shadow“ der Fa. EMD International A/S
- /2/ Deutscher Wetterdienst „Klimadaten von Deutschland, Zeitraum 1961-1990“, Selbstverlag des Deutschen Wetterdienstes, Offenbach am Main 1996
- /3/ Länderausschuss für Immissionsschutz (LAI): Hinweise zur Ermittlung und Beurteilung der optischen Emissionen von Windenergieanlagen (WEA-Schattenwurf-Hinweise), Beschlüsse der 103. LAI-Sitzung, Mai 2002

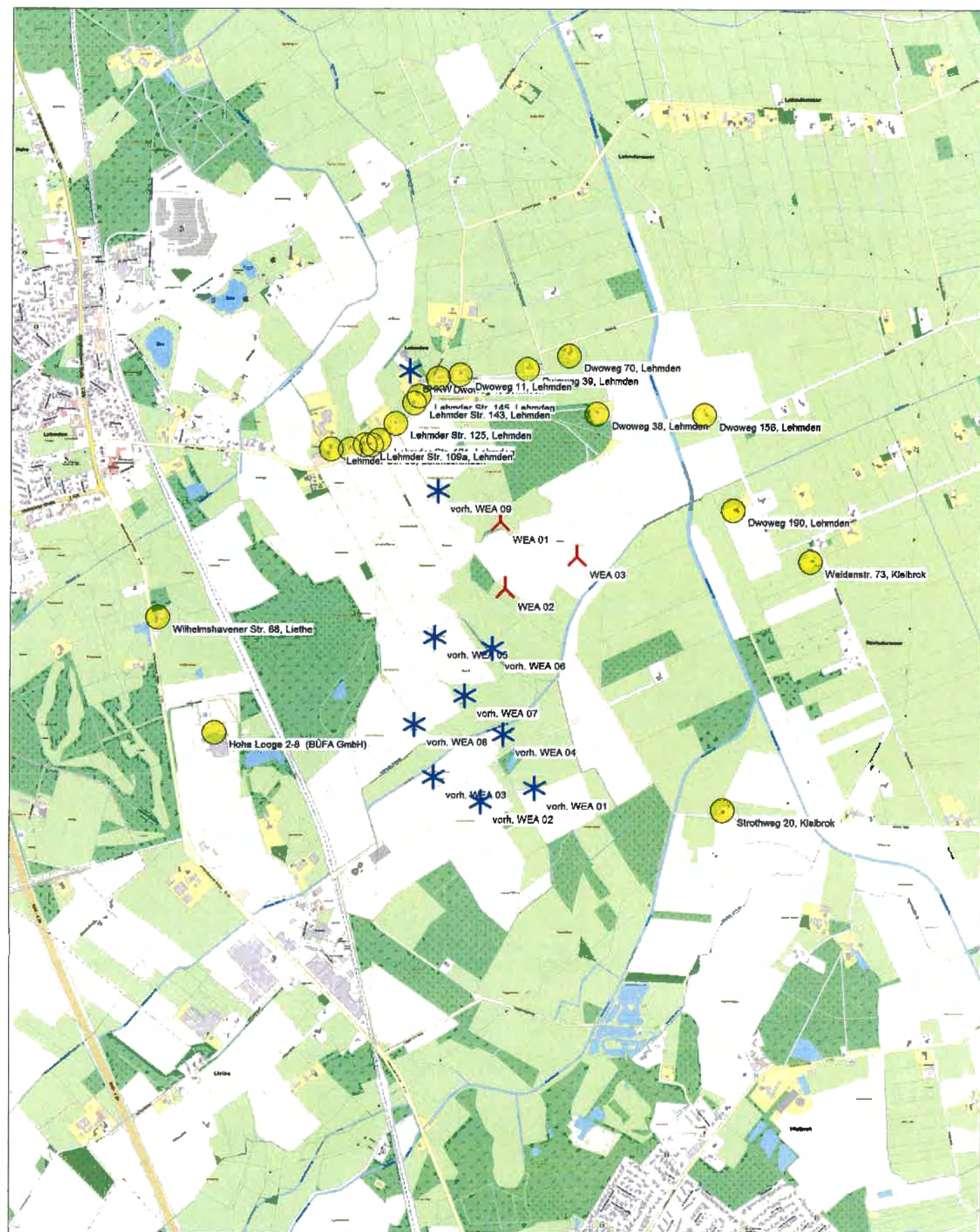
## **9 Anlagen zum Schattenwurfgutachten 3 WEA Enercon E-82 E2 (2,3 MW, TES) am Standort Lehmden - Liethe**

- 1 Blatt      Übersichtsplan
- 2 Blatt      Lageplan
- 2 Blatt      Detailansichten Standort Lehmden – Liethe (Nord & Süd)
  
- 3 Blatt      Prüfung der Vorbelastung durch 3 gepl. WEA am Standort Delfshausen: 3 x Enercon E-82 E2 (2,3 MW, TES) - Berechnungsprotokolle inkl. Eingabedaten sowie Karte der Jahresstundenzahl (Isolinien) und max. Schattenwurf pro Tag (Raster)
- 8 Blatt      Vorbelastung durch 9 vorh. WEA im Windpark Lehmden - Berechnungsprotokolle inkl. Eingabedaten und Kalender (grafisch) sowie Karte der Jahresstundenzahl (Isolinien) und max. Schattenwurf pro Tag (Raster)
- 36 Blatt      Zusatzbelastung durch 3 geplante WEA Enercon E-82 E2 (2,3 MW, TES) - Berechnungsprotokolle inkl. Eingabedaten und Kalender (tabellarisch und grafisch) sowie Karte der Jahresstundenzahl (Isolinien) und max. Schattenwurf pro Tag (Raster)
- 44 Blatt      Gesamtbelastung durch drei geplante WEA Enercon E-82 E2 (2,3 MW, TES) - Berechnungsprotokolle inkl. Eingabedaten und Kalender (tabellarisch und grafisch) sowie Karte der Jahresstundenzahl (Isolinien) und max. Schattenwurf pro Tag (Raster)
  
- 1 Blatt      Daten Sonnenwahrscheinlichkeit Station Oldenburg



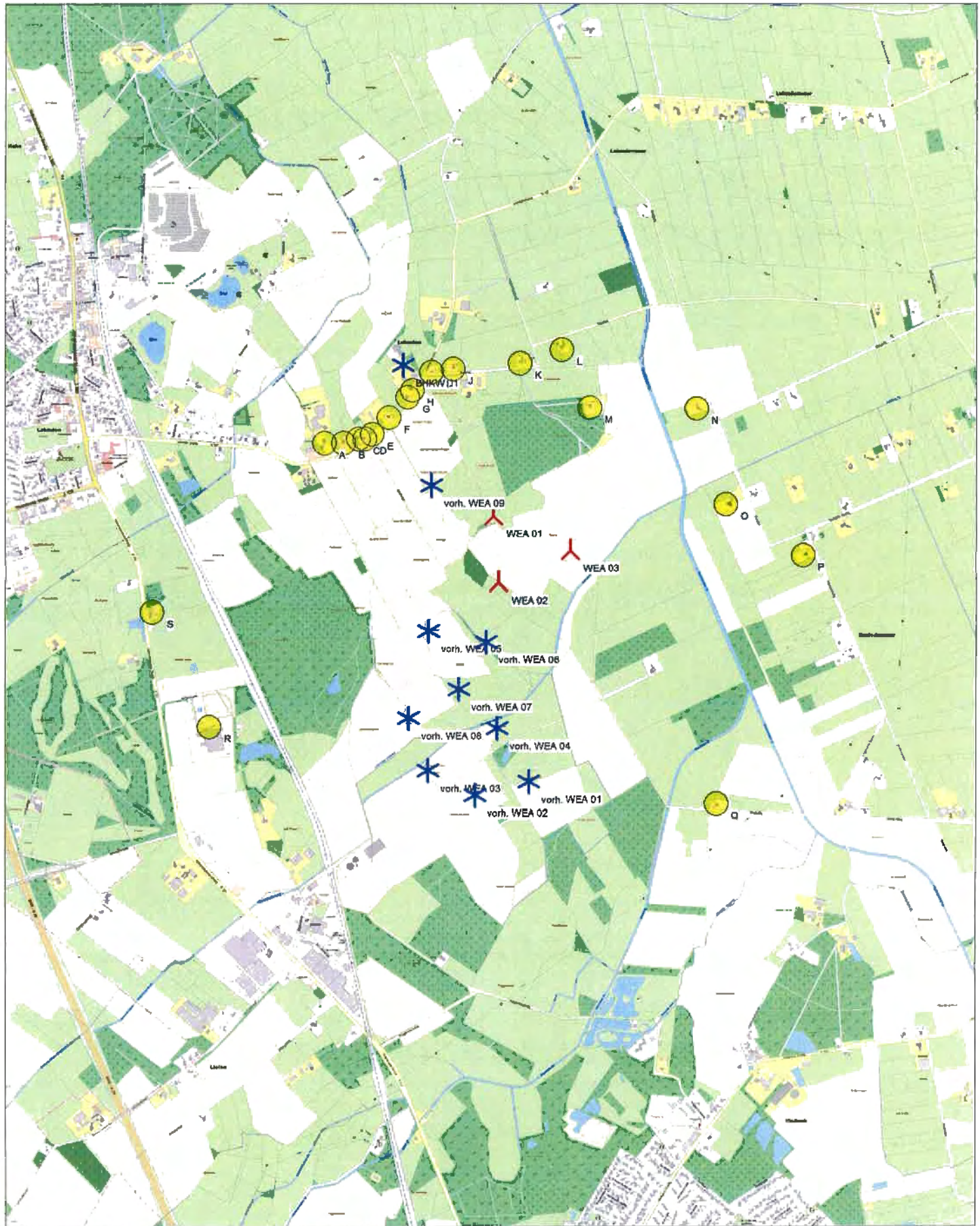
## BASIS - Karte

Berechnung: Übersicht vorhandene WEA, Geplante WEA & Immissionspunkte

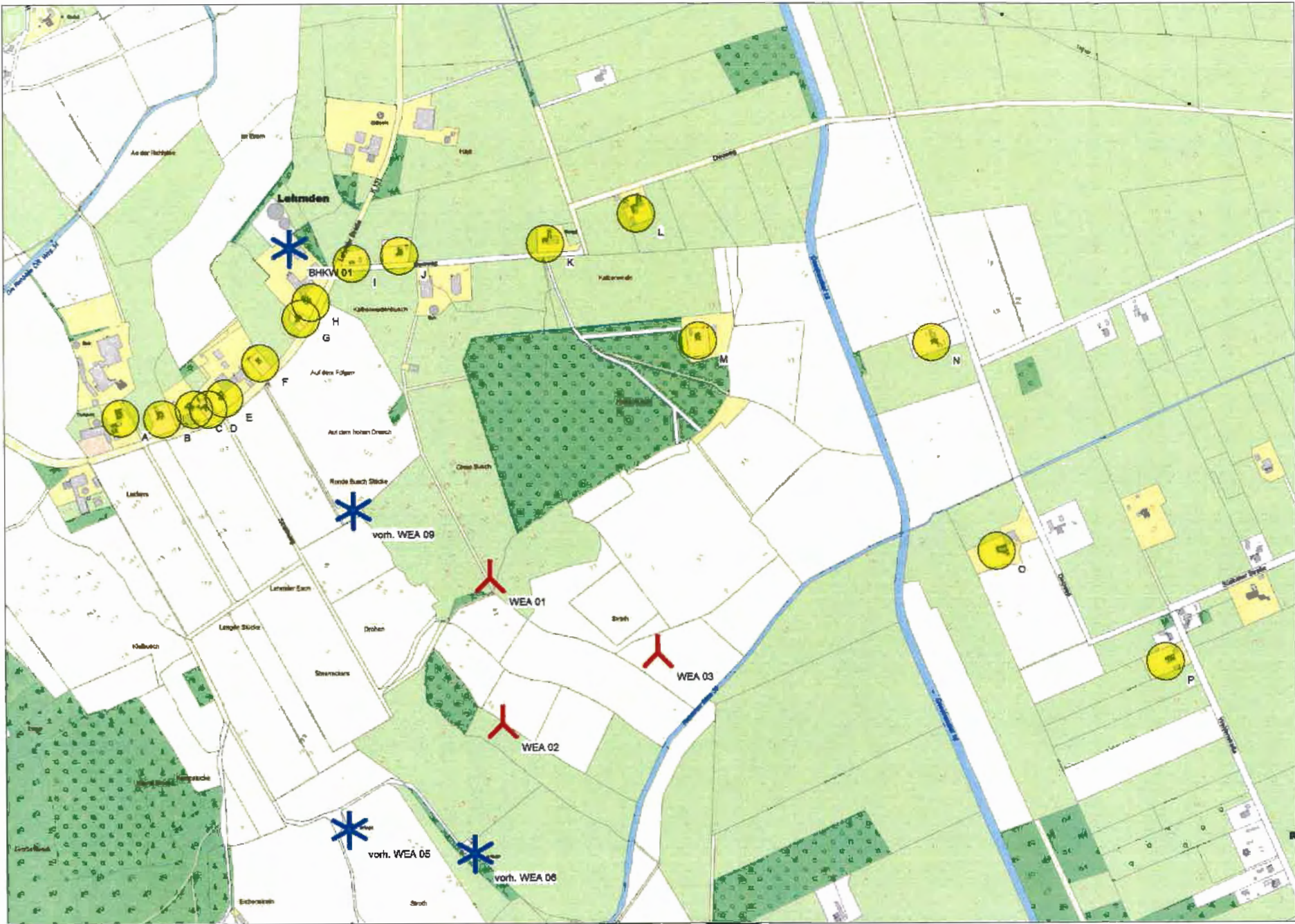


## BASIS - Karte

Berechnung: Übersicht vorhandene WEA, Geplante WEA & Immissionspunkte



0 250 500 750 1000m  
Karte: AKS LGLN Rastede, Maßstab 1:15,000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 446.016 Nord: 5.903.631  
▲ Neue WEA    \* Existierende WEA    ○ Schattenrezeptor



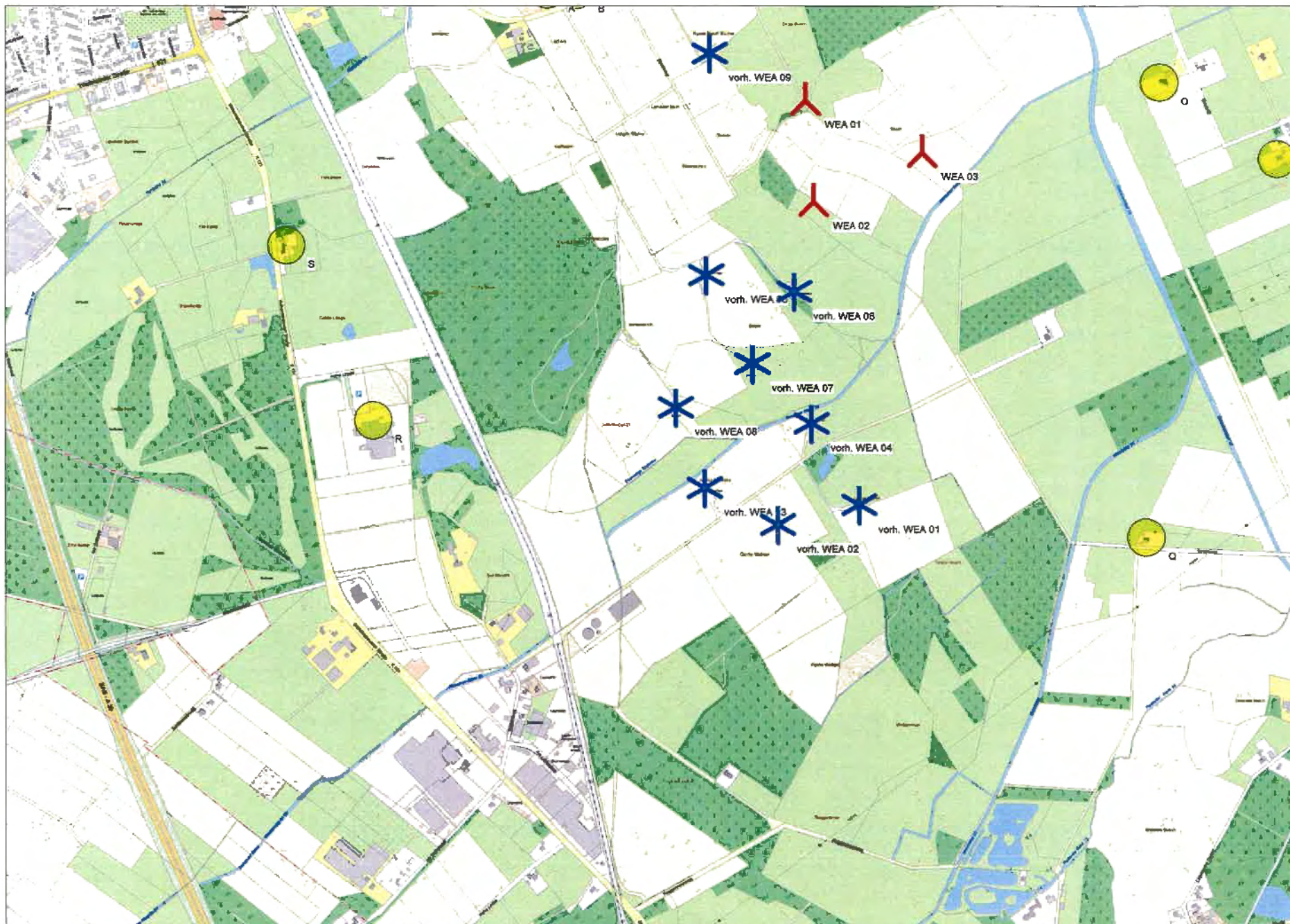
▲ Neue WEA      \* Existierende WEA

Karte: AKS LGLN Rastede, Maßstab 1:7.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 446.325 Nord: 5.904.256  
☼ Schattenrezeptor

**BASIS - Karte**  
**Berechnung:**  
Detaillierte Berechnung der WEA, Geometrie WEA & Turmhöhenprofile

Lizenzierter Anwender:  
**Ingenieurbüro PLANKON**  
Blumenstrasse 26  
DE-26121 Oldenburg  
0441 390 34 - 0

Berechnet:  
11.07.2016 15:12 / 1



Karte: AKS LGLN Rastede, Maßstab 1:10.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 445.599 Nord: 5.903.057  
 Schattenrezeptor

Neue WEA Existierende WEA

**BASIS - Karte**  
 Berechnung:  
 Grundlage: vorhandene WEA, geplante WEA & Topographie

Umfeld: Ingenieurbüro PLANKON  
 Blumenstrasse 26  
 DE-26121 Oldenburg  
 0441 390 34 - 0

Berechnet:  
 11.07.2016 14:57/3.0.629

## SHADOW - Hauptergebnis

**Berechnung:** Prüfung als mögl. Vorbelastung: 3 gepl. WEA am Standort Delfshausen

### Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °  
Tage zwischen Berechnungen 1 Tag(e)  
Berechnungszeitsprung 1 Minuten  
Die dargestellten Zeiten sind die astronomisch maximal mögliche  
Beschattungsdauer, berechnet unter folgenden Annahmen:  
Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur 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: Höhenlinien: Orographie Lehmden Liethe final bearb.

Hindernisse in Berechnung nicht verwendet

Augenhöhe: 1,5 m

Rasterauflösung: 10,0 m

Alle Koordinatenangaben in  
UTM (north)-ETRS89 Zone: 32

### WEA

|              | Ost     | Nord      | Z    | Beschreibung     | WEA-Typ |            |               | Nenn-<br>leistung<br>[kW] | Rotor-<br>durchmesser<br>[m] | Nabenhöhe<br>[m] | Schattendaten                |                  |
|--------------|---------|-----------|------|------------------|---------|------------|---------------|---------------------------|------------------------------|------------------|------------------------------|------------------|
|              |         |           |      |                  | Aktuell | Hersteller | Typ           |                           |                              |                  | Beschatt.-<br>Bereich<br>[m] | U/min<br>[U/min] |
|              |         |           | [m]  |                  |         |            |               |                           |                              |                  |                              |                  |
| vorh. WEA 10 | 448.968 | 5.906.185 | -0,5 | Enercon E-82 ... | Ja      | ENERCON    | E-82 E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |
| vorh. WEA 11 | 449.299 | 5.906.148 | -0,1 | Enercon E-82 ... | Ja      | ENERCON    | E-82 E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |
| vorh. WEA 12 | 449.677 | 5.906.369 | 0,0  | Enercon E-82 ... | Ja      | ENERCON    | E-82 E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |



Maßstab 1:75.000  
\* Existierende WEA    \* Schattenrezeptor

### Schattenrezeptor-Eingabe

| Nr. | Name                            | Ost     | Nord      | Z    | Breite | Höhe | Höhe<br>über Grund | Azimutwinkel<br>(von Süd) | Neigung des<br>Fensters | Ausrichtungsmodus   |
|-----|---------------------------------|---------|-----------|------|--------|------|--------------------|---------------------------|-------------------------|---------------------|
|     |                                 |         |           |      |        |      |                    |                           |                         |                     |
|     |                                 |         |           | [m]  | [m]    | [m]  | [m]                | [°]                       | [°]                     |                     |
| A   | Lehmden Str. 99, Lehmden        | 445.329 | 5.904.337 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| B   | Lehmden Str. 103, Lehmden       | 445.408 | 5.904.336 | 10,0 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| C   | Lehmden Str. 109, Lehmden       | 445.468 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| D   | Lehmden Str. 109a, Lehmden      | 445.496 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| E   | Lehmden Str. 121, Lehmden       | 445.526 | 5.904.374 | 9,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| F   | Lehmden Str. 125, Lehmden       | 445.595 | 5.904.441 | 7,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| G   | Lehmden Str. 143, Lehmden       | 445.672 | 5.904.525 | 6,1  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| H   | Lehmden Str. 145, Lehmden       | 445.690 | 5.904.555 | 5,7  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| I   | Dwöweg 1, Lehmden               | 445.768 | 5.904.628 | 3,8  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| J   | Dwöweg 11, Lehmden              | 445.858 | 5.904.642 | 2,9  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| K   | Dwöweg 39, Lehmden              | 446.133 | 5.904.664 | 1,6  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| L   | Dwöweg 70, Lehmden              | 446.305 | 5.904.720 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| M   | Dwöweg 38, Lehmden              | 446.420 | 5.904.481 | 5,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| N   | Dwöweg 156, Lehmden             | 446.860 | 5.904.477 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| O   | Dwöweg 190, Lehmden             | 446.981 | 5.904.084 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| P   | Weidenstr. 73, Kleibrok         | 447.300 | 5.903.875 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| Q   | Strothweg 20, Kleibrok          | 446.944 | 5.902.853 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| R   | Hohe Looze 2-8 (BÜFA GmbH)      | 444.858 | 5.903.170 | 16,8 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| S   | Wilhelmshavener Str. 88, Liethe | 444.625 | 5.903.643 | 17,5 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |

### Berechnungsergebnisse

Schattenrezeptor

| Nr. | Name                      | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------|--------------------------------------|----------------|-----------------------------|
|     |                           | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                           | [Std./Jahr]                          | [Tage/Jahr]    | [Std./Tag]                  |
| A   | Lehmden Str. 99, Lehmden  | 0:00                                 | 0              | 0:00                        |
| B   | Lehmden Str. 103, Lehmden | 0:00                                 | 0              | 0:00                        |

(Fortsetzung nächste Seite)...

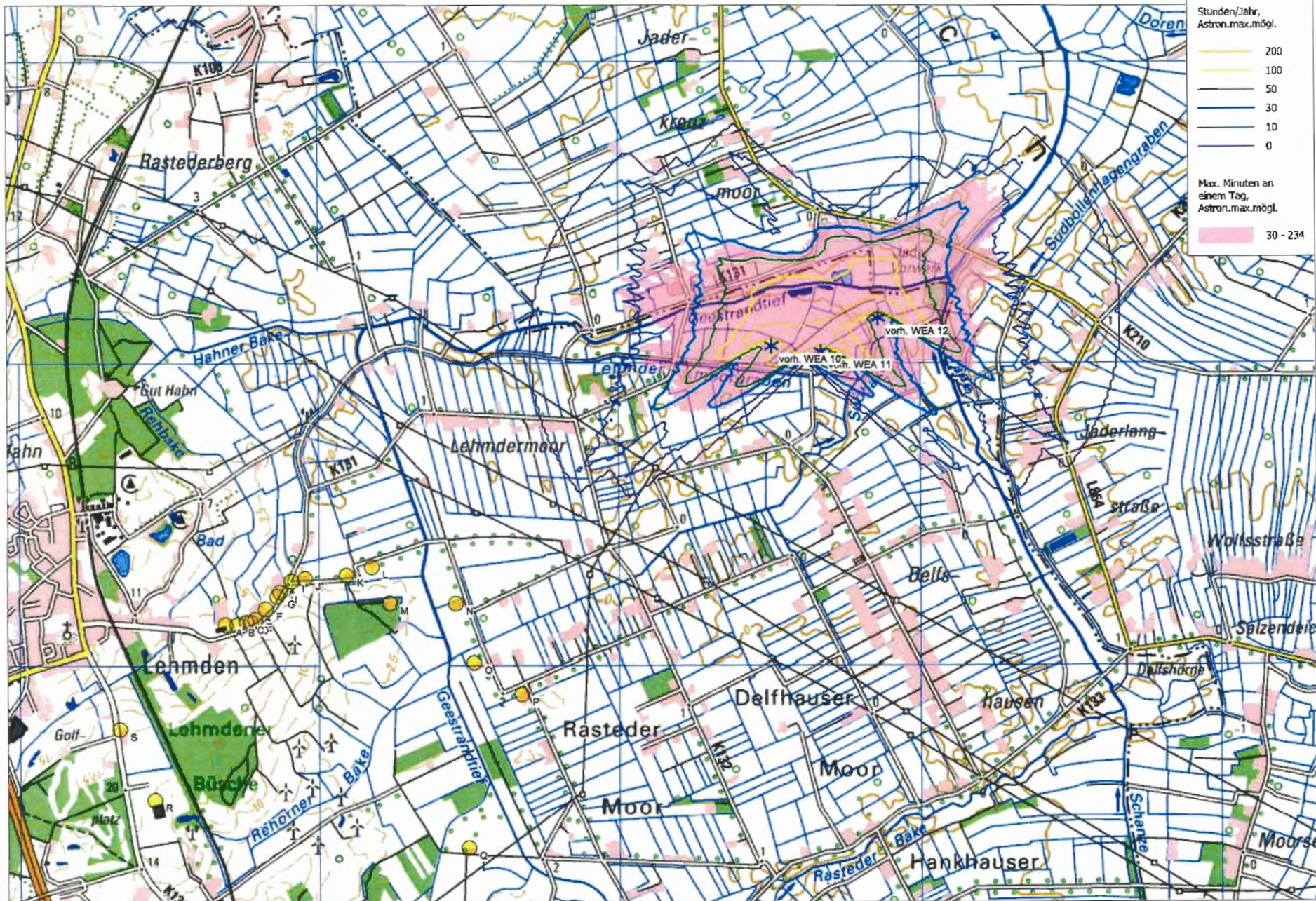
**SHADOW - Hauptergebnis****Berechnung:** Prüfung als mögl. Vorbelastung: 3 gepl. WEA am Standort Delfshausen

...(Fortsetzung von letzter Seite)

| Nr. | Name                            | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------------|--------------------------------------|----------------|-----------------------------|
|     |                                 | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                                 | [Std/Jahr]                           | [Tage/Jahr]    | [Std/Tag]                   |
| C   | Lemder Str. 109, Lehmden        | 0:00                                 | 0              | 0:00                        |
| D   | Lemder Str. 109a, Lehmden       | 0:00                                 | 0              | 0:00                        |
| E   | Lemder Str. 121, Lehmden        | 0:00                                 | 0              | 0:00                        |
| F   | Lemder Str. 125, Lehmden        | 0:00                                 | 0              | 0:00                        |
| G   | Lemder Str. 143, Lehmden        | 0:00                                 | 0              | 0:00                        |
| H   | Lemder Str. 145, Lehmden        | 0:00                                 | 0              | 0:00                        |
| I   | Dwowed 1, Lehmden               | 0:00                                 | 0              | 0:00                        |
| J   | Dwowed 11, Lehmden              | 0:00                                 | 0              | 0:00                        |
| K   | Dwowed 39, Lehmden              | 0:00                                 | 0              | 0:00                        |
| L   | Dwowed 70, Lehmden              | 0:00                                 | 0              | 0:00                        |
| M   | Dwowed 38, Lehmden              | 0:00                                 | 0              | 0:00                        |
| N   | Dwowed 156, Lehmden             | 0:00                                 | 0              | 0:00                        |
| O   | Dwowed 190, Lehmden             | 0:00                                 | 0              | 0:00                        |
| P   | Weidenstr. 73, Kleibrok         | 0:00                                 | 0              | 0:00                        |
| Q   | Strothweg 20, Kleibrok          | 0:00                                 | 0              | 0:00                        |
| R   | Hohe Looe 2-8 (BUFA GmbH)       | 0:00                                 | 0              | 0:00                        |
| S   | Wilhelmshavener Str. 88, Liethe | 0:00                                 | 0              | 0:00                        |

Gesamtmenge der max. mögl. Beschattung an Rezeptoren pro WEA

| Nr.   | Name                                 | Maximal    | Erwartet   |
|-------|--------------------------------------|------------|------------|
|       |                                      | [Std/Jahr] | [Std/Jahr] |
| vorh. | WEA 10 Enercon E-82 E2 TES (geplant) | 0:00       |            |
| vorh. | WEA 11 Enercon E-82 E2 TES (geplant) | 0:00       |            |
| vorh. | WEA 12 Enercon E-82 E2 TES (geplant) | 0:00       |            |



Projekt:  
Lehmden-Liethe

SHADOW -  
Karte

Berechnung:

Karte: TKS01 Heubült akt., Maßstab 1:25.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 448.212 Nord: 5.905.476

Ungerichtete Abstände:

Ingenieurbüro PLANKON

Blumenstrasse 26

DE-26121 Oldenburg

0441 390 34 - 0

Berechnet:

11.07.2016 12:51/3.0.629

\* Existierende WEA

☉ Schattenrezeptor

Karte: TKS01 Heubült akt., Maßstab 1:25.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 448.212 Nord: 5.905.476

Höhe der Schattenkarte: Höhenlinien: Orographie Lehmden Liethe final bearb..wpo (7)

## SHADOW - Hauptergebnis

**Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

### Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °  
Tage zwischen Berechnungen 1 Tag(e)  
Berechnungszeitsprung 1 Minuten  
Die dargestellten Zeiten sind die astronomisch maximal mögliche  
Beschattungsdauer, berechnet unter folgenden Annahmen:  
Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

Eine WEA wird nicht berücksichtigt, wenn sie von keinem Teil der  
Rezeptorfläche aus sichtbar ist. Die Sichtbarkeitsberechnung basiert auf  
den folgenden Annahmen:

Verwendete Höhenlinien: Höhenlinien: Orographie Lehmden Liethe final bearb.

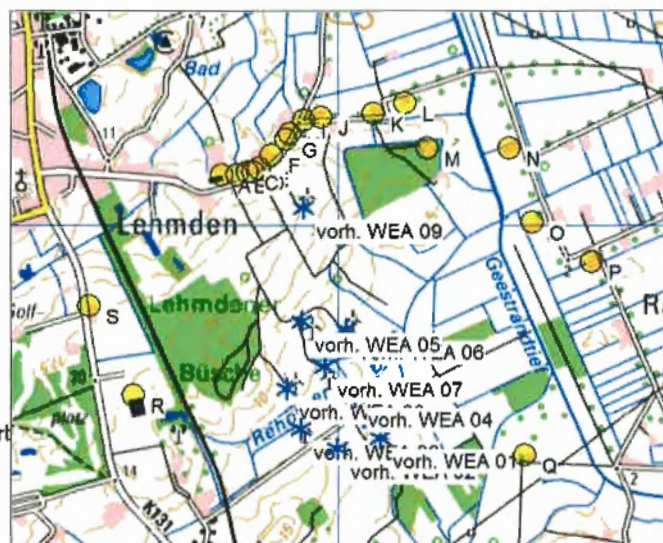
Hindernisse in Berechnung nicht verwendet

Augenhöhe: 1,5 m

Rasterauflösung: 10,0 m

Alle Koordinatenangaben in  
UTM (north)-ETRS89 Zone: 32

### WEA



Maßstab 1:40.000  
\* Existierende WEA    \* Schattenrezeptor

|              | Ost     | Nord      | Z    | Beschreibung    | WEA-Typ |            | Typ              | Nennleistung<br>[kW] | Rotor-<br>durchmesser<br>[m] | Nabenhöhe<br>[m] | Schattendaten                |                  |
|--------------|---------|-----------|------|-----------------|---------|------------|------------------|----------------------|------------------------------|------------------|------------------------------|------------------|
|              |         |           |      |                 | Aktuell | Hersteller |                  |                      |                              |                  | Beschatt.-<br>Bereich<br>[m] | U/min<br>[U/min] |
| vorh. WEA 01 | 446.169 | 5.902.942 | 4,6  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 02 | 445.948 | 5.902.888 | 7,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 03 | 445.754 | 5.902.988 | 6,0  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 04 | 446.040 | 5.903.162 | 4,2  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 05 | 445.758 | 5.903.563 | 5,8  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 06 | 445.994 | 5.903.518 | 2,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 07 | 445.881 | 5.903.323 | 4,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 08 | 445.675 | 5.903.205 | 6,7  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 09 | 445.769 | 5.904.164 | 14,0 | Enercon E-58... | Ja      | ENERCON    | E-58/10.58-1.000 | 1.000                | 58,0                         | 70,5             | 1.347                        | 24,0             |

### Schattenrezeptor-Eingabe

| Nr. | Name                            | Ost     | Nord      | Z    | Breite | Höhe | Höhe<br>über Grund | Azimutwinkel<br>(von Süd) | Neigung des<br>Fensters | Ausrichtungsmodus   |
|-----|---------------------------------|---------|-----------|------|--------|------|--------------------|---------------------------|-------------------------|---------------------|
|     |                                 |         |           | [m]  | [m]    | [m]  | [m]                | [°]                       | [°]                     |                     |
| A   | Lehmden Str. 99, Lehmden        | 445.329 | 5.904.337 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| B   | Lehmden Str. 103, Lehmden       | 445.408 | 5.904.336 | 10,0 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| C   | Lehmden Str. 109, Lehmden       | 445.468 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| D   | Lehmden Str. 109a, Lehmden      | 445.496 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| E   | Lehmden Str. 121, Lehmden       | 445.526 | 5.904.374 | 9,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| F   | Lehmden Str. 125, Lehmden       | 445.595 | 5.904.441 | 7,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| G   | Lehmden Str. 143, Lehmden       | 445.672 | 5.904.525 | 6,1  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| H   | Lehmden Str. 145, Lehmden       | 445.690 | 5.904.555 | 5,7  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| I   | Dwowege 1, Lehmden              | 445.768 | 5.904.628 | 3,8  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| J   | Dwowege 11, Lehmden             | 445.858 | 5.904.642 | 2,9  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| K   | Dwowege 39, Lehmden             | 446.133 | 5.904.664 | 1,6  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| L   | Dwowege 70, Lehmden             | 446.305 | 5.904.720 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| M   | Dwowege 38, Lehmden             | 446.420 | 5.904.481 | 5,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| N   | Dwowege 156, Lehmden            | 446.860 | 5.904.477 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| O   | Dwowege 190, Lehmden            | 446.981 | 5.904.084 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| P   | Weidenstr. 73, Kleibrok         | 447.300 | 5.903.875 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| Q   | Strothweg 20, Kleibrok          | 446.944 | 5.902.853 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| R   | Hohe Looze 2-8 (BÜFA GmbH)      | 444.858 | 5.903.170 | 16,8 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| S   | Wilhelmshavener Str. 88, Liethe | 444.625 | 5.903.643 | 17,5 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |

**SHADOW - Hauptergebnis****Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden**Berechnungsergebnisse**

Schattenrezeptor

| Nr. | Name                            | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------------|--------------------------------------|----------------|-----------------------------|
|     |                                 | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                                 | [Std/Jahr]                           | [Tage/Jahr]    | [Std/Tag]                   |
| A   | Lehmden Str. 99, Lehmden        | 16:47                                | 62             | 0:28                        |
| B   | Lehmden Str. 103, Lehmden       | 18:22                                | 43             | 0:33                        |
| C   | Lehmden Str. 109, Lehmden       | 23:42                                | 49             | 0:37                        |
| D   | Lehmden Str. 109a, Lehmden      | 27:13                                | 53             | 0:40                        |
| E   | Lehmden Str. 121, Lehmden       | 30:46                                | 57             | 0:42                        |
| F   | Lehmden Str. 125, Lehmden       | 45:29                                | 88             | 0:42                        |
| G   | Lehmden Str. 143, Lehmden       | 34:34                                | 64             | 0:38                        |
| H   | Lehmden Str. 145, Lehmden       | 22:35                                | 50             | 0:33                        |
| I   | Dwowed 1, Lehmden               | 0:00                                 | 0              | 0:00                        |
| J   | Dwowed 11, Lehmden              | 0:00                                 | 0              | 0:00                        |
| K   | Dwowed 39, Lehmden              | 21:37                                | 64             | 0:23                        |
| L   | Dwowed 70, Lehmden              | 10:26                                | 44             | 0:19                        |
| M   | Dwowed 38, Lehmden              | 6:07                                 | 25             | 0:19                        |
| N   | Dwowed 156, Lehmden             | 7:30                                 | 59             | 0:12                        |
| O   | Dwowed 190, Lehmden             | 8:32                                 | 81             | 0:11                        |
| P   | Weidenstr. 73, Kleibrok         | 3:17                                 | 51             | 0:07                        |
| Q   | Strothweg 20, Kleibrok          | 21:56                                | 147            | 0:16                        |
| R   | Hohe Looze 2-8 (BÜFA GmbH)      | 12:49                                | 97             | 0:16                        |
| S   | Wilhelmshavener Str. 88, Liethe | 4:31                                 | 59             | 0:09                        |

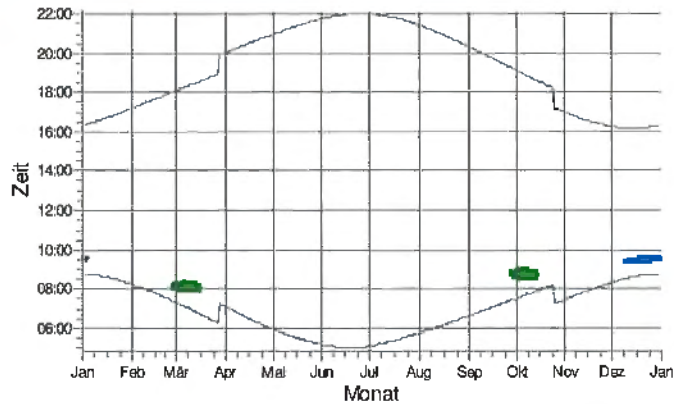
Gesamtmenge der max. mögl. Beschattung an Rezeptoren pro WEA

| Nr. | Name                            | Maximal    | Erwartet   |
|-----|---------------------------------|------------|------------|
|     |                                 | [Std/Jahr] | [Std/Jahr] |
|     | vorh. WEA 01 NEG Micon NM52     | 5:27       |            |
|     | vorh. WEA 02 NEG Micon NM52     | 4:01       |            |
|     | vorh. WEA 03 NEG Micon NM52     | 4:46       |            |
|     | vorh. WEA 04 NEG Micon NM52     | 7:11       |            |
|     | vorh. WEA 05 NEG Micon NM52     | 7:35       |            |
|     | vorh. WEA 06 NEG Micon NM52     | 17:48      |            |
|     | vorh. WEA 07 NEG Micon NM52     | 5:34       |            |
|     | vorh. WEA 08 NEG Micon NM52     | 6:55       |            |
|     | vorh. WEA 09 Enercon E-58/10.58 | 213:02     |            |

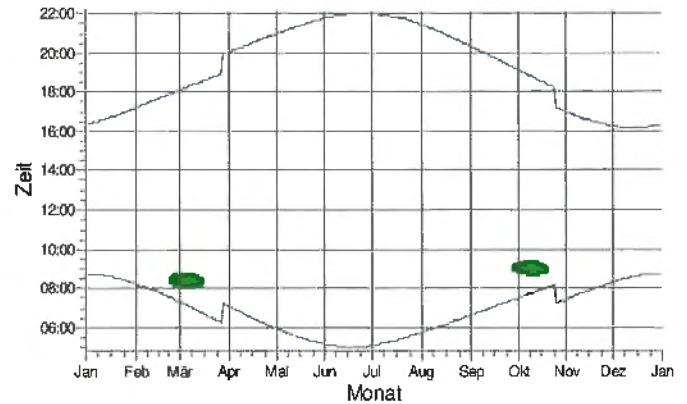
## SHADOW - Grafischer Kalender

**Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

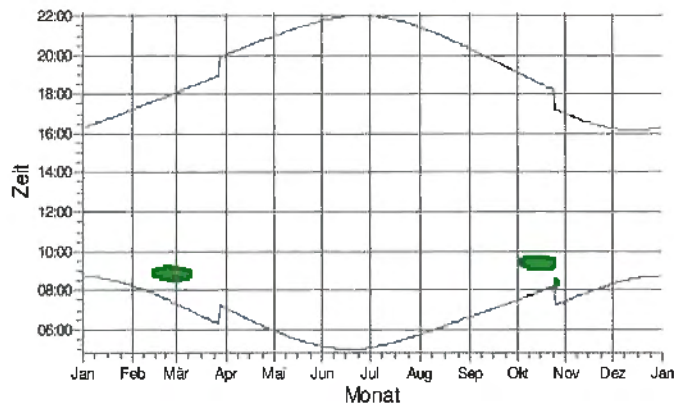
A: Lehmden Str. 99, Lehmden



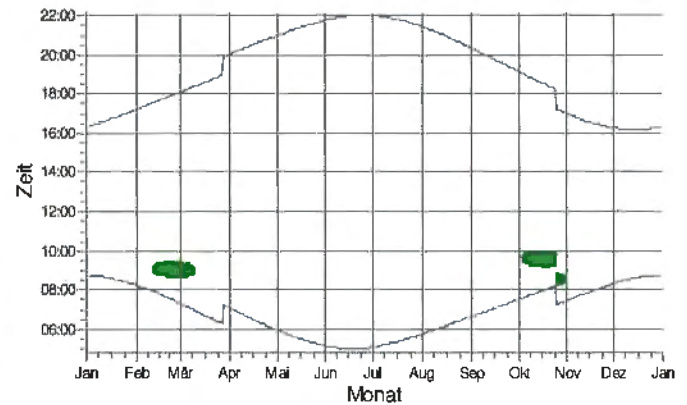
B: Lehmden Str. 103, Lehmden



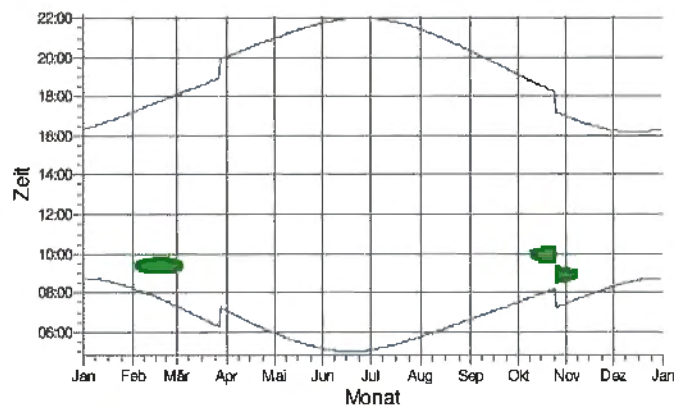
C: Lehmden Str. 109, Lehmden



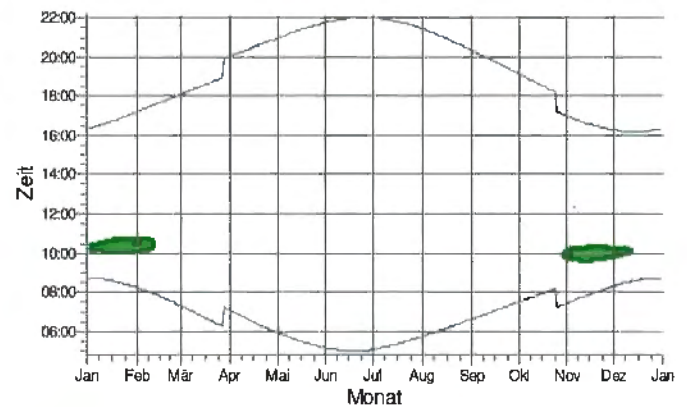
D: Lehmden Str. 109a, Lehmden



E: Lehmden Str. 121, Lehmden



F: Lehmden Str. 125, Lehmden



WEA

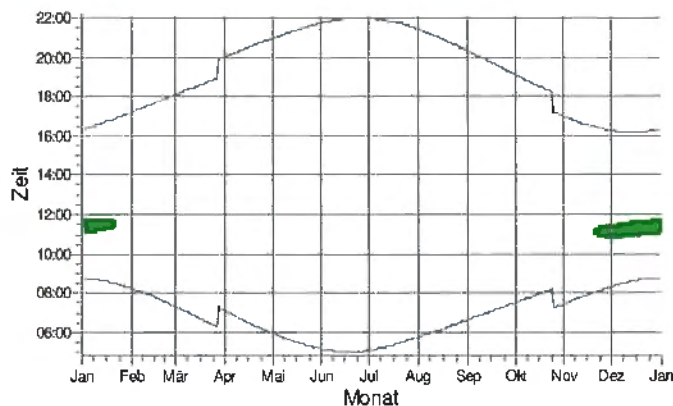
 vorh. WEA 06: NEG Micon NM52

 vorh. WEA 09: Enercon E-58/10.58

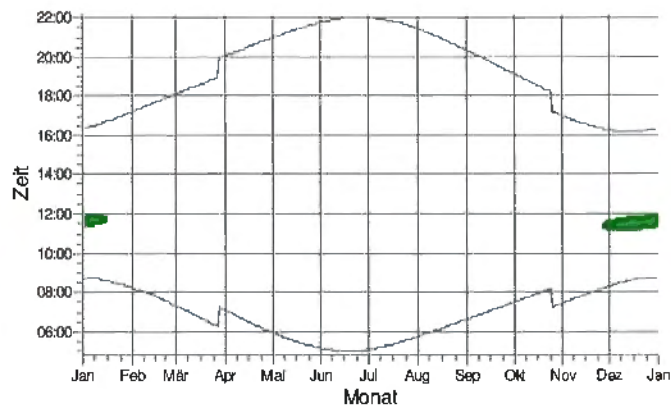
## SHADOW - Grafischer Kalender

**Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

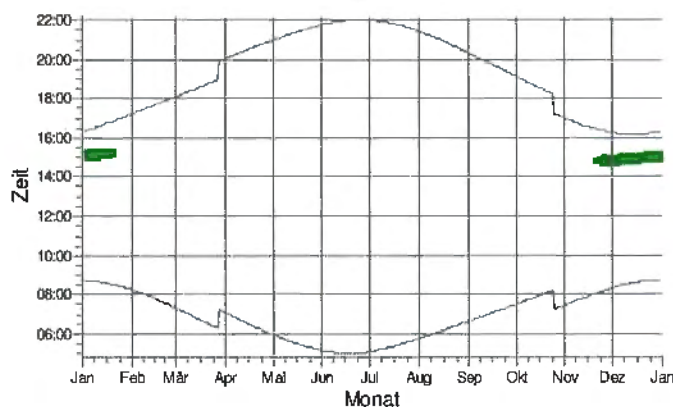
G: Lehmden Str. 143, Lehmden



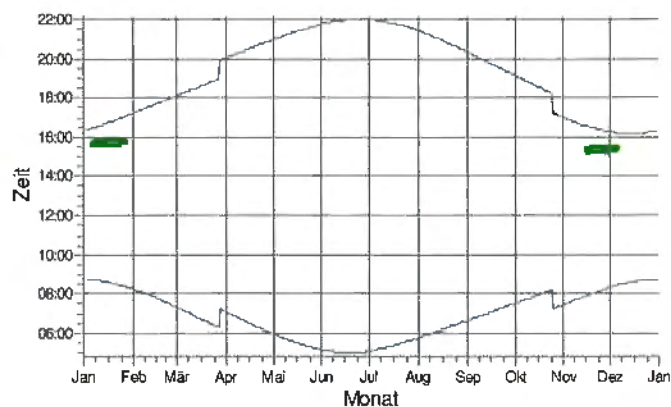
H: Lehmden Str. 145, Lehmden



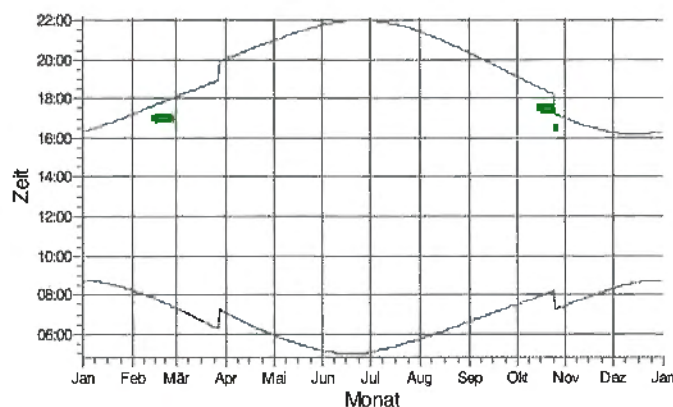
K: Dwoweg 39, Lehmden



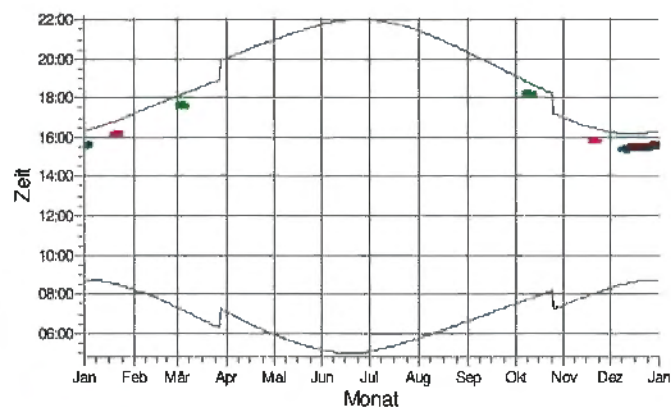
L: Dwoweg 70, Lehmden



M: Dwoweg 38, Lehmden



N: Dwoweg 156, Lehmden



WEA

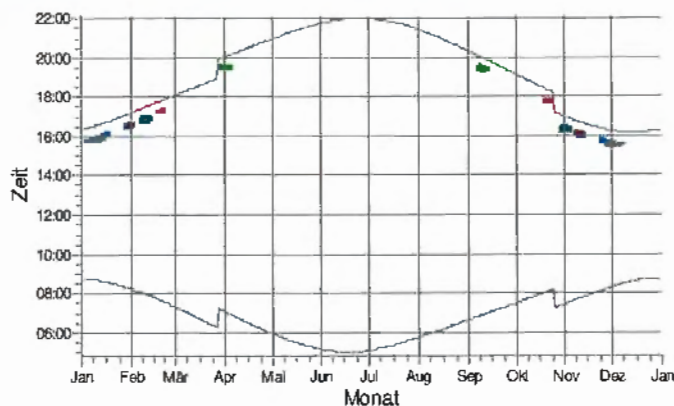
 vorh. WEA 05: NEG Micon NM52  
 vorh. WEA 06: NEG Micon NM52

 vorh. WEA 08: NEG Micon NM52  
 vorh. WEA 09: Enercon E-58/10.58

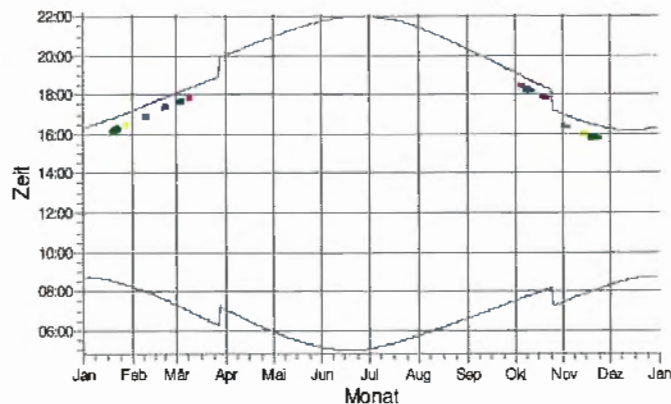
## SHADOW - Grafischer Kalender

**Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

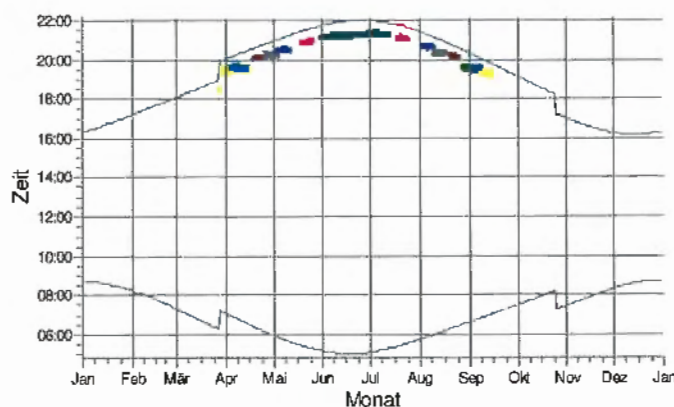
O: Droweg 190, Lehmden



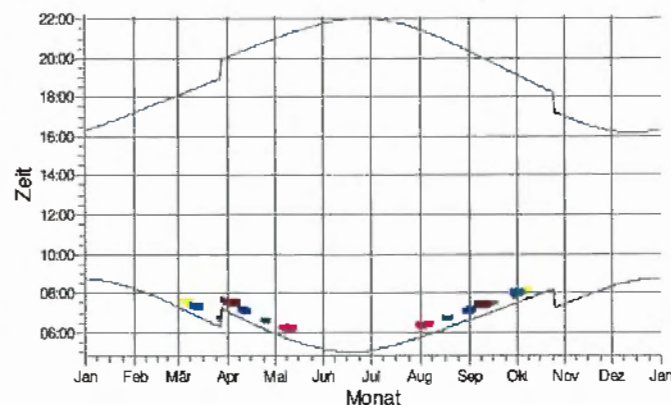
P: Weidenstr. 73, Kleibrok



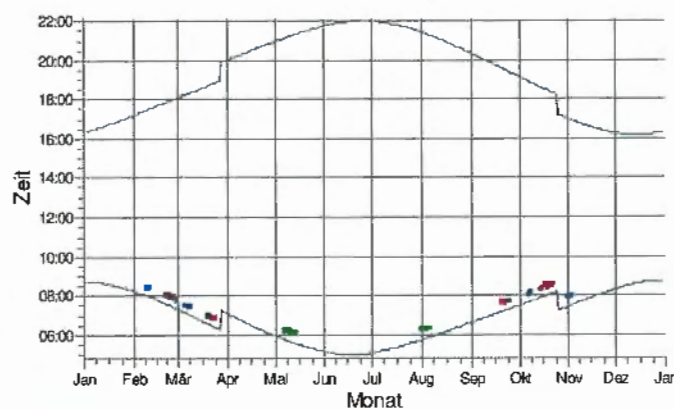
Q: Strothweg 20, Kleibrok



R: Hohe Looe 2-8 (BÜFA GmbH)

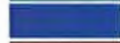
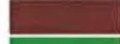


S: Wilhelmshavener Str. 88, Liethe



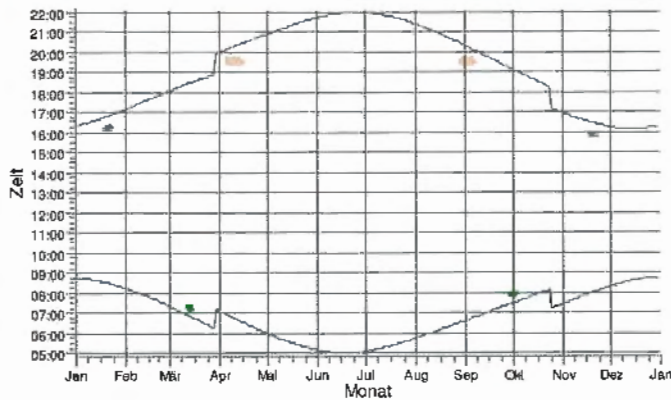
### WEA

|                                                                                     |                              |
|-------------------------------------------------------------------------------------|------------------------------|
|  | vorh. WEA 01: NEG Micon NM52 |
|  | vorh. WEA 02: NEG Micon NM52 |
|  | vorh. WEA 03: NEG Micon NM52 |
|  | vorh. WEA 04: NEG Micon NM52 |
|  | vorh. WEA 05: NEG Micon NM52 |

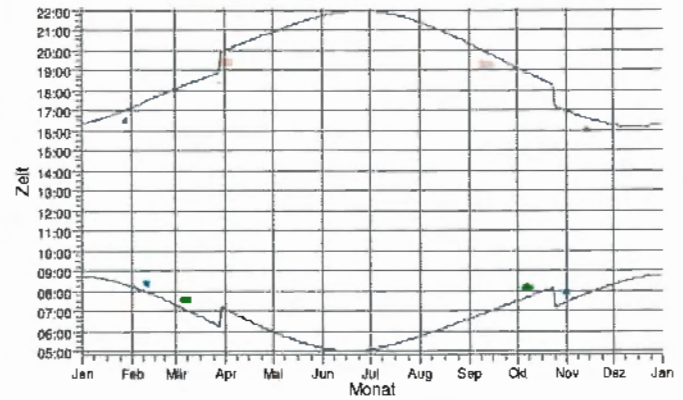
|                                                                                     |                                  |
|-------------------------------------------------------------------------------------|----------------------------------|
|  | vorh. WEA 06: NEG Micon NM52     |
|  | vorh. WEA 07: NEG Micon NM52     |
|  | vorh. WEA 08: NEG Micon NM52     |
|  | vorh. WEA 09: Enercon E-58/10.58 |

**SHADOW - Grafischer Kalender pro WEA****Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

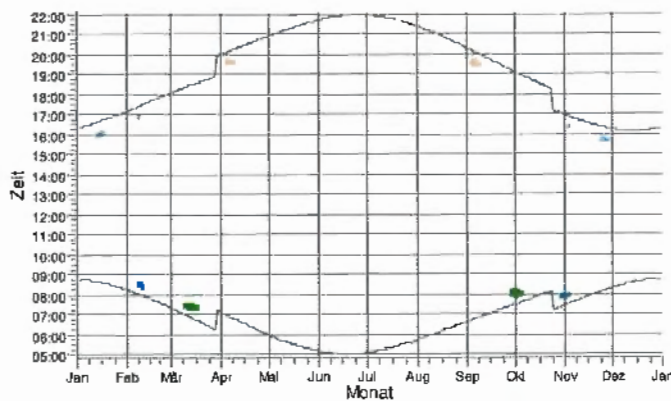
vorh. WEA 01: NEG Micon NM52



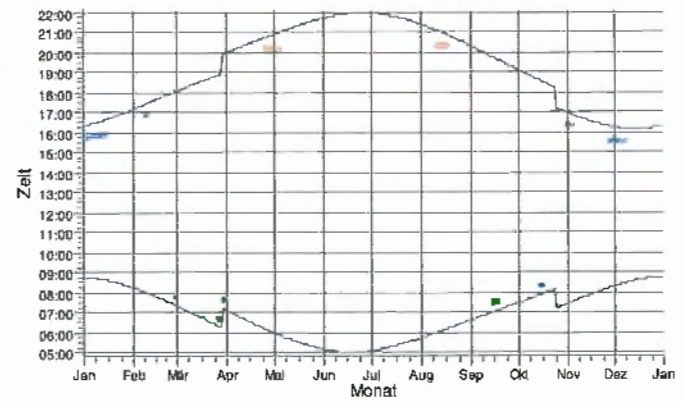
vorh. WEA 02: NEG Micon NM52



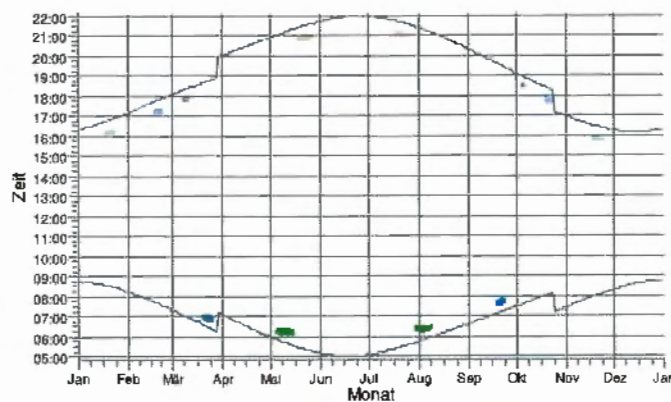
vorh. WEA 03: NEG Micon NM52



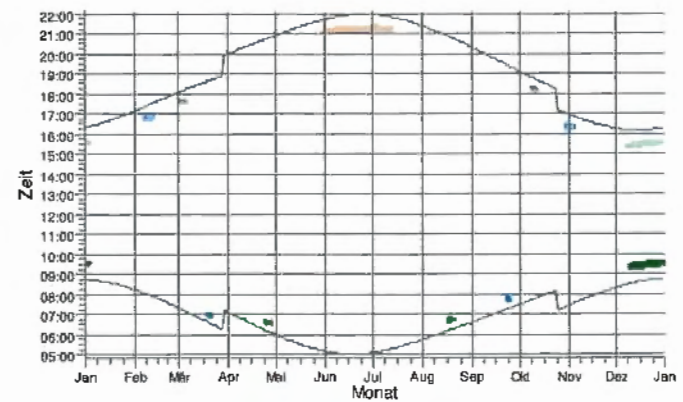
vorh. WEA 04: NEG Micon NM52



vorh. WEA 05: NEG Micon NM52



vorh. WEA 06: NEG Micon NM52



## Schattenrezeptoren



A: Lehmden Str. 99, Lehmden

N: Droweg 156, Lehmden

O: Droweg 190, Lehmden



P: Weidenstr. 73, Kleibrok

Q: Strothweg 20, Kleibrok

R: Hohe Looze 2-8 (BÜFA GmbH)

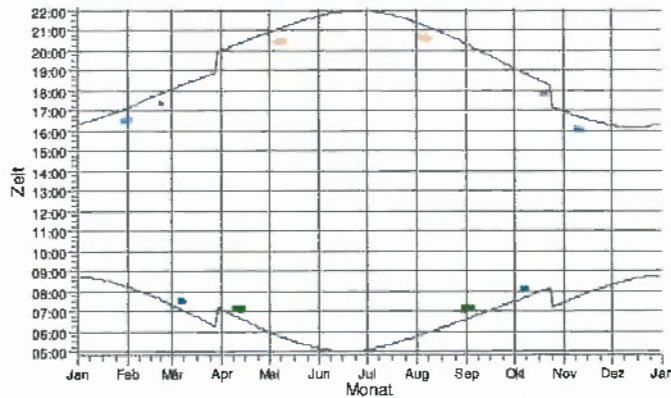


S: Wilhelmshavener Str. 88, Liethe

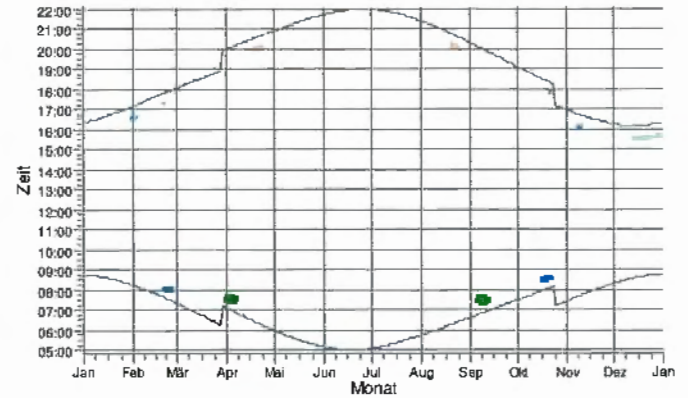
## SHADOW - Grafischer Kalender pro WEA

**Berechnung:** Vorbelastung durch 9 vorh. WEA im Windpark Lehmden

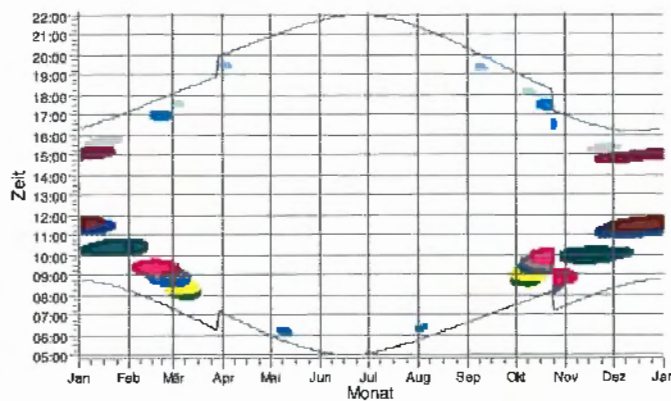
vorh. WEA 07: NEG Micon NM52



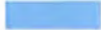
vorh. WEA 08: NEG Micon NM52

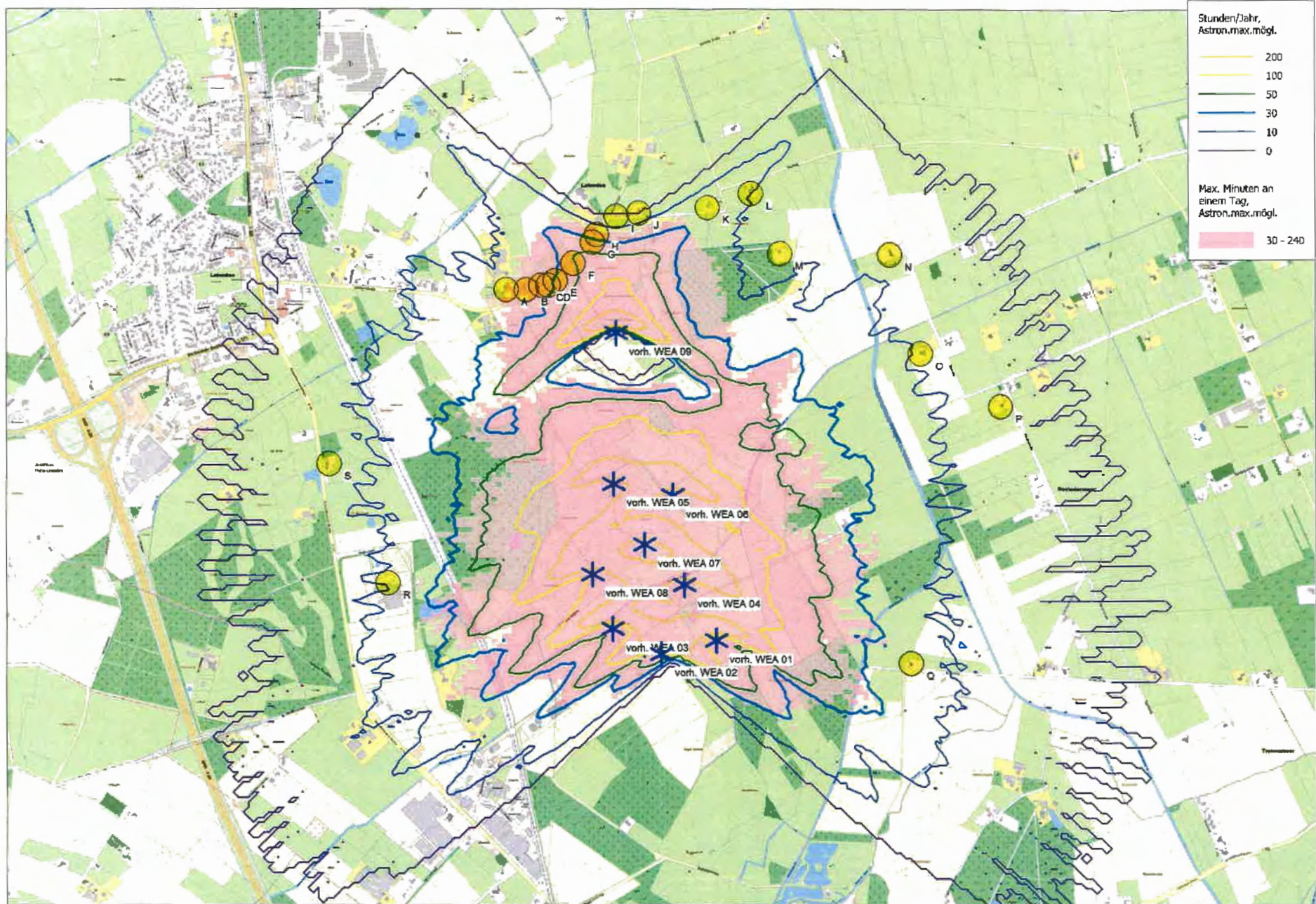


vorh. WEA 09: Enercon E-58/10.58



### Schattenrezeptoren

|                                                                                     |                               |                                                                                     |                              |                                                                                       |                                    |
|-------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------|------------------------------------|
|  | A: Lehmden Str. 99, Lehmden   |  | G: Lehmden Str. 143, Lehmden |  | O: Dwoweg 190, Lehmden             |
|  | B: Lehmden Str. 103, Lehmden  |  | H: Lehmden Str. 145, Lehmden |  | P: Weidenstr. 73, Kleibrok         |
|  | C: Lemder Str. 109, Lehmden   |  | K: Dwoweg 39, Lehmden        |  | Q: Strothweg 20, Kleibrok          |
|  | D: Lehmden Str. 109a, Lehmden |  | L: Dwoweg 70, Lehmden        |  | R: Hohe Looze 2-8 (BÜFA GmbH)      |
|  | E: Lehmden Str. 121, Lehmden  |  | M: Dwoweg 38, Lehmden        |  | S: Wilhelmshavener Str. 88, Liethe |
|  | F: Lehmden Str. 125, Lehmden  |  | N: Dwoweg 156, Lehmden       |                                                                                       |                                    |



Stunden/Jahr,  
Astron.max.mögl.

200  
100  
50  
30  
10  
0

Max. Minuten an  
einem Tag,  
Astron.max.mögl.

30 - 240

\* Existierende WEA      ☼ Schattenrezeptor

Karte: AKS LGLN Rastede, Maßstab 1:15.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 445.940 Nord: 5.903.680  
Höhe der Schattenkarte: Höhenlinien: Orographie Lehmden Liethe final bearb..wpo (7)

**SHADOW -  
Karte**  
Berechnung:  
Verfahren nach P. v. d. W. im Windpark Lehmden

Lieferanten Adresse:  
**Ingenieurbüro PLANKON**  
Blumenstrasse 26  
DE-26121 Oldenburg  
0441 390 34 - 0

Berechnet:  
11.07.2016 12:56/3.0.629

## SHADOW - Hauptergebnis

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

### Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °  
Tage zwischen Berechnungen 1 Tag(e)  
Berechnungszeitsprung 1 Minuten  
Die dargestellten Zeiten sind die astronomisch maximal mögliche  
Beschattungsdauer, berechnet unter folgenden Annahmen:  
Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur 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: Höhenlinien: Orographie Lehmden Liethe final bearb.

Hindernisse in Berechnung nicht verwendet

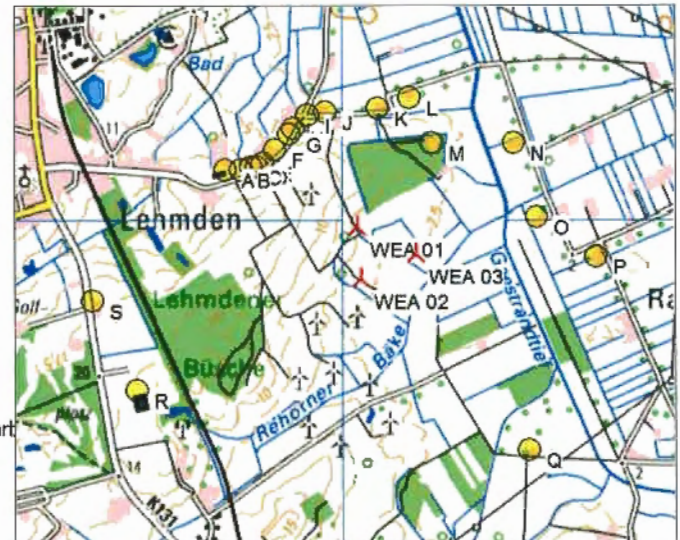
Augenhöhe: 1,5 m

Rasterauflösung: 10,0 m

Alle Koordinatenangaben in  
UTM (north)-ETRS89 Zone: 32

### WEA

|   | Ost     | Nord      | Z   | Beschreibung                    | WEA-Typ |            |          | Nenn-<br>leistung<br>[kW] | Rotor-<br>durchmesser<br>[m] | Nabenhöhe<br>[m] | Schattendaten                |                  |
|---|---------|-----------|-----|---------------------------------|---------|------------|----------|---------------------------|------------------------------|------------------|------------------------------|------------------|
|   |         |           |     |                                 | Aktuell | Hersteller | Typ      |                           |                              |                  | Beschatt.-<br>Bereich<br>[m] | U/min<br>[U/min] |
|   |         |           | [m] |                                 |         |            |          |                           |                              |                  |                              |                  |
| 1 | 446.026 | 5.904.036 | 4,6 | Enercon E-82 E2 TES (2,3 ... Ja | ENERCON | E-82       | E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |
| 2 | 446.048 | 5.903.762 | 3,3 | Enercon E-82 E2 TES (2,3 ... Ja | ENERCON | E-82       | E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |
| 3 | 446.341 | 5.903.894 | 1,7 | Enercon E-82 E2 TES (2,3 ... Ja | ENERCON | E-82       | E2-2.300 | 2.300                     | 82,0                         | 108,4            | 1.598                        | 18,0             |



Neue WEA

Maßstab 1:40.000

Schattenrezeptor

### Schattenrezeptor-Eingabe

| Nr. | Name                            | Ost     | Nord      | Z    | Breite | Höhe | Höhe<br>über Grund | Azimutwinkel<br>(von Süd) | Neigung des<br>Fensters | Ausrichtungsmodus   |
|-----|---------------------------------|---------|-----------|------|--------|------|--------------------|---------------------------|-------------------------|---------------------|
|     |                                 |         |           |      |        |      |                    |                           |                         |                     |
|     |                                 |         |           | [m]  | [m]    | [m]  | [m]                | [°]                       | [°]                     |                     |
| A   | Lehmden Str. 99, Lehmden        | 445.329 | 5.904.337 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| B   | Lehmden Str. 103, Lehmden       | 445.408 | 5.904.336 | 10,0 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| C   | Lehmden Str. 109, Lehmden       | 445.468 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| D   | Lehmden Str. 109a, Lehmden      | 445.496 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| E   | Lehmden Str. 121, Lehmden       | 445.526 | 5.904.374 | 9,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| F   | Lehmden Str. 125, Lehmden       | 445.595 | 5.904.441 | 7,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| G   | Lehmden Str. 143, Lehmden       | 445.672 | 5.904.525 | 6,1  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| H   | Lehmden Str. 145, Lehmden       | 445.690 | 5.904.555 | 5,7  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| I   | Dwöweg 1, Lehmden               | 445.768 | 5.904.628 | 3,8  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| J   | Dwöweg 11, Lehmden              | 445.858 | 5.904.642 | 2,9  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| K   | Dwöweg 39, Lehmden              | 446.133 | 5.904.664 | 1,6  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| L   | Dwöweg 70, Lehmden              | 446.305 | 5.904.720 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| M   | Dwöweg 38, Lehmden              | 446.420 | 5.904.481 | 5,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| N   | Dwöweg 156, Lehmden             | 446.860 | 5.904.477 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| O   | Dwöweg 190, Lehmden             | 446.981 | 5.904.084 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| P   | Weidenstr. 73, Kleibrok         | 447.300 | 5.903.875 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| Q   | Strothweg 20, Kleibrok          | 446.944 | 5.902.853 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| R   | Hohe Looe 2-8 (BÜFA GmbH)       | 444.858 | 5.903.170 | 16,8 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| S   | Wilhelmshavener Str. 88, Liethe | 444.625 | 5.903.643 | 17,5 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |

### Berechnungsergebnisse

Schattenrezeptor

| Nr. | Name                      | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------|--------------------------------------|----------------|-----------------------------|
|     |                           | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                           | [Std./Jahr]                          | [Tage/Jahr]    | [Std./Tag]                  |
| A   | Lehmden Str. 99, Lehmden  | 22:02                                | 76             | 0:25                        |
| B   | Lehmden Str. 103, Lehmden | 27:30                                | 81             | 0:30                        |

(Fortsetzung nächste Seite)...

**SHADOW - Hauptergebnis****Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

...(Fortsetzung von letzter Seite)

| Nr. | Name                            | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------------|--------------------------------------|----------------|-----------------------------|
|     |                                 | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                                 | [Std/Jahr]                           | [Tage/Jahr]    | [Std/Tag]                   |
| C   | Lehmdr Str. 109, Lehmnden       | 33:48                                | 89             | 0:37                        |
| D   | Lehmdr Str. 109a, Lehmnden      | 37:25                                | 95             | 0:40                        |
| E   | Lehmdr Str. 121, Lehmnden       | 44:05                                | 109            | 0:46                        |
| F   | Lehmdr Str. 125, Lehmnden       | 51:47                                | 110            | 0:53                        |
| G   | Lehmdr Str. 143, Lehmnden       | 49:16                                | 92             | 0:54                        |
| H   | Lehmdr Str. 145, Lehmnden       | 49:25                                | 86             | 0:53                        |
| I   | Dwowed 1, Lehmnden              | 44:28                                | 64             | 0:51                        |
| J   | Dwowed 11, Lehmnden             | 30:32                                | 50             | 0:50                        |
| K   | Dwowed 39, Lehmnden             | 4:50                                 | 22             | 0:17                        |
| L   | Dwowed 70, Lehmnden             | 7:50                                 | 30             | 0:20                        |
| M   | Dwowed 38, Lehmnden             | 40:52                                | 92             | 0:40                        |
| N   | Dwowed 156, Lehmnden            | 34:29                                | 90             | 0:43                        |
| O   | Dwowed 190, Lehmnden            | 23:12                                | 74             | 0:28                        |
| P   | Weidenstr. 73, Kleibrok         | 14:08                                | 55             | 0:28                        |
| Q   | Strothweg 20, Kleibrok          | 0:00                                 | 0              | 0:00                        |
| R   | Hohe Looe 2-8 (BÜFA GmbH)       | 6:34                                 | 52             | 0:15                        |
| S   | Wilhelmshavener Str. 88, Liethe | 4:53                                 | 34             | 0:13                        |

Gesamtmenge der max. mögl. Beschattung an Rezeptoren pro WEA

| Nr. | Name                         | Maximal    | Erwartet   |
|-----|------------------------------|------------|------------|
|     |                              | [Std/Jahr] | [Std/Jahr] |
| 1   | Enercon E-82 E2 TES (2,3 MW) | 212:52     |            |
| 2   | Enercon E-82 E2 TES (2,3 MW) | 108:09     |            |
| 3   | Enercon E-82 E2 TES (2,3 MW) | 126:32     |            |

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** A - Lehmden Str. 99, Lehmden

### Voraussetzungen für Berechnung des Schattenwurfs

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar | Februar      | März         | April | Mai          | Juni  |
|---------------------------|--------|--------------|--------------|-------|--------------|-------|
| 1                         | 08:43  | 08:14        | 08:51 (2)    | 07:17 | 07:59 (1)    | 07:04 |
|                           | 16:19  | 17:10        | 20 09:11 (2) | 18:04 | 25 08:24 (1) | 20:01 |
| 2                         | 08:43  | 08:12        | 08:51 (2)    | 07:15 | 07:58 (1)    | 07:01 |
|                           | 16:21  | 17:12        | 20 09:11 (2) | 18:06 | 25 08:23 (1) | 20:03 |
| 3                         | 08:43  | 08:10        | 08:51 (2)    | 07:13 | 07:59 (1)    | 06:59 |
|                           | 16:22  | 17:14        | 21 09:12 (2) | 18:08 | 24 08:23 (1) | 20:05 |
| 4                         | 08:42  | 08:09        | 08:52 (2)    | 07:11 | 07:59 (1)    | 06:56 |
|                           | 16:23  | 17:16        | 21 09:13 (2) | 18:10 | 24 08:23 (1) | 20:07 |
| 5                         | 08:42  | 08:07        | 08:52 (2)    | 07:08 | 07:58 (1)    | 06:54 |
|                           | 16:24  | 17:17        | 21 09:13 (2) | 18:12 | 24 08:22 (1) | 20:09 |
| 6                         | 08:42  | 08:05        | 08:52 (2)    | 07:06 | 07:59 (1)    | 06:52 |
|                           | 16:25  | 17:19        | 20 09:12 (2) | 18:14 | 22 08:21 (1) | 20:10 |
| 7                         | 08:41  | 08:03        | 08:52 (2)    | 07:04 | 07:59 (1)    | 06:49 |
|                           | 16:27  | 17:21        | 20 09:12 (2) | 18:16 | 20 08:19 (1) | 20:12 |
| 8                         | 08:41  | 08:01        | 08:53 (2)    | 07:01 | 08:01 (1)    | 06:47 |
|                           | 16:28  | 17:23        | 19 09:12 (2) | 18:17 | 17 08:18 (1) | 20:14 |
| 9                         | 08:40  | 08:00        | 08:54 (2)    | 06:59 | 08:03 (1)    | 06:45 |
|                           | 16:30  | 17:25        | 17 09:11 (2) | 18:19 | 13 08:16 (1) | 20:16 |
| 10                        | 08:40  | 07:58        | 08:55 (2)    | 06:57 | 08:05 (1)    | 06:42 |
|                           | 16:31  | 17:27        | 15 09:10 (2) | 18:21 | 7 08:12 (1)  | 20:18 |
| 11                        | 08:39  | 07:56        | 08:57 (2)    | 06:54 |              | 06:40 |
|                           | 16:32  | 17:29        | 11 09:08 (2) | 18:23 |              | 20:19 |
| 12                        | 08:38  | 07:54        | 09:02 (2)    | 06:52 |              | 06:38 |
|                           | 16:34  | 17:31        | 2 09:04 (2)  | 18:25 |              | 20:21 |
| 13                        | 08:37  | 07:52        |              | 06:49 |              | 06:35 |
|                           | 16:36  | 17:33        |              | 18:27 |              | 20:23 |
| 14                        | 08:37  | 07:50        |              | 06:47 |              | 06:33 |
|                           | 16:37  | 17:35        |              | 18:29 |              | 20:25 |
| 15                        | 08:36  | 07:48        |              | 06:45 |              | 06:31 |
|                           | 16:39  | 17:37        |              | 18:30 |              | 20:27 |
| 16                        | 08:35  | 07:46        |              | 06:42 |              | 06:28 |
|                           | 16:40  | 17:39        |              | 18:32 |              | 20:28 |
| 17                        | 08:34  | 07:44        |              | 06:40 |              | 06:26 |
|                           | 16:42  | 17:41        |              | 18:34 |              | 20:30 |
| 18                        | 08:33  | 07:42        |              | 06:37 |              | 06:24 |
|                           | 16:44  | 17:43        |              | 18:36 |              | 20:32 |
| 19                        | 08:32  | 07:39        | 08:05 (3)    | 06:35 |              | 06:22 |
|                           | 16:46  | 17:45        | 6 08:11 (3)  | 18:38 |              | 20:34 |
| 20                        | 08:31  | 07:37        | 08:02 (3)    | 06:33 |              | 06:19 |
|                           | 16:47  | 17:47        | 11 08:13 (3) | 18:40 |              | 20:36 |
| 21                        | 08:29  | 07:35        | 08:01 (3)    | 06:30 |              | 06:17 |
|                           | 16:49  | 17:49        | 13 08:14 (3) | 18:41 |              | 20:37 |
| 22                        | 08:28  | 07:33        | 08:00 (3)    | 06:28 |              | 06:15 |
|                           | 16:51  | 17:51        | 15 08:15 (3) | 18:43 |              | 20:39 |
| 23                        | 08:27  | 07:31        | 08:00 (3)    | 06:25 |              | 06:13 |
|                           | 16:53  | 17:53        | 18 08:18 (1) | 18:45 |              | 20:41 |
| 24                        | 08:26  | 07:29        | 07:58 (3)    | 06:23 |              | 06:11 |
|                           | 16:55  | 17:55        | 21 08:19 (1) | 18:47 |              | 20:43 |
| 25                        | 08:24  | 07:26        | 07:59 (3)    | 06:21 |              | 06:08 |
|                           | 16:56  | 17:57        | 22 08:21 (1) | 18:49 |              | 20:45 |
| 26                        | 08:23  | 07:24        | 07:59 (3)    | 06:18 |              | 06:06 |
|                           | 16:58  | 3 09:01 (2)  | 23 08:22 (1) | 18:51 |              | 20:46 |
| 27                        | 08:21  | 07:22        | 07:59 (3)    | 06:16 |              | 06:04 |
|                           | 17:00  | 9 09:05 (2)  | 23 08:22 (1) | 18:52 |              | 20:48 |
| 28                        | 08:20  | 07:20        | 08:00 (1)    | 06:13 |              | 06:02 |
|                           | 17:02  | 13 09:07 (2) | 23 08:23 (1) | 18:54 |              | 20:50 |
| 29                        | 08:18  | 08:53 (2)    |              | 07:11 |              | 06:00 |
|                           | 17:04  | 15 09:08 (2) |              | 19:56 |              | 20:52 |
| 30                        | 08:17  | 08:53 (2)    |              | 07:08 |              | 05:58 |
|                           | 17:06  | 17 09:10 (2) |              | 19:58 |              | 20:54 |
| 31                        | 08:15  | 08:52 (2)    |              | 07:06 |              | 05:08 |
|                           | 17:08  | 19 09:11 (2) |              | 20:00 |              | 21:43 |
| Sonnenscheinstunden       | 253    | 274          | 367          | 419   | 491          | 507   |
| astr.max.mögl.Beschattung | 76     | 382          | 201          |       |              |       |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** A - Lehmden Str. 99, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober |     | November  | Dezember     |
|---------------------------|-------|--------|-----------|---------|-----|-----------|--------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |     | 07:25     | 08:25 (2)    |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |     | 16:58     | 14 08:39 (2) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |     | 07:26     | 08:23 (2)    |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |     | 16:56     | 18 08:41 (2) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |     | 07:28     | 08:23 (2)    |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |     | 16:54     | 18 08:41 (2) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |     | 08:41 (1) | 07:30        |
|                           | 21:58 | 21:19  | 20:12     | 19:00   | 11  | 08:52 (1) | 16:52        |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   |     | 08:39 (1) | 07:32        |
|                           | 21:57 | 21:17  | 20:10     | 18:57   | 15  | 08:54 (1) | 16:50        |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |     | 08:37 (1) | 07:34        |
|                           | 21:56 | 21:15  | 20:07     | 18:55   | 19  | 08:56 (1) | 16:48        |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |     | 08:36 (1) | 07:36        |
|                           | 21:56 | 21:14  | 20:05     | 18:52   | 21  | 08:57 (1) | 16:46        |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |     | 08:34 (1) | 07:38        |
|                           | 21:55 | 21:12  | 20:03     | 18:50   | 23  | 08:57 (1) | 16:44        |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |     | 08:33 (1) | 07:40        |
|                           | 21:54 | 21:10  | 20:00     | 18:48   | 24  | 08:57 (1) | 16:43        |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |     | 08:33 (1) | 07:42        |
|                           | 21:54 | 21:08  | 19:58     | 18:45   | 24  | 08:57 (1) | 16:41        |
| 11                        | 05:13 | 05:59  | 06:53     | 07:46   |     | 08:33 (1) | 07:44        |
|                           | 21:53 | 21:06  | 19:55     | 18:43   | 24  | 08:57 (1) | 16:39        |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |     | 08:32 (1) | 07:45        |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 25  | 08:57 (1) | 16:38        |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |     | 08:33 (1) | 07:47        |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 24  | 08:57 (1) | 16:36        |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   |     | 08:33 (1) | 07:49        |
|                           | 21:50 | 21:00  | 19:48     | 18:36   | 23  | 08:56 (1) | 16:35        |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |     | 08:32 (3) | 07:51        |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 23  | 08:55 (1) | 16:33        |
| 16                        | 05:19 | 06:08  | 07:02     | 07:55   |     | 08:31 (3) | 07:53        |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 23  | 08:54 (1) | 16:31        |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |     | 08:30 (3) | 07:55        |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 22  | 08:52 (1) | 16:30        |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |     | 08:30 (3) | 07:56        |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 20  | 08:50 (1) | 16:29        |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |     | 08:30 (3) | 07:58        |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 17  | 08:47 (1) | 16:27        |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |     | 08:30 (3) | 08:00        |
|                           | 21:43 | 20:47  | 19:34     | 18:23   | 15  | 08:45 (3) | 16:26        |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |     | 08:31 (3) | 08:02        |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 13  | 08:44 (3) | 16:25        |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |     | 08:33 (3) | 08:04        |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 10  | 08:43 (3) | 16:23        |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   |     | 08:37 (3) | 08:05        |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 2   | 08:39 (3) | 16:22        |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   |     |           | 08:07        |
|                           | 21:37 | 20:38  | 19:24     | 18:14   |     |           | 16:21        |
| 25                        | 05:32 | 06:24  | 07:17     | 07:11   |     |           | 08:09        |
|                           | 21:36 | 20:35  | 19:21     | 17:12   |     |           | 16:20        |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   |     |           | 08:10        |
|                           | 21:34 | 20:33  | 19:19     | 17:10   |     |           | 16:19        |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |     |           | 08:12        |
|                           | 21:33 | 20:31  | 19:16     | 17:08   |     |           | 16:18        |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |     |           | 08:14        |
|                           | 21:31 | 20:29  | 19:14     | 17:06   |     |           | 16:15        |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |     |           | 08:15        |
|                           | 21:30 | 20:26  | 19:12     | 17:04   |     |           | 16:16        |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |     | 08:29 (2) | 08:17        |
|                           | 21:28 | 20:24  | 19:09     | 17:02   | 5   | 08:34 (2) | 16:15        |
| 31                        | 05:41 | 06:34  |           | 07:23   |     | 08:25 (2) |              |
|                           | 21:26 | 20:22  |           | 17:00   | 12  | 08:37 (2) |              |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 395 | 261       | 236          |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** B - Lehmden Str. 103, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar | Februar   | März      | April     | Mai       | Juni      |
|---------------------------|--------|-----------|-----------|-----------|-----------|-----------|
| 1                         | 08:43  | 08:14     | 09:02 (2) | 07:17     | 08:08 (1) | 07:04     |
|                           | 16:19  | 17:10     | 09:25 (2) | 18:04     | 08:35 (1) | 20:01     |
| 2                         | 08:43  | 08:12     | 09:03 (2) | 07:15     | 08:07 (1) | 07:01     |
|                           | 16:21  | 17:12     | 09:25 (2) | 18:06     | 08:34 (1) | 20:03     |
| 3                         | 08:43  | 08:10     | 09:03 (2) | 07:13     | 08:08 (1) | 06:59     |
|                           | 16:22  | 17:14     | 09:24 (2) | 18:08     | 08:34 (1) | 20:05     |
| 4                         | 08:42  | 08:09     | 09:05 (2) | 07:11     | 08:09 (1) | 06:56     |
|                           | 16:23  | 17:16     | 09:25 (2) | 18:10     | 08:34 (1) | 20:07     |
| 5                         | 08:42  | 08:07     | 09:05 (2) | 07:08     | 08:09 (1) | 06:54     |
|                           | 16:24  | 17:17     | 09:24 (2) | 18:12     | 08:32 (1) | 20:09     |
| 6                         | 08:42  | 08:05     | 09:06 (2) | 07:06     | 08:10 (1) | 06:52     |
|                           | 16:25  | 17:19     | 09:23 (2) | 18:14     | 08:31 (1) | 20:10     |
| 7                         | 08:41  | 08:03     | 09:08 (2) | 07:04     | 08:10 (1) | 06:49     |
|                           | 16:27  | 17:21     | 09:22 (2) | 18:16     | 08:28 (1) | 20:12     |
| 8                         | 08:41  | 08:01     | 09:10 (2) | 07:01     | 08:13 (1) | 06:47     |
|                           | 16:28  | 17:23     | 09:20 (2) | 18:17     | 08:26 (1) | 20:14     |
| 9                         | 08:40  | 08:00     | 09:11 (2) | 06:59     | 08:17 (1) | 06:45     |
|                           | 16:30  | 17:25     | 18:19     | 5         | 08:22 (1) | 20:16     |
| 10                        | 08:40  | 07:58     | 06:57     |           |           | 06:42     |
|                           | 16:31  | 17:27     | 18:21     |           |           | 20:18     |
| 11                        | 08:39  | 07:56     | 06:54     |           |           | 06:40     |
|                           | 16:32  | 17:29     | 18:23     |           |           | 20:19     |
| 12                        | 08:38  | 07:54     | 06:52     |           |           | 06:38     |
|                           | 16:34  | 17:31     | 18:25     |           |           | 20:21     |
| 13                        | 08:37  | 07:52     | 06:49     |           |           | 06:35     |
|                           | 16:36  | 17:33     | 18:27     |           |           | 20:23     |
| 14                        | 08:37  | 07:50     | 06:47     |           |           | 06:33     |
|                           | 16:37  | 17:35     | 18:29     |           |           | 20:25     |
| 15                        | 08:36  | 07:48     | 06:45     |           |           | 06:31     |
|                           | 16:39  | 17:37     | 18:30     |           |           | 20:27     |
| 16                        | 08:35  | 07:46     | 06:42     |           |           | 06:28     |
|                           | 16:40  | 17:39     | 18:32     |           |           | 20:28     |
| 17                        | 08:34  | 07:44     | 06:40     |           |           | 06:26     |
|                           | 16:42  | 17:41     | 8         | 08:10 (3) | 06:40     | 20:30     |
| 18                        | 08:33  | 07:42     | 08:08 (3) | 06:37     |           | 06:24     |
|                           | 16:44  | 17:43     | 13        | 08:21 (3) | 18:36     | 20:32     |
| 19                        | 08:32  | 07:39     | 08:07 (3) | 06:35     |           | 06:22     |
|                           | 16:46  | 17:45     | 15        | 08:22 (3) | 18:38     | 20:34     |
| 20                        | 08:31  | 07:37     | 08:05 (3) | 06:33     |           | 06:19     |
|                           | 16:47  | 17:47     | 22        | 08:27 (1) | 18:40     | 20:36     |
| 21                        | 08:29  | 09:07 (2) | 07:35     | 08:05 (3) | 06:30     | 06:17     |
|                           | 16:49  | 9         | 09:16 (2) | 17:49     | 25        | 08:30 (1) |
| 22                        | 08:28  | 09:05 (2) | 07:33     | 08:05 (3) | 06:28     | 06:15     |
|                           | 16:51  | 12        | 09:17 (2) | 17:51     | 27        | 08:32 (1) |
| 23                        | 08:27  | 09:04 (2) | 07:31     | 08:05 (3) | 06:25     | 06:13     |
|                           | 16:53  | 16        | 09:20 (2) | 17:53     | 29        | 08:34 (1) |
| 24                        | 08:26  | 09:03 (2) | 07:29     | 08:04 (3) | 06:23     | 06:11     |
|                           | 16:54  | 17        | 09:20 (2) | 17:55     | 30        | 08:34 (1) |
| 25                        | 08:24  | 09:03 (2) | 07:26     | 08:05 (3) | 06:21     | 06:08     |
|                           | 16:56  | 19        | 09:22 (2) | 17:57     | 30        | 08:35 (1) |
| 26                        | 08:23  | 09:02 (2) | 07:24     | 08:06 (3) | 06:18     | 06:06     |
|                           | 16:58  | 20        | 09:22 (2) | 17:58     | 29        | 08:35 (1) |
| 27                        | 08:21  | 09:03 (2) | 07:22     | 08:06 (3) | 06:16     | 06:04     |
|                           | 17:00  | 21        | 09:24 (2) | 18:00     | 29        | 08:35 (1) |
| 28                        | 08:20  | 09:02 (2) | 07:20     | 08:08 (1) | 06:13     | 06:02     |
|                           | 17:02  | 22        | 09:24 (2) | 18:02     | 27        | 08:35 (1) |
| 29                        | 08:18  | 09:02 (2) |           | 07:11     |           | 20:50     |
|                           | 17:04  | 22        | 09:24 (2) |           |           | 06:00     |
| 30                        | 08:17  | 09:03 (2) |           | 07:08     |           | 20:52     |
|                           | 17:06  | 22        | 09:25 (2) |           |           | 05:58     |
| 31                        | 08:15  | 09:02 (2) |           | 07:06     |           | 20:54     |
|                           | 17:08  | 23        | 09:25 (2) | 20:00     |           | 05:08     |
| Sonnenscheinstunden       | 253    | 274       | 367       |           | 419       | 21:43     |
| astr.max.mögl.Beschattung | 203    | 430       | 165       |           | 491       | 507       |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** B - Lehmden Str. 103, Lehmden

### Voraussetzungen für Berechnung des Schattenwurfs

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Juli  | August | September | Oktober |           | November  |           | Dezember  |
|---------------------------|-------|--------|-----------|---------|-----------|-----------|-----------|-----------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |           | 07:25     |           | 08:18     |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |           | 16:58     |           | 16:14     |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |           | 07:26     | 08:43 (2) | 08:20     |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |           | 16:56     | 3         | 08:46 (2) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |           | 07:28     |           | 08:21     |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |           | 16:54     | 11        | 08:50 (2) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |           | 07:30     |           | 08:23     |
|                           | 21:58 | 21:19  | 20:12     | 19:00   |           | 16:52     | 15        | 08:52 (2) |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   | 08:51 (1) | 07:32     |           | 08:24     |
|                           | 21:57 | 21:17  | 20:10     | 18:57   | 11        | 09:02 (1) | 17        | 08:53 (2) |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |           | 08:48 (1) |           | 08:26     |
|                           | 21:56 | 21:15  | 20:07     | 18:55   | 17        | 09:05 (1) | 19        | 08:54 (2) |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |           | 08:47 (1) |           | 08:27     |
|                           | 21:56 | 21:14  | 20:05     | 18:52   | 19        | 09:06 (1) | 21        | 08:55 (2) |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |           | 08:44 (1) |           | 08:28     |
|                           | 21:55 | 21:12  | 20:03     | 18:50   | 22        | 09:06 (1) | 21        | 08:55 (2) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |           | 08:43 (1) |           | 08:29     |
|                           | 21:54 | 21:10  | 20:00     | 18:48   | 24        | 09:07 (1) | 23        | 08:56 (2) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |           | 08:42 (1) |           | 08:31     |
|                           | 21:54 | 21:08  | 19:58     | 18:45   | 26        | 09:08 (1) | 23        | 08:56 (2) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |           | 08:42 (1) |           | 08:32     |
|                           | 21:53 | 21:06  | 19:55     | 18:43   | 26        | 09:08 (1) | 23        | 08:56 (2) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |           | 08:41 (1) |           | 08:33     |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 27        | 09:08 (1) | 23        | 08:56 (2) |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |           | 08:41 (1) |           | 08:34     |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 27        | 09:08 (1) | 22        | 08:56 (2) |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   |           | 08:41 (1) |           | 08:35     |
|                           | 21:50 | 21:00  | 19:48     | 18:36   | 27        | 09:08 (1) | 22        | 08:56 (2) |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |           | 08:39 (3) |           | 08:36     |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 29        | 09:08 (1) | 21        | 08:56 (2) |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   |           | 08:38 (3) |           | 08:37     |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 29        | 09:07 (1) | 20        | 08:55 (2) |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |           | 08:36 (3) |           | 08:37     |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 30        | 09:06 (1) | 19        | 08:55 (2) |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |           | 08:36 (3) |           | 08:38     |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 29        | 09:05 (1) | 17        | 08:54 (2) |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |           | 08:35 (3) |           | 08:39     |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 28        | 09:03 (1) | 16        | 08:54 (2) |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |           | 08:35 (3) |           | 08:40     |
|                           | 21:43 | 20:47  | 19:34     | 18:23   | 27        | 09:02 (1) | 13        | 08:53 (2) |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |           | 08:36 (3) |           | 08:40     |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 24        | 09:00 (1) | 9         | 08:51 (2) |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |           | 08:36 (3) |           | 08:41     |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 20        | 08:56 (1) |           | 16:11     |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   |           | 08:37 (3) |           | 08:41     |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 14        | 08:51 (3) |           | 16:12     |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   |           | 08:38 (3) |           | 08:42     |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 12        | 08:50 (3) |           | 16:12     |
| 25                        | 05:32 | 06:24  | 07:17     | 07:11   |           | 07:41 (3) |           | 08:42     |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 6         | 07:47 (3) |           | 16:13     |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   |           |           |           | 08:42     |
|                           | 21:34 | 20:33  | 19:19     | 17:10   |           |           |           | 16:14     |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |           |           |           | 08:43     |
|                           | 21:33 | 20:31  | 19:16     | 17:08   |           |           |           | 16:14     |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |           |           |           | 08:43     |
|                           | 21:31 | 20:29  | 19:14     | 17:06   |           |           |           | 16:15     |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |           |           |           | 08:43     |
|                           | 21:30 | 20:26  | 19:12     | 17:04   |           |           |           | 16:16     |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |           |           |           | 08:43     |
|                           | 21:28 | 20:24  | 19:09     | 17:01   |           |           |           | 16:17     |
| 31                        | 05:41 | 06:34  |           | 07:23   |           |           |           | 08:43     |
|                           | 21:26 | 20:22  |           | 17:00   |           |           |           | 16:18     |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 474       | 261       | 358       | 236       |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** C - Lemder Str. 109, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar | Februar | März      | April | Mai       | Juni  |
|---------------------------|--------|---------|-----------|-------|-----------|-------|
| 1                         | 08:43  | 08:14   | 09:19 (2) | 07:17 | 08:23 (1) | 07:04 |
|                           | 16:19  | 17:10   | 18:04     | 25    | 08:48 (1) | 20:01 |
| 2                         | 08:43  | 08:12   | 09:20 (2) | 07:15 | 08:23 (1) | 07:01 |
|                           | 16:21  | 17:12   | 18:06     | 24    | 08:47 (1) | 20:03 |
| 3                         | 08:43  | 08:10   | 09:21 (2) | 07:13 | 08:24 (1) | 06:59 |
|                           | 16:22  | 17:14   | 18:08     | 21    | 08:45 (1) | 20:05 |
| 4                         | 08:42  | 08:09   | 09:24 (2) | 07:11 | 08:26 (1) | 06:56 |
|                           | 16:23  | 17:16   | 18:10     | 18    | 08:44 (1) | 20:07 |
| 5                         | 08:42  | 08:07   | 09:33 (2) | 07:08 | 08:27 (1) | 06:54 |
|                           | 16:24  | 17:17   | 18:12     | 13    | 08:40 (1) | 20:09 |
| 6                         | 08:42  | 08:05   | 09:06     | 07:06 | 06:52     | 20:10 |
|                           | 16:25  | 17:19   | 18:14     | 20:10 | 21:04     | 21:50 |
| 7                         | 08:41  | 08:03   | 07:04     | 06:49 | 05:44     | 05:03 |
|                           | 16:27  | 17:21   | 18:16     | 20:12 | 21:06     | 21:51 |
| 8                         | 08:41  | 08:01   | 07:01     | 06:47 | 05:42     | 05:02 |
|                           | 16:28  | 17:23   | 18:17     | 20:14 | 21:08     | 21:52 |
| 9                         | 08:40  | 08:00   | 06:59     | 06:45 | 05:40     | 05:02 |
|                           | 16:30  | 17:25   | 18:19     | 20:16 | 21:09     | 21:52 |
| 10                        | 08:40  | 07:58   | 06:57     | 06:42 | 05:38     | 05:01 |
|                           | 16:31  | 17:27   | 18:21     | 20:18 | 21:11     | 21:53 |
| 11                        | 08:39  | 07:56   | 06:54     | 06:40 | 05:37     | 05:01 |
|                           | 16:32  | 17:29   | 18:23     | 20:19 | 21:13     | 21:54 |
| 12                        | 08:38  | 07:54   | 06:52     | 06:38 | 05:35     | 05:00 |
|                           | 16:34  | 17:31   | 18:25     | 20:21 | 21:15     | 21:55 |
| 13                        | 08:37  | 07:52   | 06:49     | 06:35 | 05:33     | 05:00 |
|                           | 16:36  | 17:33   | 18:27     | 20:23 | 21:16     | 21:56 |
| 14                        | 08:37  | 07:50   | 06:47     | 06:33 | 05:31     | 05:00 |
|                           | 16:37  | 17:35   | 18:29     | 20:25 | 21:18     | 21:56 |
| 15                        | 08:36  | 07:48   | 06:45     | 06:31 | 05:30     | 05:00 |
|                           | 16:39  | 17:37   | 18:30     | 20:27 | 21:20     | 21:57 |
| 16                        | 08:35  | 07:46   | 06:42     | 06:28 | 05:28     | 04:59 |
|                           | 16:40  | 17:39   | 18:32     | 20:28 | 21:21     | 21:57 |
| 17                        | 08:34  | 07:44   | 06:40     | 06:26 | 05:27     | 04:59 |
|                           | 16:42  | 17:41   | 18:34     | 20:30 | 21:23     | 21:58 |
| 18                        | 08:33  | 07:42   | 06:37     | 06:24 | 05:25     | 04:59 |
|                           | 16:44  | 17:43   | 18:36     | 20:32 | 21:24     | 21:58 |
| 19                        | 08:32  | 07:39   | 06:35     | 06:22 | 05:24     | 04:59 |
|                           | 16:46  | 17:45   | 18:38     | 20:34 | 21:26     | 21:59 |
| 20                        | 08:31  | 07:37   | 06:33     | 06:19 | 05:22     | 04:59 |
|                           | 16:47  | 17:47   | 18:40     | 20:36 | 21:28     | 21:59 |
| 21                        | 08:29  | 07:35   | 06:30     | 06:17 | 05:21     | 05:00 |
|                           | 16:49  | 17:49   | 18:41     | 20:37 | 21:29     | 21:59 |
| 22                        | 08:28  | 07:33   | 06:28     | 06:15 | 05:19     | 05:00 |
|                           | 16:51  | 17:51   | 18:43     | 20:39 | 21:31     | 21:59 |
| 23                        | 08:27  | 07:31   | 06:25     | 06:13 | 05:18     | 05:00 |
|                           | 16:53  | 17:53   | 18:45     | 20:41 | 21:32     | 22:00 |
| 24                        | 08:26  | 07:29   | 06:23     | 06:11 | 05:16     | 05:00 |
|                           | 16:54  | 17:55   | 18:47     | 20:43 | 21:34     | 22:00 |
| 25                        | 08:24  | 07:26   | 06:21     | 06:08 | 05:15     | 05:01 |
|                           | 16:56  | 17:57   | 18:49     | 20:45 | 21:35     | 22:00 |
| 26                        | 08:23  | 07:24   | 06:18     | 06:06 | 05:14     | 05:01 |
|                           | 16:58  | 17:58   | 18:50     | 20:46 | 21:36     | 22:00 |
| 27                        | 08:21  | 07:22   | 06:16     | 06:04 | 05:13     | 05:01 |
|                           | 17:00  | 18:00   | 18:52     | 20:48 | 21:38     | 22:00 |
| 28                        | 08:20  | 07:20   | 06:13     | 06:02 | 05:12     | 05:02 |
|                           | 17:02  | 18:02   | 18:54     | 20:50 | 21:39     | 21:59 |
| 29                        | 08:18  | 07:16   | 06:11     | 06:00 | 05:11     | 05:03 |
|                           | 17:04  | 18:04   | 19:56     | 20:52 | 21:40     | 21:59 |
| 30                        | 08:17  | 07:17   | 07:08     | 05:58 | 05:09     | 05:03 |
|                           | 17:06  | 18:06   | 19:58     | 20:54 | 21:42     | 21:59 |
| 31                        | 08:15  | 07:18   | 07:06     |       | 05:08     |       |
|                           | 17:08  | 18:08   | 20:00     |       | 21:43     |       |
| Sonnenscheinstunden       | 253    | 274     | 367       | 419   | 491       | 507   |
| astr.max.mögl.Beschattung | 378    | 523     | 101       |       |           |       |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe  
**Schattenrezeptor:** C - Lemder Str. 109, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul            | August         | September      | Oktober        |                           | November          | Dezember                 |                |
|---------------------------|----------------|----------------|----------------|----------------|---------------------------|-------------------|--------------------------|----------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 | 07:28<br>19:07 |                           | 07:25<br>16:58    | 08:18<br>16:14           |                |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 |                           | 07:26<br>16:56    | 08:20<br>16:14           |                |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 |                           | 07:28<br>16:54    | 08:21<br>16:13           |                |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 |                           | 07:30<br>16:52    | 08:23<br>16:12           |                |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 | 07:35<br>18:57 |                           | 07:32<br>16:50    | 08:24<br>16:12           |                |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:37<br>18:55 |                           | 07:34<br>16:48    | 08:26<br>16:11           |                |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 | 07:38<br>18:52 |                           | 07:36<br>16:46    | 9 08:54 (2)<br>09:03 (2) | 08:27<br>16:11 |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 09:04 (1)<br>09:14 (1)    | 07:38<br>16:44    | 08:52 (2)<br>09:06 (2)   | 08:28<br>16:10 |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 10 09:01 (1)<br>09:17 (1) | 07:40<br>16:43    | 08:50 (2)<br>09:07 (2)   | 08:29<br>16:10 |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 16 08:59 (1)<br>09:19 (1) | 07:42<br>16:41    | 08:49 (2)<br>09:08 (2)   | 08:31<br>16:10 |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 20 08:57 (1)<br>09:20 (1) | 07:44<br>16:39    | 08:49 (2)<br>09:09 (2)   | 08:32<br>16:10 |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 23 08:56 (1)<br>09:21 (1) | 07:45<br>16:38    | 08:48 (2)<br>09:10 (2)   | 08:33<br>16:09 |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 25 08:55 (1)<br>09:22 (1) | 07:47<br>16:36    | 08:48 (2)<br>09:10 (2)   | 08:34<br>16:09 |
| 14                        | 05:16<br>21:50 | 06:05<br>21:00 | 06:58<br>19:48 | 07:51<br>18:36 | 27 08:55 (1)<br>09:22 (1) | 07:49<br>16:35    | 08:48 (2)<br>09:11 (2)   | 08:35<br>16:09 |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 27 08:54 (1)<br>09:23 (1) | 07:51<br>16:33    | 08:47 (2)<br>09:11 (2)   | 08:36<br>16:09 |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 29 08:51 (3)<br>09:23 (1) | 07:53<br>16:31    | 08:48 (2)<br>09:11 (2)   | 08:37<br>16:09 |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 32 08:47 (3)<br>09:22 (1) | 07:55<br>16:30    | 08:48 (2)<br>09:12 (2)   | 08:37<br>16:10 |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 35 08:46 (3)<br>09:22 (1) | 07:56<br>16:29    | 08:48 (2)<br>09:12 (2)   | 08:38<br>16:10 |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 36 08:45 (3)<br>09:21 (1) | 07:58<br>16:27    | 08:48 (2)<br>09:12 (2)   | 08:39<br>16:10 |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:34 | 08:02<br>18:23 | 36 08:44 (3)<br>09:21 (1) | 08:00<br>16:26    | 08:49 (2)<br>09:12 (2)   | 08:40<br>16:10 |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 37 08:43 (3)<br>09:20 (1) | 08:02<br>16:25    | 08:50 (2)<br>09:12 (2)   | 08:40<br>16:11 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 37 08:43 (3)<br>09:19 (1) | 08:04<br>16:23    | 08:50 (2)<br>09:12 (2)   | 08:41<br>16:11 |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 36 08:43 (3)<br>09:18 (1) | 08:05<br>16:22    | 08:51 (2)<br>09:12 (2)   | 08:41<br>16:12 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 35 08:43 (3)<br>09:17 (1) | 08:07<br>16:21    | 08:52 (2)<br>09:11 (2)   | 08:42<br>16:12 |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 34 07:44 (3)<br>08:15 (1) | 08:09<br>16:20    | 08:53 (2)<br>09:11 (2)   | 08:42<br>16:13 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 31 07:45 (3)<br>08:13 (1) | 08:10<br>16:19    | 08:55 (2)<br>09:11 (2)   | 08:42<br>16:14 |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 28 07:46 (3)<br>08:09 (1) | 08:12<br>16:18    | 08:55 (2)<br>09:09 (2)   | 08:43<br>16:14 |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>17:06 | 20 07:48 (3)<br>07:57 (3) | 08:14<br>16:17    | 08:57 (2)<br>09:09 (2)   | 08:43<br>16:15 |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:04 | 9 08:15 (1)<br>16:16      | 14 08:17<br>16:15 | 08:59 (2)<br>09:08 (2)   | 08:43<br>16:16 |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 16 08:13 (1)<br>16:15     | 16 08:12<br>16:15 | 09:03 (2)<br>09:05 (2)   | 08:43<br>16:17 |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 08:23<br>16:59 |                           | 2 16:15           |                          | 08:43<br>16:18 |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 583                       | 261               | 236                      |                |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** D - Lehmden Str. 109a, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar         | Februar            | März               | April              | Mai            | Juni           |
|---------------------------|----------------|--------------------|--------------------|--------------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10     | 09:26 (2)<br>18:04 | 08:28 (1)<br>20:01 | 05:56<br>20:55 | 05:08<br>21:44 |
| 2                         | 08:43<br>16:21 | 08:12<br>17:12     | 09:27 (2)<br>18:06 | 08:28 (1)<br>20:03 | 05:54<br>20:57 | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:14     | 09:30 (2)<br>18:08 | 08:30 (1)<br>20:05 | 05:52<br>20:59 | 05:06<br>21:46 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:16     | 09:36 (2)<br>18:11 | 08:32 (1)<br>20:07 | 05:50<br>21:01 | 05:05<br>21:48 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17     | 09:30 (2)<br>18:12 | 08:35 (1)<br>20:09 | 05:48<br>21:02 | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19     | 09:30 (2)<br>18:14 | 08:43 (1)<br>20:10 | 05:46<br>21:04 | 05:04<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21     | 09:30 (2)<br>18:16 | 08:43 (1)<br>20:12 | 05:44<br>21:06 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23     | 09:30 (2)<br>18:17 | 08:43 (1)<br>20:14 | 05:42<br>21:08 | 05:02<br>21:52 |
| 9                         | 08:40<br>16:30 | 09:24 (2)<br>17:25 | 08:00<br>18:19     | 06:45<br>20:16     | 05:40<br>21:09 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 09:22 (2)<br>17:27 | 08:00<br>18:21     | 06:42<br>20:18     | 05:38<br>21:11 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 09:21 (2)<br>17:29 | 08:00<br>18:23     | 06:40<br>20:19     | 05:37<br>21:13 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 09:20 (2)<br>17:31 | 08:25 (3)<br>18:25 | 06:38<br>20:21     | 05:35<br>21:15 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:36 | 09:20 (2)<br>17:33 | 08:20 (3)<br>18:27 | 06:35<br>20:23     | 05:33<br>21:16 | 05:00<br>21:56 |
| 14                        | 08:37<br>16:37 | 09:19 (2)<br>17:35 | 08:19 (3)<br>18:29 | 06:33<br>20:25     | 05:31<br>21:18 | 05:00<br>21:56 |
| 15                        | 08:36<br>16:39 | 09:19 (2)<br>17:37 | 08:18 (3)<br>18:30 | 06:31<br>20:27     | 05:30<br>21:20 | 05:00<br>21:57 |
| 16                        | 08:35<br>16:40 | 09:19 (2)<br>17:39 | 08:17 (3)<br>18:32 | 06:28<br>20:28     | 05:28<br>21:21 | 04:59<br>21:57 |
| 17                        | 08:34<br>16:42 | 09:19 (2)<br>17:41 | 08:17 (3)<br>18:34 | 06:26<br>20:30     | 05:27<br>21:23 | 04:59<br>21:58 |
| 18                        | 08:33<br>16:44 | 09:19 (2)<br>17:43 | 08:16 (3)<br>18:36 | 06:24<br>20:32     | 05:25<br>21:24 | 04:59<br>21:58 |
| 19                        | 08:32<br>16:46 | 09:19 (2)<br>17:45 | 08:16 (3)<br>18:38 | 06:22<br>20:34     | 05:24<br>21:26 | 04:59<br>21:59 |
| 20                        | 08:31<br>16:47 | 09:19 (2)<br>17:47 | 08:16 (3)<br>18:40 | 06:19<br>20:36     | 05:22<br>21:28 | 04:59<br>21:59 |
| 21                        | 08:29<br>16:49 | 09:19 (2)<br>17:49 | 08:16 (3)<br>18:41 | 06:17<br>20:37     | 05:21<br>21:29 | 05:00<br>21:59 |
| 22                        | 08:28<br>16:51 | 09:19 (2)<br>17:51 | 08:17 (3)<br>18:43 | 06:15<br>20:39     | 05:19<br>21:31 | 05:00<br>21:59 |
| 23                        | 08:27<br>16:53 | 09:19 (2)<br>17:53 | 08:18 (3)<br>18:45 | 06:13<br>20:41     | 05:18<br>21:32 | 05:00<br>22:00 |
| 24                        | 08:26<br>16:54 | 09:19 (2)<br>17:55 | 08:19 (3)<br>18:47 | 06:10<br>20:43     | 05:16<br>21:34 | 05:00<br>22:00 |
| 25                        | 08:24<br>16:56 | 09:20 (2)<br>17:57 | 08:21 (3)<br>18:49 | 06:08<br>20:45     | 05:15<br>21:35 | 05:01<br>22:00 |
| 26                        | 08:23<br>16:58 | 09:20 (2)<br>17:58 | 08:26 (1)<br>18:50 | 06:06<br>20:46     | 05:14<br>21:36 | 05:01<br>22:00 |
| 27                        | 08:21<br>17:00 | 09:21 (2)<br>18:00 | 08:26 (1)<br>18:52 | 06:04<br>20:48     | 05:13<br>21:38 | 05:01<br>22:00 |
| 28                        | 08:20<br>17:02 | 09:21 (2)<br>18:02 | 08:27 (1)<br>18:54 | 06:02<br>20:50     | 05:12<br>21:39 | 05:02<br>21:59 |
| 29                        | 08:18<br>17:04 | 09:22 (2)<br>18:04 | 08:27 (1)<br>18:56 | 06:00<br>20:52     | 05:11<br>21:40 | 05:03<br>21:59 |
| 30                        | 08:17<br>17:06 | 09:24 (2)<br>18:06 | 08:27 (1)<br>18:58 | 05:58<br>20:54     | 05:09<br>21:42 | 05:03<br>21:59 |
| 31                        | 08:15<br>17:08 | 09:24 (2)<br>18:08 | 08:27 (1)<br>19:00 |                    | 05:08<br>21:43 |                |
| Sonnenscheinstunden       | 253            | 274                | 367                | 419                | 491            | 507            |
| astr.max.mögl.Beschattung | 457            | 571                | 92                 |                    |                |                |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** D - Lehmden Str. 109a, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober |     | November  |     | Dezember  |              |
|---------------------------|-------|--------|-----------|---------|-----|-----------|-----|-----------|--------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |     | 07:25     |     | 08:18     | 09:03 (2)    |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |     | 16:58     |     | 16:14     | 12 09:15 (2) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |     | 07:26     |     | 08:20     | 09:05 (2)    |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |     | 16:56     |     | 16:14     | 10 09:15 (2) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |     | 07:28     |     | 08:21     | 09:08 (2)    |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |     | 16:54     |     | 16:13     | 6 09:14 (2)  |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |     | 07:30     |     | 08:23     |              |
|                           | 21:58 | 21:19  | 20:12     | 19:00   |     | 16:52     |     | 16:12     |              |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   |     | 07:32     |     | 08:24     |              |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |     | 16:50     |     | 16:12     |              |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |     | 07:34     |     | 08:26     |              |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |     | 16:48     |     | 16:11     |              |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |     | 07:36     |     | 08:27     |              |
|                           | 21:56 | 21:14  | 20:05     | 18:52   |     | 16:46     |     | 16:11     |              |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |     | 07:38     |     | 09:01 (2) | 08:28        |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |     | 16:44     | 7   | 09:08 (2) | 16:10        |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |     | 07:40     |     | 08:58 (2) | 08:29        |
|                           | 21:54 | 21:10  | 20:00     | 18:48   | 12  | 09:20 (1) | 12  | 09:10 (2) | 16:10        |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |     | 09:05 (1) |     | 08:56 (2) | 08:31        |
|                           | 21:54 | 21:08  | 19:58     | 18:45   | 18  | 09:23 (1) | 16  | 09:12 (2) | 16:10        |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |     | 09:03 (1) |     | 08:55 (2) | 08:32        |
|                           | 21:53 | 21:06  | 19:55     | 18:43   | 21  | 09:24 (1) | 18  | 09:13 (2) | 16:10        |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |     | 09:02 (1) |     | 08:54 (2) | 08:33        |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 24  | 09:26 (1) | 20  | 09:14 (2) | 16:09        |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |     | 09:00 (1) |     | 08:54 (2) | 08:34        |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 27  | 09:27 (1) | 21  | 09:15 (2) | 16:09        |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   |     | 09:00 (1) |     | 08:53 (2) | 08:35        |
|                           | 21:50 | 21:00  | 19:48     | 18:36   | 27  | 09:27 (1) | 23  | 09:16 (2) | 16:09        |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |     | 08:59 (1) |     | 08:53 (2) | 08:36        |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 29  | 09:28 (1) | 23  | 09:16 (2) | 16:09        |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   |     | 08:58 (1) |     | 08:53 (2) | 08:37        |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 30  | 09:28 (1) | 24  | 09:17 (2) | 16:09        |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |     | 08:51 (3) |     | 08:53 (2) | 08:37        |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 36  | 09:27 (1) | 24  | 09:17 (2) | 16:10        |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |     | 08:49 (3) |     | 08:53 (2) | 08:38        |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 38  | 09:27 (1) | 25  | 09:18 (2) | 16:10        |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |     | 08:48 (3) |     | 08:53 (2) | 08:39        |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 39  | 09:27 (1) | 25  | 09:18 (2) | 16:10        |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |     | 08:47 (3) |     | 08:54 (2) | 08:40        |
|                           | 21:43 | 20:47  | 19:34     | 18:23   | 40  | 09:27 (1) | 24  | 09:18 (2) | 16:10        |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |     | 08:46 (3) |     | 08:54 (2) | 08:40        |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 40  | 09:26 (1) | 24  | 09:18 (2) | 16:11        |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |     | 08:46 (3) |     | 08:55 (2) | 08:41        |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 40  | 09:26 (1) | 23  | 09:18 (2) | 16:11        |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   |     | 08:46 (3) |     | 08:56 (2) | 08:41        |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 39  | 09:25 (1) | 22  | 09:18 (2) | 16:12        |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   |     | 08:46 (3) |     | 08:56 (2) | 08:42        |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 38  | 09:24 (1) | 22  | 09:18 (2) | 16:12        |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   |     | 07:46 (3) |     | 08:57 (2) | 08:42        |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 37  | 08:23 (1) | 21  | 09:18 (2) | 16:13        |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   |     | 07:47 (3) |     | 08:58 (2) | 08:42        |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 34  | 08:21 (1) | 20  | 09:18 (2) | 16:14        |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |     | 07:47 (3) |     | 08:58 (2) | 08:43        |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 32  | 08:19 (1) | 19  | 09:17 (2) | 16:14        |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |     | 07:48 (3) |     | 09:00 (2) | 08:43        |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 25  | 08:16 (1) | 17  | 09:17 (2) | 16:15        |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |     | 07:50 (3) |     | 09:01 (2) | 08:43        |
|                           | 21:30 | 20:26  | 19:12     | 17:04   | 10  | 08:00 (3) | 16  | 09:17 (2) | 16:16        |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |     | 08:17     |     | 09:02 (2) | 08:43        |
|                           | 21:28 | 20:24  | 19:09     | 17:01   |     | 16:15     | 15  | 09:17 (2) | 16:17        |
| 31                        | 05:41 | 06:34  |           | 07:23   |     |           |     | 08:43     |              |
|                           | 21:26 | 20:22  |           | 16:59   |     |           |     | 16:18     |              |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 636 | 261       | 461 | 236       | 28           |
| 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)   | Zeitpunkt (SS:MM)    | Schattenanfang    | (WEA mit erstem Schatten)  |
|              | Sonnenuntergang (SS:MM) | Minuten mit Schatten | Zeitpunkt (SS:MM) | Schattenende               |
|              |                         |                      |                   | (WEA mit letztem Schatten) |

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** E - Lehmden Str. 121, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar |     | Februar   |       | März |           | April |           | Mai   |  | Juni  |       |
|---------------------------|--------|-----|-----------|-------|------|-----------|-------|-----------|-------|--|-------|-------|
| 1                         | 08:43  |     | 09:28 (2) | 08:14 |      | 07:17     |       | 08:45 (1) | 07:04 |  | 05:56 | 05:08 |
|                           | 16:19  | 10  | 09:38 (2) | 17:10 |      | 18:04     | 13    | 08:58 (1) | 20:01 |  | 20:55 | 21:44 |
| 2                         | 08:43  |     | 09:28 (2) | 08:12 |      | 07:15     |       | 08:50 (1) | 07:01 |  | 05:54 | 05:07 |
|                           | 16:21  | 11  | 09:39 (2) | 17:12 |      | 18:06     | 1     | 08:51 (1) | 20:03 |  | 20:57 | 21:45 |
| 3                         | 08:43  |     | 09:28 (2) | 08:10 |      | 07:13     |       |           | 06:59 |  | 05:52 | 05:06 |
|                           | 16:22  | 13  | 09:41 (2) | 17:14 |      | 18:08     |       |           | 20:05 |  | 20:59 | 21:46 |
| 4                         | 08:42  |     | 09:27 (2) | 08:09 |      | 07:11     |       |           | 06:56 |  | 05:50 | 05:05 |
|                           | 16:23  | 14  | 09:41 (2) | 17:16 |      | 18:10     |       |           | 20:07 |  | 21:01 | 21:48 |
| 5                         | 08:42  |     | 09:28 (2) | 08:07 |      | 07:08     |       |           | 06:54 |  | 05:48 | 05:04 |
|                           | 16:24  | 15  | 09:43 (2) | 17:17 |      | 18:12     |       |           | 20:09 |  | 21:02 | 21:49 |
| 6                         | 08:42  |     | 09:27 (2) | 08:05 |      | 07:06     |       |           | 06:52 |  | 05:46 | 05:03 |
|                           | 16:25  | 17  | 09:44 (2) | 17:19 |      | 18:14     |       |           | 20:10 |  | 21:04 | 21:50 |
| 7                         | 08:41  |     | 09:27 (2) | 08:03 |      | 07:04     |       |           | 06:49 |  | 05:44 | 05:03 |
|                           | 16:27  | 17  | 09:44 (2) | 17:21 |      | 18:16     |       |           | 20:12 |  | 21:06 | 21:51 |
| 8                         | 08:41  |     | 09:27 (2) | 08:01 |      | 07:01     |       |           | 06:47 |  | 05:42 | 05:02 |
|                           | 16:28  | 19  | 09:46 (2) | 17:23 |      | 18:17     |       |           | 20:14 |  | 21:08 | 21:52 |
| 9                         | 08:40  |     | 09:27 (2) | 08:00 |      | 08:31 (3) |       |           | 06:45 |  | 05:40 | 05:02 |
|                           | 16:30  | 19  | 09:46 (2) | 17:25 | 12   | 08:57 (1) |       |           | 20:16 |  | 21:09 | 21:52 |
| 10                        | 08:40  |     | 09:27 (2) | 07:58 |      | 08:28 (3) |       |           | 06:42 |  | 05:38 | 05:01 |
|                           | 16:31  | 20  | 09:47 (2) | 17:27 | 26   | 09:01 (1) |       |           | 20:18 |  | 21:11 | 21:53 |
| 11                        | 08:39  |     | 09:26 (2) | 07:56 |      | 08:26 (3) |       |           | 06:40 |  | 05:37 | 05:01 |
|                           | 16:32  | 22  | 09:48 (2) | 17:29 | 33   | 09:03 (1) |       |           | 20:19 |  | 21:13 | 21:54 |
| 12                        | 08:38  |     | 09:26 (2) | 07:54 |      | 08:25 (3) |       |           | 06:38 |  | 05:35 | 05:00 |
|                           | 16:34  | 22  | 09:48 (2) | 17:31 | 40   | 09:05 (1) |       |           | 20:21 |  | 21:15 | 21:55 |
| 13                        | 08:37  |     | 09:26 (2) | 07:52 |      | 08:23 (3) |       |           | 06:35 |  | 05:33 | 05:00 |
|                           | 16:36  | 23  | 09:49 (2) | 17:33 | 42   | 09:05 (1) |       |           | 20:23 |  | 21:16 | 21:56 |
| 14                        | 08:37  |     | 09:26 (2) | 07:50 |      | 08:23 (3) |       |           | 06:33 |  | 05:31 | 05:00 |
|                           | 16:37  | 24  | 09:50 (2) | 17:35 | 43   | 09:06 (1) |       |           | 20:25 |  | 21:18 | 21:56 |
| 15                        | 08:36  |     | 09:27 (2) | 07:48 |      | 08:23 (3) |       |           | 06:31 |  | 05:30 | 05:00 |
|                           | 16:39  | 24  | 09:51 (2) | 17:37 | 44   | 09:07 (1) |       |           | 20:27 |  | 21:20 | 21:57 |
| 16                        | 08:35  |     | 09:27 (2) | 07:46 |      | 08:23 (3) |       |           | 06:28 |  | 05:28 | 04:59 |
|                           | 16:40  | 24  | 09:51 (2) | 17:39 | 45   | 09:08 (1) |       |           | 20:28 |  | 21:21 | 21:57 |
| 17                        | 08:34  |     | 09:27 (2) | 07:44 |      | 08:23 (3) |       |           | 06:26 |  | 05:27 | 04:59 |
|                           | 16:42  | 25  | 09:52 (2) | 17:41 | 45   | 09:08 (1) |       |           | 20:30 |  | 21:23 | 21:58 |
| 18                        | 08:33  |     | 09:28 (2) | 07:42 |      | 08:23 (3) |       |           | 06:24 |  | 05:25 | 04:59 |
|                           | 16:44  | 25  | 09:53 (2) | 17:43 | 46   | 09:09 (1) |       |           | 20:32 |  | 21:24 | 21:58 |
| 19                        | 08:32  |     | 09:28 (2) | 07:39 |      | 08:24 (3) |       |           | 06:22 |  | 05:24 | 04:59 |
|                           | 16:46  | 25  | 09:53 (2) | 17:45 | 45   | 09:09 (1) |       |           | 20:34 |  | 21:26 | 21:59 |
| 20                        | 08:31  |     | 09:28 (2) | 07:37 |      | 08:24 (3) |       |           | 06:19 |  | 05:22 | 04:59 |
|                           | 16:47  | 25  | 09:53 (2) | 17:47 | 44   | 09:08 (1) |       |           | 20:36 |  | 21:28 | 21:59 |
| 21                        | 08:29  |     | 09:29 (2) | 07:35 |      | 08:25 (3) |       |           | 06:17 |  | 05:21 | 05:00 |
|                           | 16:49  | 24  | 09:53 (2) | 17:49 | 43   | 09:08 (1) |       |           | 20:37 |  | 21:29 | 21:59 |
| 22                        | 08:28  |     | 09:29 (2) | 07:33 |      | 08:27 (3) |       |           | 06:15 |  | 05:19 | 05:00 |
|                           | 16:51  | 24  | 09:53 (2) | 17:51 | 41   | 09:08 (1) |       |           | 20:39 |  | 21:31 | 21:59 |
| 23                        | 08:27  |     | 09:30 (2) | 07:31 |      | 08:31 (3) |       |           | 06:13 |  | 05:18 | 05:00 |
|                           | 16:53  | 23  | 09:53 (2) | 17:53 | 34   | 09:08 (1) |       |           | 20:41 |  | 21:32 | 22:00 |
| 24                        | 08:26  |     | 09:30 (2) | 07:29 |      | 08:38 (1) |       |           | 06:10 |  | 05:16 | 05:00 |
|                           | 16:54  | 23  | 09:53 (2) | 17:55 | 28   | 09:06 (1) |       |           | 20:43 |  | 21:34 | 22:00 |
| 25                        | 08:24  |     | 09:31 (2) | 07:26 |      | 08:39 (1) |       |           | 06:08 |  | 05:15 | 05:01 |
|                           | 16:56  | 22  | 09:53 (2) | 17:57 | 27   | 09:06 (1) |       |           | 20:45 |  | 21:35 | 22:00 |
| 26                        | 08:23  |     | 09:32 (2) | 07:24 |      | 08:40 (1) |       |           | 06:06 |  | 05:14 | 05:01 |
|                           | 16:58  | 20  | 09:52 (2) | 17:58 | 25   | 09:05 (1) |       |           | 20:46 |  | 21:36 | 22:00 |
| 27                        | 08:21  |     | 09:33 (2) | 07:22 |      | 08:40 (1) |       |           | 06:04 |  | 05:13 | 05:01 |
|                           | 17:00  | 19  | 09:52 (2) | 18:00 | 22   | 09:02 (1) |       |           | 20:48 |  | 21:38 | 22:00 |
| 28                        | 08:20  |     | 09:34 (2) | 07:20 |      | 08:42 (1) |       |           | 06:02 |  | 05:12 | 05:02 |
|                           | 17:02  | 17  | 09:51 (2) | 18:02 | 19   | 09:01 (1) |       |           | 20:50 |  | 21:39 | 21:59 |
| 29                        | 08:18  |     | 09:36 (2) |       |      | 07:11     |       |           | 06:00 |  | 05:11 | 05:03 |
|                           | 17:04  | 13  | 09:49 (2) |       |      | 19:56     |       |           | 20:52 |  | 21:40 | 21:59 |
| 30                        | 08:17  |     | 09:39 (2) |       |      | 07:08     |       |           | 05:58 |  | 05:09 | 05:03 |
|                           | 17:06  | 9   | 09:48 (2) |       |      | 19:58     |       |           | 20:54 |  | 21:42 | 21:59 |
| 31                        | 08:15  |     |           |       |      | 07:06     |       |           |       |  | 05:08 |       |
|                           | 17:08  |     |           |       |      | 20:00     |       |           |       |  | 21:43 |       |
| Sonnenscheinstunden       | 253    |     |           | 274   |      | 367       |       |           | 419   |  | 491   | 507   |
| astr.max.mögl.Beschattung |        | 588 |           | 704   |      | 14        |       |           |       |  |       |       |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** E - Lehmden Str. 121, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober |              | November |              | Dezember |              |
|---------------------------|-------|--------|-----------|---------|--------------|----------|--------------|----------|--------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |              | 07:25    | 07:58 (3)    | 08:18    | 09:09 (2)    |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |              | 16:58    | 24 08:30 (1) | 16:14    | 21 09:30 (2) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |              | 07:26    | 08:19 (1)    | 08:20    | 09:10 (2)    |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |              | 16:56    | 7 08:25 (1)  | 16:14    | 20 09:30 (2) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |              | 07:28    |              | 08:21    | 09:11 (2)    |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |              | 16:54    |              | 16:13    | 20 09:31 (2) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |              | 07:30    |              | 08:23    | 09:11 (2)    |
|                           | 21:58 | 21:19  | 20:12     | 19:00   |              | 16:52    |              | 16:12    | 19 09:30 (2) |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   |              | 07:32    |              | 08:24    | 09:13 (2)    |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |              | 16:50    |              | 16:12    | 17 09:30 (2) |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |              | 07:34    |              | 08:26    | 09:13 (2)    |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |              | 16:48    |              | 16:11    | 17 09:30 (2) |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |              | 07:36    |              | 08:27    | 09:14 (2)    |
|                           | 21:56 | 21:14  | 20:05     | 18:52   |              | 16:46    |              | 16:11    | 15 09:29 (2) |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |              | 07:38    |              | 08:28    | 09:16 (2)    |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |              | 16:44    |              | 16:10    | 14 09:30 (2) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |              | 07:40    |              | 08:29    | 09:16 (2)    |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |              | 16:43    |              | 16:10    | 13 09:29 (2) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |              | 07:42    |              | 08:31    | 09:17 (2)    |
|                           | 21:54 | 21:08  | 19:58     | 18:45   |              | 16:41    |              | 16:10    | 11 09:28 (2) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |              | 07:44    |              | 08:32    | 09:18 (2)    |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |              | 16:39    |              | 16:10    | 10 09:28 (2) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   | 09:20 (1)    | 07:45    | 09:09 (2)    | 08:33    | 09:21 (2)    |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 9 09:29 (1)  | 16:38    | 10 09:19 (2) | 16:09    | 7 09:28 (2)  |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   | 09:17 (1)    | 07:47    | 09:07 (2)    | 08:34    | 09:22 (2)    |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 16 09:33 (1) | 16:36    | 14 09:21 (2) | 16:09    | 5 09:27 (2)  |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   | 09:14 (1)    | 07:49    | 09:06 (2)    | 08:35    | 09:25 (2)    |
|                           | 21:50 | 20:59  | 19:48     | 18:36   | 21 09:35 (1) | 16:35    | 17 09:23 (2) | 16:09    | 1 09:26 (2)  |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   | 09:13 (1)    | 07:51    | 09:05 (2)    | 08:36    |              |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 23 09:36 (1) | 16:33    | 19 09:24 (2) | 16:09    |              |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   | 09:11 (1)    | 07:53    | 09:05 (2)    | 08:37    |              |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 25 09:36 (1) | 16:31    | 20 09:25 (2) | 16:09    |              |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   | 09:10 (1)    | 07:55    | 09:04 (2)    | 08:37    |              |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 27 09:37 (1) | 16:30    | 22 09:26 (2) | 16:10    |              |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   | 09:09 (1)    | 07:56    | 09:04 (2)    | 08:38    |              |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 29 09:38 (1) | 16:29    | 23 09:27 (2) | 16:10    |              |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   | 08:59 (3)    | 07:58    | 09:04 (2)    | 08:39    |              |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 38 09:38 (1) | 16:27    | 23 09:27 (2) | 16:10    |              |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   | 08:57 (3)    | 08:00    | 09:04 (2)    | 08:40    |              |
|                           | 21:43 | 20:47  | 19:34     | 18:23   | 41 09:38 (1) | 16:26    | 24 09:28 (2) | 16:10    |              |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   | 08:55 (3)    | 08:02    | 09:04 (2)    | 08:40    |              |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 43 09:38 (1) | 16:25    | 24 09:28 (2) | 16:11    |              |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   | 08:54 (3)    | 08:04    | 09:04 (2)    | 08:41    |              |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 44 09:38 (1) | 16:23    | 25 09:29 (2) | 16:11    |              |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   | 08:53 (3)    | 08:05    | 09:04 (2)    | 08:41    |              |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 45 09:38 (1) | 16:22    | 25 09:29 (2) | 16:12    |              |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 08:53 (3)    | 08:07    | 09:05 (2)    | 08:42    |              |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 45 09:38 (1) | 16:21    | 25 09:30 (2) | 16:12    |              |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 07:52 (3)    | 08:09    | 09:05 (2)    | 08:42    |              |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 45 08:37 (1) | 16:20    | 25 09:30 (2) | 16:13    |              |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 07:52 (3)    | 08:10    | 09:06 (2)    | 08:42    |              |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 45 08:37 (1) | 16:19    | 24 09:30 (2) | 16:14    |              |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   | 07:52 (3)    | 08:12    | 09:06 (2)    | 08:43    |              |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 44 08:36 (1) | 16:18    | 24 09:30 (2) | 16:14    |              |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   | 07:53 (3)    | 08:14    | 09:07 (2)    | 08:43    |              |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 42 08:35 (1) | 16:17    | 23 09:30 (2) | 16:15    |              |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   | 07:53 (3)    | 08:15    | 09:07 (2)    | 08:43    |              |
|                           | 21:30 | 20:26  | 19:12     | 17:04   | 41 08:34 (1) | 16:16    | 23 09:30 (2) | 16:16    |              |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   | 07:54 (3)    | 08:17    | 09:08 (2)    | 08:43    | 09:30 (2)    |
|                           | 21:28 | 20:24  | 19:09     | 17:01   | 38 08:33 (1) | 16:15    | 23 09:31 (2) | 16:17    | 5 09:35 (2)  |
| 31                        | 05:41 | 06:34  |           | 07:23   | 07:55 (3)    |          |              | 08:43    | 09:30 (2)    |
|                           | 21:26 | 20:22  |           | 16:59   | 32 08:31 (1) |          |              | 16:18    | 7 09:37 (2)  |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 693          | 261      | 444          | 236      | 202          |
| 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 | (WEA mit erstem Schatten) | Zeitpunkt (SS:MM) Schattenende | (WEA mit letztem Schatten) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** F - Lehmden Str. 125, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar | Februar   | März  | April     | Mai   | Juni  |
|---------------------------|--------|-----------|-------|-----------|-------|-------|
| 1                         | 08:43  | 09:47 (2) | 08:14 | 08:47 (3) | 07:17 | 07:04 |
| 2                         | 16:19  | 10:12 (2) | 17:10 | 09:39 (1) | 18:04 | 20:01 |
| 3                         | 08:43  | 09:48 (2) | 08:12 | 08:45 (3) | 07:15 | 07:01 |
| 4                         | 16:21  | 10:13 (2) | 17:12 | 09:40 (1) | 18:06 | 20:03 |
| 5                         | 08:43  | 09:49 (2) | 08:10 | 08:44 (3) | 07:13 | 06:59 |
| 6                         | 16:22  | 10:14 (2) | 17:14 | 09:40 (1) | 18:08 | 20:05 |
| 7                         | 08:42  | 09:49 (2) | 08:09 | 08:44 (3) | 07:11 | 06:56 |
| 8                         | 16:23  | 10:13 (2) | 17:15 | 09:42 (1) | 18:10 | 20:07 |
| 9                         | 08:42  | 09:50 (2) | 08:07 | 08:44 (3) | 07:08 | 06:54 |
| 10                        | 16:24  | 10:14 (2) | 17:17 | 09:42 (1) | 18:12 | 20:09 |
| 11                        | 08:42  | 09:50 (2) | 08:05 | 08:43 (3) | 07:06 | 06:52 |
| 12                        | 16:25  | 10:14 (2) | 17:19 | 09:42 (1) | 18:14 | 20:10 |
| 13                        | 08:41  | 09:50 (2) | 08:03 | 08:43 (3) | 07:04 | 06:49 |
| 14                        | 16:27  | 10:14 (2) | 17:21 | 09:42 (1) | 18:16 | 20:12 |
| 15                        | 08:41  | 09:51 (2) | 08:01 | 08:43 (3) | 07:01 | 06:47 |
| 16                        | 16:28  | 10:15 (2) | 17:23 | 09:42 (1) | 18:17 | 20:14 |
| 17                        | 08:40  | 09:51 (2) | 08:00 | 08:44 (3) | 06:59 | 06:45 |
| 18                        | 16:30  | 10:15 (2) | 17:25 | 09:42 (1) | 18:19 | 20:16 |
| 19                        | 08:40  | 09:52 (2) | 07:58 | 08:44 (3) | 06:57 | 06:42 |
| 20                        | 16:31  | 10:15 (2) | 17:27 | 09:42 (1) | 18:21 | 20:18 |
| 21                        | 08:39  | 09:52 (2) | 07:56 | 08:44 (3) | 06:54 | 06:40 |
| 22                        | 16:32  | 10:15 (2) | 17:29 | 09:42 (1) | 18:23 | 20:19 |
| 23                        | 08:38  | 09:53 (2) | 07:54 | 08:45 (3) | 06:52 | 06:38 |
| 24                        | 16:34  | 10:15 (2) | 17:31 | 09:42 (1) | 18:25 | 20:21 |
| 25                        | 08:37  | 09:54 (2) | 07:52 | 08:45 (3) | 06:49 | 06:35 |
| 26                        | 16:36  | 10:15 (2) | 17:33 | 09:40 (1) | 18:27 | 20:23 |
| 27                        | 08:37  | 09:55 (2) | 07:50 | 08:47 (3) | 06:47 | 06:33 |
| 28                        | 16:37  | 10:15 (2) | 17:35 | 09:39 (1) | 18:29 | 20:25 |
| 29                        | 08:36  | 09:56 (2) | 07:48 | 08:50 (3) | 06:45 | 06:31 |
| 30                        | 16:39  | 10:15 (2) | 17:37 | 09:38 (1) | 18:30 | 20:27 |
| 31                        | 08:35  | 09:57 (2) | 07:46 | 09:15 (1) | 06:42 | 06:28 |
| 32                        | 16:40  | 10:14 (2) | 17:39 | 09:37 (1) | 18:32 | 20:28 |
| 33                        | 08:34  | 09:59 (2) | 07:44 | 09:17 (1) | 06:40 | 06:26 |
| 34                        | 16:42  | 10:14 (2) | 17:41 | 09:35 (1) | 18:34 | 20:30 |
| 35                        | 08:33  | 10:00 (2) | 07:42 | 09:19 (1) | 06:37 | 06:24 |
| 36                        | 16:44  | 10:13 (2) | 17:43 | 09:33 (1) | 18:36 | 20:32 |
| 37                        | 08:32  | 10:03 (2) | 07:39 | 09:24 (1) | 06:35 | 06:22 |
| 38                        | 16:46  | 10:12 (2) | 17:45 | 09:28 (1) | 18:38 | 20:34 |
| 39                        | 08:31  |           | 07:37 |           | 06:33 | 06:19 |
| 40                        | 16:47  |           | 17:47 |           | 18:40 | 20:36 |
| 41                        | 08:29  |           | 07:35 |           | 06:30 | 06:17 |
| 42                        | 16:49  |           | 17:49 |           | 18:41 | 20:37 |
| 43                        | 08:28  |           | 07:33 |           | 06:28 | 06:15 |
| 44                        | 16:51  |           | 17:51 |           | 18:43 | 20:39 |
| 45                        | 08:27  |           | 07:31 |           | 06:25 | 06:13 |
| 46                        | 16:53  |           | 17:53 |           | 18:45 | 20:41 |
| 47                        | 08:26  |           | 07:29 |           | 06:23 | 06:10 |
| 48                        | 16:54  |           | 17:55 |           | 18:47 | 20:43 |
| 49                        | 08:24  | 09:22 (1) | 07:26 |           | 06:21 | 06:08 |
| 50                        | 16:56  | 09:26 (1) | 17:57 |           | 18:49 | 20:45 |
| 51                        | 08:23  | 09:18 (1) | 07:24 |           | 06:18 | 06:06 |
| 52                        | 16:58  | 09:30 (1) | 17:58 |           | 18:50 | 20:46 |
| 53                        | 08:21  | 09:16 (1) | 07:22 |           | 06:16 | 06:04 |
| 54                        | 17:00  | 09:33 (1) | 18:00 |           | 18:52 | 20:48 |
| 55                        | 08:20  | 09:15 (1) | 07:20 |           | 06:13 | 06:02 |
| 56                        | 17:02  | 09:34 (1) | 18:02 |           | 18:54 | 20:50 |
| 57                        | 08:18  | 09:13 (1) |       |           | 07:11 | 06:00 |
| 58                        | 17:04  | 09:36 (1) |       |           | 19:56 | 20:52 |
| 59                        | 08:17  | 09:13 (1) |       |           | 07:08 | 05:58 |
| 60                        | 17:06  | 09:38 (1) |       |           | 19:58 | 20:54 |
| 61                        | 08:15  | 08:49 (3) |       |           | 07:06 | 05:08 |
| 62                        | 17:08  | 09:38 (1) |       |           | 20:00 | 21:43 |
| Sonnenscheinstunden       | 252    |           | 274   |           | 367   | 419   |
| astr.max.mögl.Beschattung | 534    |           | 768   |           |       | 507   |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** F - Lehmden Str. 125, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul   | August | September | Oktober |     | November  |           | Dezember  |           |
|---------------------------|-------|--------|-----------|---------|-----|-----------|-----------|-----------|-----------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |     | 07:25     | 08:13 (3) | 08:18     | 09:35 (2) |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |     | 16:58     | 09:12 (1) | 16:14     | 09:57 (2) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |     | 07:26     | 08:13 (3) | 08:20     | 09:35 (2) |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |     | 16:56     | 09:12 (1) | 16:14     | 09:58 (2) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |     | 07:28     | 08:13 (3) | 08:21     | 09:36 (2) |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |     | 16:54     | 09:12 (1) | 16:13     | 09:59 (2) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |     | 07:30     | 08:13 (3) | 08:23     | 09:35 (2) |
|                           | 21:58 | 21:19  | 20:12     | 19:00   |     | 16:52     | 09:12 (1) | 16:12     | 09:59 (2) |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   |     | 07:32     | 08:13 (3) | 08:24     | 09:36 (2) |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |     | 16:50     | 09:12 (1) | 16:12     | 10:00 (2) |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |     | 07:34     | 08:14 (3) | 08:26     | 09:36 (2) |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |     | 16:48     | 09:12 (1) | 16:11     | 10:00 (2) |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |     | 07:36     | 08:14 (3) | 08:27     | 09:36 (2) |
|                           | 21:56 | 21:14  | 20:05     | 18:52   |     | 16:46     | 09:11 (1) | 16:11     | 10:00 (2) |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |     | 07:38     | 08:15 (3) | 08:28     | 09:37 (2) |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |     | 16:44     | 09:11 (1) | 16:10     | 10:02 (2) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |     | 07:40     | 08:16 (3) | 08:29     | 09:37 (2) |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |     | 16:43     | 09:10 (1) | 16:10     | 10:02 (2) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |     | 07:42     | 08:18 (3) | 08:31     | 09:37 (2) |
|                           | 21:54 | 21:08  | 19:58     | 18:45   |     | 16:41     | 09:10 (1) | 16:10     | 10:02 (2) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |     | 07:44     | 08:20 (3) | 08:32     | 09:37 (2) |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |     | 16:39     | 09:09 (1) | 16:10     | 10:02 (2) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |     | 07:45     | 08:44 (1) | 08:33     | 09:39 (2) |
|                           | 21:52 | 21:04  | 19:53     | 18:41   |     | 16:38     | 09:08 (1) | 16:09     | 10:03 (2) |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |     | 07:47     | 08:45 (1) | 08:34     | 09:39 (2) |
|                           | 21:51 | 21:02  | 19:51     | 18:38   |     | 16:36     | 09:07 (1) | 16:09     | 10:04 (2) |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   |     | 07:49     | 08:47 (1) | 08:35     | 09:39 (2) |
|                           | 21:50 | 20:59  | 19:48     | 18:36   |     | 16:34     | 09:06 (1) | 16:09     | 10:04 (2) |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |     | 07:51     | 08:48 (1) | 08:36     | 09:40 (2) |
|                           | 21:49 | 20:57  | 19:46     | 18:34   |     | 16:33     | 09:05 (1) | 16:09     | 10:05 (2) |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   |     | 07:53     | 08:51 (1) | 08:37     | 09:40 (2) |
|                           | 21:48 | 20:55  | 19:43     | 18:32   |     | 16:31     | 09:03 (1) | 16:09     | 10:04 (2) |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |     | 07:55     | 08:55 (1) | 08:37     | 09:40 (2) |
|                           | 21:47 | 20:53  | 19:41     | 18:29   |     | 16:30     | 08:59 (1) | 16:10     | 10:05 (2) |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |     | 07:56     |           | 08:38     | 09:41 (2) |
|                           | 21:45 | 20:51  | 19:38     | 18:27   |     | 16:29     |           | 16:10     | 10:06 (2) |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |     | 07:58     |           | 08:39     | 09:42 (2) |
|                           | 21:44 | 20:49  | 19:36     | 18:25   |     | 16:27     |           | 16:10     | 10:06 (2) |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |     | 08:00     |           | 08:40     | 09:42 (2) |
|                           | 21:43 | 20:47  | 19:34     | 18:23   |     | 16:26     |           | 16:10     | 10:06 (2) |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |     | 08:02     |           | 08:40     | 09:43 (2) |
|                           | 21:42 | 20:44  | 19:31     | 18:20   |     | 16:25     |           | 16:11     | 10:07 (2) |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |     | 08:04     |           | 08:41     | 09:43 (2) |
|                           | 21:40 | 20:42  | 19:29     | 18:18   |     | 16:23     |           | 16:11     | 10:07 (2) |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   |     | 08:05     | 09:39 (2) | 08:41     | 09:44 (2) |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 9   | 10:00 (1) | 16:22     | 9         | 09:48 (2) |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   |     | 09:48 (1) | 08:07     | 09:37 (2) | 08:42     |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 15  | 10:03 (1) | 16:21     | 13        | 09:50 (2) |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   |     | 08:45 (1) | 08:09     | 09:37 (2) | 08:42     |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 20  | 09:05 (1) | 16:20     | 15        | 09:52 (2) |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   |     | 08:44 (1) | 08:10     | 09:36 (2) | 08:42     |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 23  | 09:07 (1) | 16:19     | 17        | 09:53 (2) |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |     | 08:18 (3) | 08:12     | 09:35 (2) | 08:43     |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 34  | 09:08 (1) | 16:18     | 19        | 09:54 (2) |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |     | 08:16 (3) | 08:14     | 09:35 (2) | 08:43     |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 41  | 09:09 (1) | 16:17     | 20        | 09:55 (2) |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |     | 08:15 (3) | 08:15     | 09:35 (2) | 08:43     |
|                           | 21:30 | 20:26  | 19:12     | 17:04   | 45  | 09:10 (1) | 16:16     | 21        | 09:56 (2) |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |     | 08:14 (3) | 08:17     | 09:35 (2) | 08:43     |
|                           | 21:28 | 20:24  | 19:09     | 17:01   | 48  | 09:10 (1) | 16:15     | 22        | 09:57 (2) |
| 31                        | 05:41 | 06:34  |           | 07:23   |     | 08:13 (3) |           | 08:43     | 09:47 (2) |
|                           | 21:26 | 20:22  |           | 16:59   | 51  | 09:11 (1) |           | 16:18     | 10:12 (2) |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 286 | 261       | 236       | 756       |           |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** G - Lehmden Str. 143, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|    | Januar | Februar   | März      | April     | Mai   | Juni      | Juli  | August | September | Oktober | November | Dezember |           |           |           |       |           |           |
|----|--------|-----------|-----------|-----------|-------|-----------|-------|--------|-----------|---------|----------|----------|-----------|-----------|-----------|-------|-----------|-----------|
| 1  | 08:43  | 09:48 (1) | 08:14     | 09:09 (3) | 07:17 | 07:04     | 05:56 | 05:08  | 05:04     | 05:43   | 06:36    | 07:28    | 08:18     | 09:28 (1) |           |       |           |           |
| 2  | 16:19  | 21        | 10:33 (2) | 17:10     | 43    | 10:17 (1) | 18:04 | 20:01  | 20:55     | 21:44   | 21:59    | 21:25    | 20:19     | 19:07     | 16:58     | 16:14 | 27        | 09:55 (1) |
| 3  | 08:43  | 09:48 (1) | 08:12     | 09:10 (3) | 07:15 | 07:01     | 05:54 | 05:07  | 05:05     | 05:44   | 06:37    | 07:29    | 08:20     | 09:29 (1) |           |       |           |           |
| 4  | 16:21  | 19        | 10:32 (2) | 17:12     | 38    | 10:16 (1) | 18:06 | 20:03  | 20:57     | 21:45   | 21:58    | 21:23    | 20:17     | 19:04     | 16:56     | 16:14 | 26        | 09:55 (1) |
| 5  | 08:43  | 09:48 (1) | 08:10     | 09:11 (3) | 07:13 | 06:59     | 05:52 | 05:06  | 05:05     | 05:46   | 06:39    | 07:31    | 08:22     | 09:30 (1) |           |       |           |           |
| 6  | 16:22  | 18        | 10:36 (1) | 17:14     | 33    | 10:14 (1) | 18:08 | 20:05  | 20:59     | 21:46   | 21:58    | 21:21    | 20:15     | 19:02     | 16:54     | 16:13 | 26        | 09:56 (1) |
| 7  | 08:42  | 09:47 (1) | 08:09     | 09:13 (3) | 07:11 | 06:55     | 05:50 | 05:05  | 05:06     | 05:48   | 06:41    | 07:33    | 08:24     | 09:31 (1) |           |       |           |           |
| 8  | 16:23  | 19        | 10:36 (1) | 17:15     | 26    | 10:13 (1) | 18:10 | 20:07  | 21:01     | 21:48   | 21:58    | 21:19    | 20:12     | 19:00     | 16:52     | 16:12 | 24        | 09:55 (1) |
| 9  | 08:42  | 09:47 (1) | 08:07     | 09:16 (3) | 07:08 | 06:54     | 05:48 | 05:04  | 05:07     | 05:49   | 06:43    | 07:35    | 08:26     | 09:32 (1) |           |       |           |           |
| 10 | 16:24  | 21        | 10:38 (1) | 17:17     | 13    | 10:09 (1) | 18:12 | 20:09  | 21:02     | 21:49   | 21:57    | 21:17    | 20:10     | 18:57     | 16:50     | 16:12 | 23        | 09:55 (1) |
| 11 | 08:42  | 09:47 (1) | 08:05     | 07:05     | 06:52 | 05:46     | 05:03 | 05:08  | 05:51     | 06:44   | 07:36    | 08:27    | 09:34 (3) | 08:26     | 08:45     | 08:26 | 09:33 (1) |           |
| 12 | 16:25  | 21        | 10:38 (1) | 17:19     | 18:14 | 20:10     | 21:04 | 21:50  | 21:56     | 21:15   | 20:07    | 18:55    | 16:48     | 16        | 09:40 (1) | 16:11 | 22        | 09:55 (1) |
| 13 | 08:41  | 09:46 (1) | 08:03     | 07:04     | 06:49 | 05:44     | 05:03 | 05:09  | 05:53     | 06:46   | 07:38    | 08:29    | 09:36 (1) | 08:43     | 08:43     | 08:27 | 09:33 (1) |           |
| 14 | 16:27  | 23        | 10:39 (1) | 17:21     | 18:16 | 20:12     | 21:06 | 21:51  | 21:56     | 21:14   | 20:05    | 18:52    | 16:46     | 26        | 09:43 (1) | 16:11 | 21        | 09:54 (1) |
| 15 | 08:41  | 09:47 (1) | 08:01     | 07:01     | 06:47 | 05:42     | 05:02 | 05:10  | 05:54     | 06:48   | 07:40    | 08:31    | 09:38 (1) | 08:42     | 08:42     | 08:28 | 09:35 (1) |           |
| 16 | 16:28  | 24        | 10:41 (1) | 17:23     | 18:17 | 20:14     | 21:08 | 21:52  | 21:55     | 21:12   | 20:03    | 18:50    | 16:44     | 33        | 09:45 (1) | 16:10 | 19        | 09:54 (1) |
| 17 | 08:40  | 09:46 (1) | 08:00     | 06:59     | 06:45 | 05:40     | 05:02 | 05:11  | 05:56     | 06:49   | 07:42    | 08:33    | 09:40 (1) | 08:41     | 08:41     | 08:29 | 09:36 (1) |           |
| 18 | 16:29  | 25        | 10:41 (1) | 17:25     | 18:19 | 20:16     | 21:09 | 21:52  | 21:54     | 21:10   | 20:00    | 18:48    | 16:43     | 39        | 09:47 (1) | 16:10 | 18        | 09:54 (1) |
| 19 | 08:40  | 09:46 (1) | 07:58     | 06:57     | 06:42 | 05:38     | 05:01 | 05:12  | 05:58     | 06:51   | 07:44    | 08:35    | 09:42 (1) | 08:40     | 08:40     | 08:31 | 09:37 (1) |           |
| 20 | 16:31  | 26        | 10:42 (1) | 17:27     | 18:21 | 20:18     | 21:11 | 21:53  | 21:54     | 21:08   | 19:58    | 18:45    | 16:41     | 43        | 09:48 (1) | 16:10 | 17        | 10:20 (2) |
| 21 | 08:39  | 09:46 (1) | 07:56     | 06:54     | 06:40 | 05:37     | 05:01 | 05:13  | 05:59     | 06:53   | 07:45    | 08:36    | 09:43 (1) | 08:39     | 08:39     | 08:32 | 09:38 (1) |           |
| 22 | 16:32  | 27        | 10:43 (1) | 17:29     | 18:23 | 20:19     | 21:13 | 21:54  | 21:53     | 21:06   | 19:55    | 18:43    | 16:39     | 46        | 09:49 (1) | 16:10 | 21        | 10:23 (2) |
| 23 | 08:38  | 09:46 (1) | 07:54     | 06:52     | 06:38 | 05:35     | 05:00 | 05:14  | 06:01     | 06:55   | 07:47    | 08:38    | 09:45 (1) | 08:39     | 08:39     | 08:33 | 09:40 (1) |           |
| 24 | 16:34  | 28        | 10:44 (1) | 17:31     | 18:25 | 20:21     | 21:15 | 21:55  | 21:52     | 21:04   | 19:53    | 18:41    | 16:38     | 48        | 09:50 (1) | 16:09 | 22        | 10:25 (2) |
| 25 | 08:37  | 09:46 (1) | 07:52     | 06:49     | 06:35 | 05:33     | 05:00 | 05:15  | 06:03     | 06:56   | 07:49    | 08:40    | 09:47 (1) | 08:39     | 08:39     | 08:34 | 09:41 (1) |           |
| 26 | 16:36  | 28        | 10:44 (1) | 17:33     | 18:27 | 20:23     | 21:16 | 21:55  | 21:51     | 21:02   | 19:51    | 18:39    | 16:36     | 50        | 09:51 (1) | 16:09 | 22        | 10:27 (2) |
| 27 | 08:37  | 09:46 (1) | 07:50     | 06:47     | 06:33 | 05:31     | 05:00 | 05:16  | 06:04     | 06:58   | 07:51    | 08:42    | 09:49 (1) | 08:39     | 08:39     | 08:35 | 09:42 (1) |           |
| 28 | 16:37  | 29        | 10:45 (1) | 17:35     | 18:29 | 20:25     | 21:18 | 21:56  | 21:50     | 20:59   | 19:48    | 18:36    | 16:34     | 51        | 09:52 (1) | 16:09 | 23        | 10:28 (2) |
| 29 | 08:36  | 09:46 (1) | 07:46     | 06:45     | 06:31 | 05:30     | 05:00 | 05:18  | 06:06     | 06:50   | 07:53    | 08:44    | 09:51 (1) | 08:39     | 08:39     | 08:36 | 09:43 (1) |           |
| 30 | 16:39  | 30        | 10:46 (1) | 17:37     | 18:30 | 20:27     | 21:20 | 21:57  | 21:49     | 20:57   | 19:46    | 18:34    | 16:32     | 52        | 09:52 (1) | 16:09 | 22        | 10:29 (2) |
| 31 | 08:35  | 09:46 (1) | 07:46     | 06:42     | 06:28 | 05:28     | 05:00 | 05:19  | 06:08     | 06:52   | 07:55    | 08:46    | 09:53 (1) | 08:39     | 08:39     | 08:37 | 09:43 (1) |           |
| 32 | 16:40  | 31        | 10:47 (1) | 17:39     | 18:32 | 20:28     | 21:21 | 21:57  | 21:48     | 20:55   | 19:43    | 18:32    | 16:31     | 54        | 09:53 (1) | 16:09 | 22        | 10:29 (2) |
| 33 | 08:34  | 09:42 (3) | 07:44     | 06:40     | 06:26 | 05:27     | 05:00 | 05:20  | 06:10     | 07:03   | 07:56    | 08:47    | 09:54 (1) | 08:40     | 08:40     | 08:37 | 09:45 (1) |           |
| 34 | 16:42  | 37        | 10:47 (1) | 17:41     | 18:34 | 20:30     | 21:23 | 21:58  | 21:47     | 20:53   | 19:41    | 18:29    | 16:30     | 53        | 09:53 (1) | 16:10 | 20        | 10:29 (2) |
| 35 | 08:33  | 09:40 (3) | 07:42     | 06:37     | 06:24 | 05:25     | 05:00 | 05:22  | 06:11     | 07:05   | 07:58    | 08:49    | 09:56 (1) | 08:40     | 08:40     | 08:38 | 09:46 (1) |           |
| 36 | 16:44  | 41        | 10:48 (1) | 17:43     | 18:36 | 20:32     | 21:24 | 21:58  | 21:45     | 20:51   | 19:38    | 18:27    | 16:29     | 53        | 09:54 (1) | 16:10 | 19        | 10:30 (2) |
| 37 | 08:32  | 09:39 (3) | 07:39     | 06:35     | 06:22 | 05:23     | 05:00 | 05:23  | 06:13     | 07:07   | 07:59    | 08:50    | 09:57 (1) | 08:41     | 08:41     | 08:39 | 09:47 (1) |           |
| 38 | 16:46  | 45        | 10:49 (1) | 17:45     | 18:38 | 20:34     | 21:26 | 21:59  | 21:44     | 20:49   | 19:36    | 18:25    | 16:27     | 52        | 09:54 (1) | 16:10 | 19        | 10:31 (2) |
| 39 | 08:31  | 09:38 (3) | 07:37     | 06:33     | 06:19 | 05:22     | 05:00 | 05:24  | 06:15     | 07:08   | 08:02    | 08:53    | 09:60 (1) | 08:42     | 08:42     | 08:40 | 09:48 (1) |           |
| 40 | 16:47  | 48        | 10:49 (1) | 17:47     | 18:40 | 20:36     | 21:28 | 21:59  | 21:43     | 20:47   | 19:33    | 18:23    | 16:26     | 50        | 09:54 (1) | 16:10 | 17        | 10:31 (2) |
| 41 | 08:29  | 09:36 (3) | 07:35     | 06:30     | 06:17 | 05:21     | 05:00 | 05:26  | 06:17     | 07:10   | 08:04    | 08:55    | 09:62 (1) | 08:43     | 08:43     | 08:40 | 09:49 (1) |           |
| 42 | 16:49  | 50        | 10:50 (1) | 17:49     | 18:41 | 20:37     | 21:29 | 21:59  | 21:42     | 20:44   | 19:31    | 18:20    | 16:25     | 50        | 09:55 (1) | 16:11 | 17        | 10:32 (2) |
| 43 | 08:28  | 09:37 (3) | 07:33     | 06:28     | 06:15 | 05:19     | 05:00 | 05:27  | 06:18     | 07:12   | 08:06    | 08:57    | 09:64 (1) | 08:44     | 08:44     | 08:41 | 09:49 (1) |           |
| 44 | 16:51  | 50        | 10:49 (1) | 17:51     | 18:43 | 20:39     | 21:31 | 21:59  | 21:40     | 20:42   | 19:29    | 18:18    | 16:23     | 48        | 09:55 (1) | 16:11 | 16        | 10:32 (2) |
| 45 | 08:27  | 09:37 (3) | 07:31     | 06:25     | 06:13 | 05:18     | 05:00 | 05:29  | 06:20     | 07:14   | 08:08    | 08:59    | 09:66 (1) | 08:45     | 08:45     | 08:41 | 09:50 (1) |           |
| 46 | 16:53  | 52        | 10:50 (1) | 17:53     | 18:45 | 20:41     | 21:32 | 22:00  | 21:39     | 20:40   | 19:26    | 18:16    | 16:22     | 45        | 09:55 (1) | 16:12 | 17        | 10:33 (2) |
| 47 | 08:26  | 09:36 (3) | 07:29     | 06:23     | 06:10 | 05:16     | 05:00 | 05:30  | 06:22     | 07:15   | 08:09    | 08:57    | 09:63 (1) | 08:47     | 08:47     | 08:42 | 09:50 (1) |           |
| 48 | 16:54  | 53        | 10:50 (1) | 17:55     | 18:47 | 20:43     | 21:34 | 22:00  | 21:37     | 20:38   | 19:24    | 18:14    | 16:21     | 42        | 09:55 (1) | 16:12 | 18        | 10:33 (2) |
| 49 | 08:24  | 09:37 (3) | 07:26     | 06:21     | 06:08 | 05:15     | 05:01 | 05:32  | 06:23     | 07:17   | 08:11    | 09:04    | 09:70 (1) | 08:49     | 08:49     | 08:42 | 09:49 (1) |           |
| 50 | 16:56  | 53        | 10:50 (1) | 17:57     | 18:49 | 20:45     | 21:35 | 22:00  | 21:36     | 20:35   | 19:21    | 18:12    | 16:20     | 39        | 09:56 (1) | 16:13 | 19        | 10:33 (2) |
| 51 | 08:23  | 09:36 (3) | 07:24     | 06:18     | 06:06 | 05:14     | 05:01 | 05:33  | 06:25     | 07:19   | 08:13    | 09:06    | 09:72 (1) | 08:10     | 08:10     | 08:42 | 09:50 (1) |           |
| 52 | 16:58  | 54        | 10:50 (1) | 17:58     | 18:50 | 20:46     | 21:36 | 22:00  | 21:34     | 20:33   | 19:19    | 18:10    | 16:19     | 31        | 09:56 (1) | 16:14 | 19        | 10:34 (2) |
| 53 | 08:21  | 09:37 (3) | 07:22     | 06:16     | 06:04 | 05:13     | 05:01 | 05:35  | 06:27     | 07:21   | 08:15    | 09:08    | 09:74 (1) | 08:12     | 08:12     | 08:43 | 09:49 (1) |           |
| 54 | 17:00  | 52        | 10:50 (1) | 18:00     | 18:52 | 20:48     | 21:38 | 22:00  | 21:33     | 20:31   | 19:16    | 18:06    | 16:16     | 30        | 09:55 (1) | 16:14 | 21        | 10:34 (2) |
| 55 | 08:20  | 09:37 (3) | 07:20     | 06:13     | 06:02 | 05:12     | 05:02 | 05:36  | 06:29     | 07:23   | 08:17    | 09:10    | 09:76 (1) | 08:14     | 08:14     | 08:43 | 09:49 (1) |           |
| 56 | 17:02  | 51        | 10:50 (1) | 18:02     | 18:54 | 20:50     | 21:39 | 21:59  | 21:31     | 20:29   | 19:14    | 18:06    | 16:17     | 29        | 09:55 (1) | 16:15 | 23        | 10:35 (2) |
| 57 | 08:18  | 09:37 (3) | 07:19     | 06:11     | 06:00 | 05:11     | 05:03 | 05:38  | 06:30     | 07:24   | 08:19    | 09:15    | 09:81 (1) | 08:15     | 08:15     | 08:43 | 09:49 (1) |           |
| 58 | 17:04  | 50        | 10:49 (1) | 18:01     | 18:56 | 20:52     | 21:40 | 21:59  | 21:30     | 20:26   | 19:12    | 18:03    | 16:16     | 28        | 09:55 (1) | 16:16 | 23        | 10:35 (2) |
| 59 | 08:17  | 09:38 (3) | 07:19     | 06:10     | 05:58 | 05:09     | 05:03 | 05:39  | 06:32     | 07:26   | 08:21    | 09:17    | 09:83 (1) | 08:17     | 08:17     | 08:43 | 09:49 (1) |           |
| 60 | 17:06  | 48        | 10:49 (1) | 18:01     | 18:58 | 20:54     | 21:42 | 21:59  | 21:29     | 20:24   | 19:09    | 18:01    | 16:15     | 28        | 09:56 (1) | 16:17 | 23        | 10:35 (2) |
| 61 | 08:15  | 09:39 (3) | 07:19     | 06:10     | 05:58 |           |       |        |           |         |          |          |           |           |           |       |           |           |

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** H - Lehmden Str. 145, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar | Februar   | März      | April     | Mai   | Juni      | Juli  | August | September | Oktober | November | Dezember |       |           |           |           |           |           |
|---------------------------|--------|-----------|-----------|-----------|-------|-----------|-------|--------|-----------|---------|----------|----------|-------|-----------|-----------|-----------|-----------|-----------|
| 1                         | 08:43  | 09:53 (1) | 08:14     | 09:21 (3) | 07:17 | 07:04     | 05:56 | 05:07  | 05:04     | 05:43   | 06:36    | 07:28    | 07:25 | 08:18     | 09:01 (3) |           |           |           |
| 2                         | 15:19  | 27        | 10:20 (1) | 17:10     | 10    | 09:31 (3) | 18:04 | 20:01  | 20:55     | 21:44   | 21:59    | 21:25    | 20:19 | 19:07     | 16:58     | 16:14     | 34        | 10:08 (1) |
| 3                         | 08:43  | 09:54 (1) | 08:12     | 09:26 (3) | 07:15 | 07:01     | 05:54 | 05:07  | 05:05     | 05:44   | 06:37    | 07:29    | 07:26 | 08:20     | 09:38 (1) |           |           |           |
| 4                         | 15:21  | 27        | 10:21 (1) | 17:12     | 2     | 09:27 (3) | 18:06 | 20:03  | 20:57     | 21:45   | 21:58    | 21:23    | 20:17 | 19:04     | 16:56     | 16:14     | 31        | 10:09 (1) |
| 5                         | 08:43  | 09:54 (1) | 08:10     | 07:13     | 06:59 | 05:52     | 05:06 | 05:05  | 05:05     | 05:46   | 06:39    | 07:31    | 07:28 | 08:21     | 09:39 (1) |           |           |           |
| 6                         | 15:22  | 28        | 10:22 (1) | 17:14     | 18:08 | 20:05     | 20:59 | 21:46  | 21:58     | 21:21   | 20:15    | 19:02    | 16:54 | 16:13     | 31        | 10:10 (1) |           |           |
| 7                         | 08:42  | 09:54 (1) | 08:09     | 07:11     | 06:56 | 05:50     | 05:05 | 05:05  | 05:05     | 05:46   | 06:41    | 07:33    | 07:30 | 08:23     | 09:39 (1) |           |           |           |
| 8                         | 15:23  | 28        | 10:22 (1) | 17:15     | 18:10 | 20:07     | 21:01 | 21:48  | 21:58     | 21:19   | 20:12    | 19:00    | 16:52 | 16:12     | 30        | 10:09 (1) |           |           |
| 9                         | 08:42  | 09:55 (1) | 08:07     | 07:08     | 06:54 | 05:48     | 05:04 | 05:07  | 05:49     | 06:43   | 07:35    | 07:32    | 08:24 | 09:40 (1) |           |           |           |           |
| 10                        | 15:24  | 28        | 10:23 (1) | 17:17     | 18:12 | 20:09     | 21:02 | 21:49  | 21:57     | 21:17   | 20:10    | 18:57    | 16:50 | 16:12     | 30        | 10:10 (1) |           |           |
| 11                        | 08:42  | 09:54 (1) | 08:05     | 07:06     | 06:52 | 05:46     | 05:03 | 05:08  | 05:51     | 06:44   | 07:36    | 07:34    | 08:26 | 09:41 (1) |           |           |           |           |
| 12                        | 15:25  | 30        | 10:24 (1) | 17:19     | 18:14 | 20:10     | 21:04 | 21:50  | 21:56     | 21:15   | 20:07    | 18:55    | 16:48 | 16:11     | 29        | 10:10 (1) |           |           |
| 13                        | 08:41  | 09:54 (1) | 08:03     | 07:04     | 06:49 | 05:44     | 05:03 | 05:09  | 05:53     | 06:46   | 07:38    | 07:36    | 08:27 | 09:41 (1) |           |           |           |           |
| 14                        | 15:27  | 30        | 10:24 (1) | 17:21     | 18:16 | 20:12     | 21:06 | 21:51  | 21:56     | 21:14   | 20:05    | 18:52    | 16:46 | 16:11     | 28        | 10:09 (1) |           |           |
| 15                        | 08:41  | 09:55 (1) | 08:01     | 07:01     | 06:47 | 05:42     | 05:02 | 05:10  | 05:54     | 06:48   | 07:40    | 07:38    | 08:28 | 09:42 (1) |           |           |           |           |
| 16                        | 15:28  | 30        | 10:25 (1) | 17:23     | 18:17 | 20:14     | 21:08 | 21:52  | 21:55     | 21:12   | 20:03    | 18:50    | 16:44 | 16:10     | 28        | 10:10 (1) |           |           |
| 17                        | 08:40  | 09:55 (1) | 08:00     | 06:59     | 06:45 | 05:40     | 05:02 | 05:11  | 05:56     | 06:49   | 07:42    | 07:40    | 08:29 | 09:42 (1) |           |           |           |           |
| 18                        | 15:29  | 31        | 10:26 (1) | 17:25     | 18:19 | 20:16     | 21:09 | 21:52  | 21:54     | 21:10   | 20:00    | 18:48    | 16:43 | 4         | 08:55 (3) | 08:29     | 09:42 (1) |           |
| 19                        | 08:40  | 09:55 (1) | 07:58     | 06:57     | 06:42 | 05:38     | 05:01 | 05:12  | 05:58     | 06:51   | 07:44    | 07:42    | 08:31 | 09:43 (1) |           |           |           |           |
| 20                        | 15:31  | 31        | 10:26 (1) | 17:27     | 18:21 | 20:18     | 21:11 | 21:53  | 21:54     | 21:08   | 19:58    | 18:45    | 16:41 | 10        | 09:52 (3) | 08:31     | 09:43 (1) |           |
| 21                        | 08:39  | 09:19 (3) | 07:56     | 06:54     | 06:40 | 05:37     | 05:01 | 05:13  | 05:59     | 06:53   | 07:45    | 07:44    | 08:30 | 09:43 (1) |           |           |           |           |
| 22                        | 15:32  | 33        | 10:26 (1) | 17:29     | 18:23 | 20:19     | 21:13 | 21:54  | 21:56     | 21:06   | 19:55    | 18:43    | 16:39 | 24        | 09:53 (1) | 08:32     | 09:43 (1) |           |
| 23                        | 08:38  | 09:16 (3) | 07:54     | 06:52     | 06:38 | 05:35     | 05:00 | 05:14  | 06:01     | 06:55   | 07:47    | 07:45    | 08:33 | 09:45 (1) |           |           |           |           |
| 24                        | 15:34  | 40        | 10:27 (1) | 17:31     | 18:25 | 20:21     | 21:15 | 21:55  | 21:52     | 21:04   | 19:53    | 18:41    | 16:38 | 32        | 09:56 (1) | 08:34     | 09:46 (1) |           |
| 25                        | 08:37  | 09:15 (3) | 07:52     | 06:49     | 06:35 | 05:33     | 05:00 | 05:15  | 06:03     | 06:56   | 07:49    | 07:47    | 08:36 | 09:46 (1) |           |           |           |           |
| 26                        | 15:36  | 42        | 10:27 (1) | 17:33     | 18:27 | 20:23     | 21:16 | 21:56  | 21:51     | 21:02   | 19:51    | 18:38    | 16:36 | 37        | 09:57 (1) | 08:35     | 09:46 (1) |           |
| 27                        | 08:37  | 09:15 (3) | 07:50     | 06:47     | 06:33 | 05:31     | 05:00 | 05:16  | 06:04     | 06:58   | 07:51    | 07:49    | 08:38 | 09:46 (1) |           |           |           |           |
| 28                        | 15:37  | 45        | 10:28 (1) | 17:35     | 18:29 | 20:25     | 21:18 | 21:56  | 21:50     | 20:59   | 19:48    | 18:36    | 16:34 | 41        | 09:59 (1) | 08:36     | 09:47 (1) |           |
| 29                        | 08:36  | 09:14 (3) | 07:48     | 06:45     | 06:31 | 05:30     | 05:00 | 05:18  | 06:06     | 06:59   | 07:53    | 07:51    | 08:40 | 09:47 (1) |           |           |           |           |
| 30                        | 15:39  | 47        | 10:28 (1) | 17:37     | 18:30 | 20:27     | 21:20 | 21:57  | 21:49     | 20:57   | 19:46    | 18:34    | 16:33 | 44        | 10:00 (1) | 08:37     | 09:47 (1) |           |
| 31                        | 08:35  | 09:14 (3) | 07:46     | 06:42     | 06:28 | 05:28     | 04:59 | 05:19  | 06:08     | 07:01   | 07:55    | 07:53    | 08:42 | 09:47 (1) |           |           |           |           |
| 32                        | 15:40  | 48        | 10:29 (1) | 17:39     | 18:32 | 20:28     | 21:21 | 21:57  | 21:48     | 20:55   | 19:43    | 18:32    | 16:31 | 46        | 10:01 (1) | 08:37     | 09:47 (1) |           |
| 33                        | 08:34  | 09:14 (3) | 07:44     | 06:40     | 06:26 | 05:27     | 04:59 | 05:20  | 06:10     | 07:03   | 07:56    | 07:55    | 08:47 | 09:47 (1) |           |           |           |           |
| 34                        | 15:42  | 49        | 10:29 (1) | 17:41     | 18:34 | 20:30     | 21:23 | 21:58  | 21:47     | 20:53   | 19:41    | 18:29    | 16:30 | 49        | 10:02 (1) | 08:37     | 09:47 (1) |           |
| 35                        | 08:33  | 09:14 (3) | 07:42     | 06:37     | 06:24 | 05:25     | 04:59 | 05:22  | 06:11     | 07:05   | 07:58    | 07:56    | 08:48 | 09:48 (1) |           |           |           |           |
| 36                        | 15:44  | 50        | 10:30 (1) | 17:43     | 18:36 | 20:32     | 21:24 | 21:58  | 21:45     | 20:51   | 19:38    | 18:27    | 16:29 | 49        | 10:03 (1) | 08:38     | 09:48 (1) |           |
| 37                        | 08:32  | 09:14 (3) | 07:39     | 06:35     | 06:22 | 05:23     | 04:59 | 05:23  | 06:13     | 07:07   | 07:59    | 07:58    | 08:49 | 09:49 (1) |           |           |           |           |
| 38                        | 15:45  | 51        | 10:30 (1) | 17:45     | 18:38 | 20:34     | 21:26 | 21:59  | 21:44     | 20:49   | 19:36    | 18:25    | 16:27 | 51        | 10:04 (1) | 08:39     | 09:49 (1) |           |
| 39                        | 08:31  | 09:13 (3) | 07:37     | 06:33     | 06:19 | 05:22     | 04:59 | 05:24  | 06:15     | 07:08   | 07:59    | 07:58    | 08:49 | 09:49 (1) |           |           |           |           |
| 40                        | 15:47  | 53        | 10:30 (1) | 17:47     | 18:40 | 20:36     | 21:28 | 21:59  | 21:43     | 20:47   | 19:33    | 18:23    | 16:26 | 52        | 10:05 (1) | 08:40     | 09:49 (1) |           |
| 41                        | 08:29  | 09:14 (3) | 07:35     | 06:30     | 06:17 | 05:21     | 05:00 | 05:26  | 06:17     | 07:10   | 08:04    | 08:02    | 08:49 | 09:50 (1) |           |           |           |           |
| 42                        | 15:49  | 51        | 10:30 (1) | 17:49     | 18:41 | 20:37     | 21:29 | 21:59  | 21:42     | 20:44   | 19:31    | 18:20    | 16:25 | 51        | 10:05 (1) | 08:41     | 09:50 (1) |           |
| 43                        | 08:28  | 09:13 (3) | 07:33     | 06:28     | 06:15 | 05:19     | 05:00 | 05:27  | 06:18     | 07:12   | 08:06    | 08:04    | 08:49 | 09:50 (1) |           |           |           |           |
| 44                        | 15:51  | 52        | 10:30 (1) | 17:51     | 18:43 | 20:39     | 21:31 | 21:59  | 21:40     | 20:42   | 19:29    | 18:18    | 16:23 | 53        | 10:06 (1) | 08:41     | 09:51 (1) |           |
| 45                        | 08:27  | 09:14 (3) | 07:31     | 06:25     | 06:13 | 05:18     | 05:00 | 05:29  | 06:20     | 07:14   | 08:08    | 08:06    | 08:50 | 09:51 (1) |           |           |           |           |
| 46                        | 15:53  | 51        | 10:30 (1) | 17:53     | 18:45 | 20:41     | 21:32 | 22:00  | 21:39     | 20:40   | 19:26    | 18:16    | 16:22 | 51        | 10:06 (1) | 08:42     | 09:51 (1) |           |
| 47                        | 08:26  | 09:14 (3) | 07:29     | 06:23     | 06:10 | 05:16     | 05:00 | 05:30  | 06:22     | 07:15   | 08:09    | 08:07    | 08:51 | 09:51 (1) |           |           |           |           |
| 48                        | 15:54  | 49        | 10:29 (1) | 17:55     | 18:47 | 20:43     | 21:34 | 22:00  | 21:37     | 20:38   | 19:24    | 18:14    | 16:21 | 51        | 10:07 (1) | 08:42     | 09:51 (1) |           |
| 49                        | 08:24  | 09:14 (3) | 07:26     | 06:21     | 06:08 | 05:15     | 05:01 | 05:32  | 06:23     | 07:17   | 08:11    | 08:09    | 08:52 | 09:51 (1) |           |           |           |           |
| 50                        | 15:56  | 49        | 10:29 (1) | 17:57     | 18:49 | 20:45     | 21:35 | 22:00  | 21:36     | 20:35   | 19:21    | 18:12    | 16:20 | 49        | 10:07 (1) | 08:42     | 09:51 (1) |           |
| 51                        | 08:23  | 09:15 (3) | 07:24     | 06:18     | 06:06 | 05:14     | 05:01 | 05:33  | 06:25     | 07:19   | 08:13    | 08:10    | 08:53 | 09:52 (1) |           |           |           |           |
| 52                        | 15:58  | 45        | 10:28 (1) | 17:58     | 18:50 | 20:46     | 21:36 | 22:00  | 21:34     | 20:33   | 19:19    | 18:10    | 16:19 | 48        | 10:08 (1) | 08:43     | 09:53 (1) |           |
| 53                        | 08:21  | 09:16 (3) | 07:22     | 06:16     | 06:04 | 05:13     | 05:01 | 05:35  | 06:27     | 07:21   | 08:15    | 08:12    | 08:54 | 09:53 (1) |           |           |           |           |
| 54                        | 15:00  | 44        | 10:28 (1) | 18:00     | 18:52 | 20:48     | 21:38 | 22:00  | 21:33     | 20:31   | 19:16    | 18:08    | 16:18 | 47        | 10:07 (1) | 08:43     | 09:53 (1) |           |
| 55                        | 08:20  | 09:16 (3) | 07:20     | 06:13     | 06:02 | 05:12     | 05:02 | 05:36  | 06:29     | 07:22   | 08:16    | 08:14    | 08:55 | 09:53 (1) |           |           |           |           |
| 56                        | 15:02  | 41        | 10:27 (1) | 18:02     | 18:54 | 20:50     | 21:39 | 21:59  | 21:31     | 20:29   | 19:14    | 18:06    | 16:17 | 45        | 10:08 (1) | 08:43     | 09:54 (1) |           |
| 57                        | 08:18  | 09:17 (3) |           | 07:11     | 06:00 | 05:11     | 05:03 | 05:38  | 06:30     | 07:24   | 08:19    | 08:15    | 08:56 | 09:54 (1) |           |           |           |           |
| 58                        | 15:04  | 35        | 10:25 (1) |           | 19:56 | 20:52     | 21:40 | 21:59  | 21:30     | 20:26   | 19:12    | 18:03    | 16:16 | 42        | 10:08 (1) | 08:43     | 09:54 (1) |           |
| 59                        | 08:17  | 09:18 (3) |           | 07:08     | 05:58 | 05:09     | 05:03 | 05:39  | 06:32     | 07:26   | 08:21    | 08:17    | 08:58 | 09:54 (1) |           |           |           |           |
| 60                        | 15:06  | 31        | 10:24 (1) |           | 19:58 | 20:54     | 21:42 | 21:59  | 21:28     | 20:24   | 19:09    | 18:01    | 16:15 | 41        | 10:09 (1) | 08:43     | 09:54 (1) |           |
| 61                        | 08:15  | 23        | 10:22 (1) |           | 07:06 | 06:00     | 05:08 | 05:08  | 05:41     | 06:34   |          | 07:23    |       |           |           | 08:43     | 09:54 (1) |           |
| 62                        | 15:08  | 31        |           |           | 20:00 | 21:43     | 21:26 | 20:22  |           |         |          | 16:59    |       |           |           | 16:18     | 26        | 10:20 (1) |
| Sonnenscheinstunden       | 252    |           | 274       |           | 367   | 419       | 491   | 507    | 509       | 458     | 382      | 329      | 261   |           | 236       |           |           |           |
| astr.max.mögl.Beschattung | 1219   |           | 12        |           |       |           |       |        |           |         |          | 917      |       |           | 617       |           |           |           |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** I - Dwoweg 1, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar               | Februar                         | März                    | April                   | Mai                     | Juni                    | Juli                    | August                  | September               | Oktober                 | November                | Dezember             |                                     |
|---------------------------|----------------------|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------------|-------------------------------------|
| 1                         | 08:43<br>16:19<br>50 | 09:31 (3)<br>10:59 (1)<br>17:10 | 08:14<br>17:10<br>18:04 | 07:17<br>18:04<br>20:01 | 05:56<br>20:55<br>21:44 | 05:07<br>21:59<br>21:59 | 05:04<br>21:59<br>21:25 | 05:43<br>21:25<br>20:19 | 06:36<br>20:19<br>19:07 | 07:28<br>19:07<br>16:57 | 07:25<br>16:57<br>16:57 | 08:18<br>16:14<br>46 | 09:17 (3)<br>10:43 (1)<br>09:18 (3) |
| 2                         | 08:43<br>16:20<br>50 | 09:32 (3)<br>11:00 (1)<br>17:12 | 08:12<br>17:12<br>18:06 | 07:15<br>18:06<br>20:03 | 05:54<br>20:57<br>21:45 | 05:07<br>21:58<br>21:23 | 05:05<br>21:58<br>21:23 | 05:44<br>21:23<br>20:17 | 06:37<br>20:17<br>19:04 | 07:29<br>19:04<br>16:56 | 07:26<br>16:56<br>16:56 | 08:20<br>16:14<br>46 | 09:18 (3)<br>10:44 (1)<br>09:18 (3) |
| 3                         | 08:43<br>16:22<br>50 | 09:33 (3)<br>11:01 (1)<br>17:14 | 08:10<br>17:14<br>18:08 | 07:13<br>18:08<br>20:05 | 05:52<br>20:58<br>21:46 | 05:06<br>21:58<br>21:21 | 05:05<br>21:58<br>21:21 | 05:46<br>21:21<br>20:15 | 06:39<br>20:15<br>19:02 | 07:31<br>19:02<br>16:54 | 07:28<br>16:54<br>16:54 | 08:21<br>16:13<br>48 | 09:18 (3)<br>10:45 (1)<br>09:18 (3) |
| 4                         | 08:42<br>16:23<br>50 | 09:32 (3)<br>11:00 (1)<br>17:15 | 08:09<br>17:15<br>18:10 | 07:11<br>18:10<br>20:07 | 05:50<br>21:01<br>21:48 | 05:05<br>21:58<br>21:19 | 05:06<br>21:58<br>21:19 | 05:48<br>21:19<br>20:12 | 06:41<br>20:12<br>19:00 | 07:33<br>19:00<br>16:52 | 07:30<br>16:52<br>16:52 | 08:23<br>16:12<br>49 | 09:19 (3)<br>10:45 (1)<br>09:19 (3) |
| 5                         | 08:42<br>16:24<br>50 | 09:33 (3)<br>11:01 (1)<br>17:17 | 08:07<br>17:17<br>18:12 | 07:08<br>18:12<br>20:09 | 05:48<br>21:02<br>21:49 | 05:04<br>21:57<br>21:17 | 05:07<br>21:57<br>21:17 | 05:49<br>21:17<br>20:10 | 06:43<br>20:10<br>18:57 | 07:35<br>18:57<br>16:50 | 07:32<br>16:50<br>16:50 | 08:24<br>16:12<br>50 | 09:19 (3)<br>10:47 (1)<br>09:19 (3) |
| 6                         | 08:42<br>16:25<br>49 | 09:33 (3)<br>11:01 (1)<br>17:19 | 08:05<br>17:19<br>18:14 | 07:06<br>18:14<br>20:10 | 05:46<br>21:04<br>21:50 | 05:03<br>21:56<br>21:15 | 05:08<br>21:56<br>21:15 | 05:51<br>21:15<br>20:07 | 06:44<br>20:07<br>18:55 | 07:36<br>18:55<br>16:48 | 07:34<br>16:48<br>16:48 | 08:26<br>16:11<br>50 | 09:19 (3)<br>10:47 (1)<br>09:19 (3) |
| 7                         | 08:41<br>16:27<br>50 | 09:33 (3)<br>11:01 (1)<br>17:21 | 08:03<br>17:21<br>18:16 | 07:04<br>18:16<br>20:12 | 05:44<br>21:06<br>21:51 | 05:03<br>21:56<br>21:14 | 05:09<br>21:56<br>21:14 | 05:53<br>21:14<br>20:05 | 06:46<br>20:05<br>18:52 | 07:38<br>18:52<br>16:46 | 07:36<br>16:46<br>16:46 | 08:27<br>16:11<br>50 | 09:19 (3)<br>10:47 (1)<br>09:19 (3) |
| 8                         | 08:41<br>16:28<br>49 | 09:34 (3)<br>11:01 (1)<br>17:23 | 08:01<br>17:23<br>18:17 | 07:01<br>18:17<br>20:14 | 05:42<br>21:08<br>21:52 | 05:02<br>21:55<br>21:12 | 05:10<br>21:55<br>21:12 | 05:54<br>21:12<br>20:03 | 06:48<br>20:03<br>18:50 | 07:40<br>18:50<br>16:44 | 07:38<br>16:44<br>16:44 | 08:28<br>16:10<br>49 | 09:19 (3)<br>10:48 (1)<br>09:19 (3) |
| 9                         | 08:40<br>16:29<br>48 | 09:34 (3)<br>11:01 (1)<br>17:25 | 08:00<br>17:25<br>18:19 | 06:59<br>18:19<br>20:16 | 05:40<br>21:09<br>21:52 | 05:02<br>21:54<br>21:10 | 05:11<br>21:54<br>21:10 | 05:56<br>21:10<br>20:00 | 06:49<br>20:00<br>18:48 | 07:42<br>18:48<br>16:43 | 07:40<br>16:43<br>16:43 | 08:29<br>16:10<br>50 | 09:21 (3)<br>10:49 (1)<br>09:21 (3) |
| 10                        | 08:40<br>16:31<br>47 | 09:35 (3)<br>11:01 (1)<br>17:27 | 07:58<br>17:27<br>18:21 | 06:57<br>18:21<br>20:18 | 05:38<br>21:11<br>21:53 | 05:01<br>21:54<br>21:08 | 05:12<br>21:54<br>21:08 | 05:58<br>21:08<br>19:58 | 06:51<br>19:58<br>18:45 | 07:44<br>18:45<br>16:41 | 07:42<br>16:41<br>16:41 | 08:31<br>16:10<br>50 | 09:21 (3)<br>10:49 (1)<br>09:21 (3) |
| 11                        | 08:39<br>16:32<br>46 | 09:35 (3)<br>11:01 (1)<br>17:29 | 07:56<br>17:29<br>18:23 | 06:54<br>18:23<br>20:19 | 05:37<br>21:13<br>21:54 | 05:01<br>21:53<br>21:06 | 05:13<br>21:53<br>21:06 | 05:59<br>21:06<br>19:55 | 06:53<br>19:55<br>18:43 | 07:45<br>18:43<br>16:39 | 07:44<br>16:39<br>16:39 | 08:32<br>16:10<br>51 | 09:22 (3)<br>10:50 (1)<br>09:22 (3) |
| 12                        | 08:38<br>16:34<br>45 | 09:35 (3)<br>11:00 (1)<br>17:31 | 07:54<br>17:31<br>18:25 | 06:52<br>18:25<br>20:21 | 05:35<br>21:15<br>21:55 | 05:00<br>21:52<br>21:52 | 05:14<br>21:52<br>21:04 | 06:01<br>21:04<br>19:53 | 06:55<br>19:53<br>18:41 | 07:47<br>18:41<br>16:38 | 07:47<br>16:38<br>16:38 | 08:33<br>16:09<br>50 | 09:23 (3)<br>10:51 (1)<br>09:23 (3) |
| 13                        | 08:37<br>16:36<br>43 | 09:36 (3)<br>11:00 (1)<br>17:33 | 07:52<br>17:33<br>18:27 | 06:49<br>18:27<br>20:23 | 05:33<br>21:16<br>21:56 | 05:00<br>21:51<br>21:51 | 05:15<br>21:51<br>21:02 | 06:04<br>21:02<br>19:51 | 06:58<br>19:51<br>18:38 | 07:51<br>18:38<br>16:36 | 07:49<br>16:36<br>16:36 | 08:34<br>16:09<br>49 | 09:24 (3)<br>10:52 (1)<br>09:24 (3) |
| 14                        | 08:37<br>16:37<br>42 | 09:36 (3)<br>11:00 (1)<br>17:35 | 07:50<br>17:35<br>18:29 | 06:47<br>18:29<br>20:25 | 05:31<br>21:18<br>21:56 | 05:00<br>21:50<br>21:50 | 05:16<br>21:50<br>21:00 | 06:04<br>21:00<br>19:48 | 06:58<br>19:48<br>18:36 | 07:53<br>18:36<br>16:34 | 07:51<br>16:34<br>16:34 | 08:35<br>16:09<br>50 | 09:24 (3)<br>10:52 (1)<br>09:24 (3) |
| 15                        | 08:36<br>16:39<br>38 | 09:37 (3)<br>11:01 (1)<br>17:37 | 07:48<br>17:37<br>18:30 | 06:45<br>18:30<br>20:27 | 05:30<br>21:20<br>21:57 | 05:00<br>21:49<br>21:49 | 05:18<br>21:49<br>21:00 | 06:06<br>21:00<br>19:46 | 07:00<br>19:46<br>18:34 | 07:53<br>18:34<br>16:33 | 07:51<br>16:33<br>16:33 | 08:36<br>16:09<br>49 | 09:25 (3)<br>10:52 (1)<br>09:25 (3) |
| 16                        | 08:35<br>16:40<br>34 | 09:38 (3)<br>11:01 (1)<br>17:39 | 07:46<br>17:39<br>18:32 | 06:42<br>18:32<br>20:28 | 05:28<br>21:21<br>21:57 | 04:59<br>21:48<br>21:48 | 05:19<br>21:48<br>21:00 | 06:08<br>21:00<br>19:43 | 07:01<br>19:43<br>18:32 | 07:55<br>18:32<br>16:31 | 07:53<br>16:31<br>16:31 | 08:37<br>16:09<br>50 | 09:25 (3)<br>10:52 (1)<br>09:25 (3) |
| 17                        | 08:34<br>16:42<br>30 | 09:39 (3)<br>11:01 (1)<br>17:41 | 07:44<br>17:41<br>18:34 | 06:40<br>18:34<br>20:30 | 05:27<br>21:23<br>21:58 | 04:59<br>21:47<br>21:47 | 05:20<br>21:47<br>21:00 | 06:10<br>21:00<br>19:41 | 07:03<br>19:41<br>18:29 | 07:56<br>18:29<br>16:30 | 07:55<br>16:30<br>16:30 | 08:37<br>16:10<br>50 | 09:25 (3)<br>10:53 (1)<br>09:25 (3) |
| 18                        | 08:33<br>16:44<br>23 | 09:40 (3)<br>11:01 (1)<br>17:43 | 07:42<br>17:43<br>18:36 | 06:37<br>18:36<br>20:32 | 05:25<br>21:24<br>21:58 | 04:59<br>21:45<br>21:45 | 05:22<br>21:45<br>21:00 | 06:11<br>21:00<br>19:38 | 07:05<br>19:38<br>18:27 | 07:58<br>18:27<br>16:29 | 07:56<br>16:29<br>16:29 | 08:38<br>16:10<br>49 | 09:26 (3)<br>10:54 (1)<br>09:26 (3) |
| 19                        | 08:32<br>16:45<br>16 | 09:41 (3)<br>11:01 (1)<br>17:45 | 07:39<br>17:45<br>18:38 | 06:35<br>18:38<br>20:34 | 05:23<br>21:26<br>21:59 | 04:59<br>21:44<br>21:44 | 05:23<br>21:44<br>21:00 | 06:13<br>21:00<br>19:36 | 07:07<br>19:36<br>18:25 | 07:58<br>18:25<br>16:27 | 07:58<br>16:27<br>16:27 | 08:39<br>16:10<br>49 | 09:27 (3)<br>10:54 (1)<br>09:27 (3) |
| 20                        | 08:31<br>16:47<br>14 | 09:42 (3)<br>11:01 (1)<br>17:47 | 07:37<br>17:47<br>18:40 | 06:33<br>18:40<br>20:36 | 05:22<br>21:28<br>21:59 | 04:59<br>21:43<br>21:43 | 05:24<br>21:43<br>21:00 | 06:15<br>21:00<br>19:33 | 07:08<br>19:33<br>18:23 | 07:58<br>18:23<br>16:26 | 07:58<br>16:26<br>16:26 | 08:40<br>16:10<br>49 | 09:28 (3)<br>10:54 (1)<br>09:28 (3) |
| 21                        | 08:29<br>16:49<br>11 | 09:44 (3)<br>11:01 (1)<br>17:49 | 07:35<br>17:49<br>18:41 | 06:30<br>18:41<br>20:37 | 05:21<br>21:29<br>21:59 | 05:00<br>21:42<br>21:42 | 05:26<br>21:42<br>21:00 | 06:17<br>21:00<br>19:31 | 07:10<br>19:31<br>18:20 | 08:04<br>18:20<br>16:25 | 08:02<br>16:25<br>16:25 | 08:41<br>16:11<br>49 | 09:28 (3)<br>10:55 (1)<br>09:28 (3) |
| 22                        | 08:28<br>16:51<br>7  | 09:45 (3)<br>11:01 (1)<br>17:51 | 07:33<br>17:51<br>18:43 | 06:28<br>18:43<br>20:39 | 05:19<br>21:31<br>21:59 | 05:00<br>21:40<br>21:40 | 05:27<br>21:40<br>21:00 | 06:18<br>21:00<br>19:29 | 07:12<br>19:29<br>18:18 | 08:06<br>18:18<br>16:23 | 08:04<br>16:23<br>16:23 | 08:41<br>16:11<br>49 | 09:28 (3)<br>10:55 (1)<br>09:28 (3) |
| 23                        | 08:27<br>16:53       | 09:46 (3)<br>11:01 (1)<br>17:53 | 07:31<br>17:53<br>18:45 | 06:25<br>18:45<br>20:41 | 05:18<br>21:32<br>22:00 | 05:00<br>21:39<br>21:39 | 05:29<br>21:39<br>21:00 | 06:20<br>21:00<br>19:26 | 07:14<br>19:26<br>18:16 | 08:08<br>18:16<br>16:22 | 08:06<br>16:22<br>16:22 | 08:42<br>16:12<br>49 | 09:29 (3)<br>10:56 (1)<br>09:29 (3) |
| 24                        | 08:26<br>16:54       | 09:47 (3)<br>11:01 (1)<br>17:55 | 07:29<br>17:55<br>18:47 | 06:23<br>18:47<br>20:43 | 05:16<br>21:34<br>22:00 | 05:00<br>21:37<br>21:37 | 05:30<br>21:37<br>21:00 | 06:22<br>21:00<br>19:24 | 07:15<br>19:24<br>18:14 | 08:09<br>18:14<br>16:21 | 08:07<br>16:21<br>16:21 | 08:43<br>16:12<br>49 | 09:29 (3)<br>10:56 (1)<br>09:29 (3) |
| 25                        | 08:24<br>16:56       | 09:48 (3)<br>11:01 (1)<br>17:57 | 07:26<br>17:57<br>18:49 | 06:21<br>18:49<br>20:45 | 05:15<br>21:35<br>22:00 | 05:01<br>21:36<br>21:36 | 05:32<br>21:36<br>21:00 | 06:23<br>21:00<br>19:21 | 07:17<br>19:21<br>17:12 | 08:10<br>17:12<br>16:20 | 08:09<br>16:20<br>16:20 | 08:44<br>16:13<br>48 | 09:30 (3)<br>10:56 (1)<br>09:30 (3) |
| 26                        | 08:23<br>16:58       | 09:49 (3)<br>11:01 (1)<br>17:58 | 07:24<br>17:58<br>18:50 | 06:18<br>18:50<br>20:46 | 05:14<br>21:36<br>22:00 | 05:01<br>21:34<br>21:34 | 05:33<br>21:34<br>21:00 | 06:25<br>21:00<br>19:19 | 07:19<br>19:19<br>17:10 | 08:13<br>17:10<br>16:19 | 08:12<br>16:19<br>16:19 | 08:45<br>16:14<br>49 | 09:30 (3)<br>10:57 (1)<br>09:30 (3) |
| 27                        | 08:21<br>17:00       | 09:50 (3)<br>11:01 (1)<br>17:59 | 07:22<br>17:59<br>18:52 | 06:16<br>18:52<br>20:48 | 05:13<br>21:38<br>22:00 | 05:01<br>21:33<br>21:33 | 05:35<br>21:33<br>21:00 | 06:27<br>21:00<br>19:16 | 07:21<br>19:16<br>17:08 | 08:15<br>17:08<br>16:18 | 08:14<br>16:18<br>16:18 | 08:46<br>16:14<br>50 | 09:31 (3)<br>10:58 (1)<br>09:31 (3) |
| 28                        | 08:20<br>17:02       | 09:51 (3)<br>11:01 (1)<br>18:00 | 07:20<br>18:00<br>18:54 | 06:13<br>18:54<br>20:50 | 05:12<br>21:39<br>22:00 | 05:02<br>21:31<br>21:31 | 05:36<br>21:31<br>21:00 | 06:29<br>21:00<br>19:14 | 07:22<br>19:14<br>17:06 | 08:16<br>17:06<br>16:17 | 08:15<br>16:17<br>16:17 | 08:47<br>16:15<br>48 | 09:31 (3)<br>10:59 (1)<br>09:31 (3) |
| 29                        | 08:18<br>17:04       | 09:52 (3)<br>11:01 (1)<br>18:01 | 07:19<br>18:01<br>18:55 | 06:11<br>18:55<br>20:51 | 05:11<br>21:40<br>22:00 | 05:03<br>21:30<br>21:30 | 05:38<br>21:30<br>21:00 | 06:30<br>21:00<br>19:12 | 07:24<br>19:12<br>17:03 | 08:17<br>17:03<br>16:16 | 08:16<br>16:16<br>16:16 | 08:48<br>16:15<br>50 | 09:32 (3)<br>10:59 (1)<br>09:32 (3) |
| 30                        | 08:17<br>17:06       | 09:53 (3)<br>11:01 (1)<br>18:02 | 07:17<br>18:02<br>18:56 | 06:10<br>18:56<br>20:52 | 05:10<br>21:41<br>22:00 | 05:04<br>21:30<br>21:30 | 05:39<br>21:30<br>21:00 | 06:32<br>21:00<br>19:09 | 07:26<br>19:09<br>17:01 | 08:19<br>17:01<br>16:15 | 08:18<br>16:15<br>16:15 | 08:49<br>16:14<br>50 | 09:33 (3)<br>10:59 (1)<br>09:33 (3) |
| 31                        | 08:15<br>17:08       | 09:54 (3)<br>11:01 (1)<br>18:03 | 07:15<br>18:03<br>18:57 | 06:09<br>18:57<br>20:53 | 05:09<br>21:42<br>22:00 | 05:05<br>21:26<br>21:26 | 05:41<br>21:26<br>21:00 | 06:34<br>21:00<br>19:09 | 07:28<br>19:09<br>17:01 | 08:21<br>17:01<br>16:15 | 08:20<br>16:15<br>16:15 | 08:51<br>16:14<br>50 | 09:34 (3)<br>10:59 (1)<br>09:34 (3) |
| Sonnenscheinstunden       | 252                  | 274                             | 367                     | 419                     | 491                     | 507                     | 509                     | 458                     | 382                     | 329                     | 261                     | 192                  |                                     |
| astr.max.mögl.Beschattung | 842                  |                                 |                         |                         |                         |                         |                         |                         |                         |                         | 301                     | 1525                 |                                     |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** J - Dwoweg 11, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|    | Januar |    | Februar   |       | März    |       | April |       | Mai   |       | Juni  |       | Juli  |  | August |  | September |  | Oktober |  | November |       | Dezember  |           |
|----|--------|----|-----------|-------|---------|-------|-------|-------|-------|-------|-------|-------|-------|--|--------|--|-----------|--|---------|--|----------|-------|-----------|-----------|
| 1  | 08:43  |    | 09:51 (3) | 08:14 | 07:17   | 07:04 | 05:56 | 05:07 | 05:04 | 05:43 | 06:36 | 07:28 | 07:25 |  |        |  |           |  |         |  |          | 08:18 | 09:41 (3) |           |
|    | 16:19  | 46 | 11:30 (1) | 17:10 | 18:04   | 20:01 | 20:55 | 21:44 | 21:59 | 21:25 | 20:19 | 19:07 | 16:57 |  |        |  |           |  |         |  |          | 16:14 | 16        | 09:57 (3) |
| 2  | 08:43  |    | 09:52 (3) | 08:12 | 07:15   | 07:01 | 05:54 | 05:07 | 05:05 | 05:44 | 06:37 | 07:29 | 07:26 |  |        |  |           |  |         |  |          | 08:20 | 09:41 (3) |           |
|    | 16:20  | 45 | 11:31 (1) | 17:12 | 18:06   | 20:03 | 20:57 | 21:45 | 21:59 | 21:23 | 20:17 | 19:04 | 16:56 |  |        |  |           |  |         |  |          | 16:14 | 22        | 11:08 (1) |
| 3  | 08:43  |    | 09:53 (3) | 08:10 | 07:13   | 06:59 | 05:52 | 05:06 | 05:05 | 05:46 | 06:39 | 07:31 | 07:28 |  |        |  |           |  |         |  |          | 08:21 | 09:41 (3) |           |
|    | 16:22  | 44 | 11:31 (1) | 17:14 | 18:08   | 20:05 | 20:59 | 21:46 | 21:59 | 21:21 | 20:15 | 19:02 | 16:54 |  |        |  |           |  |         |  |          | 16:13 | 29        | 11:12 (1) |
| 4  | 08:42  |    | 09:53 (3) | 08:09 | 07:11   | 06:56 | 05:50 | 05:05 | 05:06 | 05:48 | 06:41 | 07:33 | 07:30 |  |        |  |           |  |         |  |          | 08:23 | 09:41 (3) |           |
|    | 16:23  | 42 | 11:30 (1) | 17:15 | 18:10   | 20:07 | 21:01 | 21:48 | 21:57 | 21:19 | 20:12 | 19:00 | 16:52 |  |        |  |           |  |         |  |          | 16:12 | 34        | 11:13 (1) |
| 5  | 08:42  |    | 09:54 (3) | 08:07 | 07:08   | 06:54 | 05:48 | 05:04 | 05:07 | 05:49 | 06:43 | 07:35 | 07:32 |  |        |  |           |  |         |  |          | 08:24 | 09:41 (3) |           |
|    | 16:24  | 41 | 11:31 (1) | 17:17 | 18:12   | 20:09 | 21:02 | 21:49 | 21:57 | 21:17 | 20:10 | 18:57 | 16:50 |  |        |  |           |  |         |  |          | 16:12 | 36        | 11:15 (1) |
| 6  | 08:42  |    | 09:55 (3) | 08:05 | 07:06   | 06:52 | 05:46 | 05:03 | 05:08 | 05:51 | 06:44 | 07:36 | 07:34 |  |        |  |           |  |         |  |          | 08:26 | 09:41 (3) |           |
|    | 16:25  | 38 | 11:30 (1) | 17:19 | 18:14   | 20:10 | 21:04 | 21:50 | 21:56 | 21:15 | 20:07 | 18:55 | 16:48 |  |        |  |           |  |         |  |          | 16:11 | 38        | 11:16 (1) |
| 7  | 08:41  |    | 09:55 (3) | 08:03 | 07:04   | 06:49 | 05:44 | 05:03 | 05:09 | 05:53 | 06:46 | 07:38 | 07:36 |  |        |  |           |  |         |  |          | 08:27 | 09:40 (3) |           |
|    | 16:27  | 36 | 11:29 (1) | 17:21 | 18:16   | 20:12 | 21:06 | 21:51 | 21:56 | 21:14 | 20:05 | 18:52 | 16:46 |  |        |  |           |  |         |  |          | 16:11 | 41        | 11:17 (1) |
| 8  | 08:41  |    | 09:56 (3) | 08:01 | 07:01   | 06:47 | 05:42 | 05:02 | 05:10 | 05:54 | 06:49 | 07:40 | 07:38 |  |        |  |           |  |         |  |          | 08:28 | 09:41 (3) |           |
|    | 16:28  | 33 | 11:29 (1) | 17:23 | 18:17   | 20:14 | 21:08 | 21:52 | 21:55 | 21:12 | 20:03 | 18:50 | 16:44 |  |        |  |           |  |         |  |          | 16:10 | 42        | 11:18 (1) |
| 9  | 08:40  |    | 09:57 (3) | 08:00 | 06:59   | 06:45 | 05:40 | 05:02 | 05:11 | 05:56 | 06:49 | 07:42 | 07:40 |  |        |  |           |  |         |  |          | 08:29 | 09:41 (3) |           |
|    | 16:29  | 29 | 11:28 (1) | 17:25 | 18:19   | 20:16 | 21:09 | 21:52 | 21:54 | 21:10 | 20:00 | 18:48 | 16:43 |  |        |  |           |  |         |  |          | 16:10 | 44        | 11:19 (1) |
| 10 | 08:40  |    | 09:58 (3) | 07:58 | 06:57   | 06:42 | 05:38 | 05:01 | 05:12 | 05:58 | 06:51 | 07:44 | 07:42 |  |        |  |           |  |         |  |          | 08:31 | 09:41 (3) |           |
|    | 16:31  | 23 | 11:25 (1) | 17:27 | 18:21   | 20:18 | 21:11 | 21:53 | 21:54 | 21:08 | 19:58 | 18:45 | 16:41 |  |        |  |           |  |         |  |          | 16:10 | 45        | 11:20 (1) |
| 11 | 08:39  |    | 09:59 (3) | 07:56 | 06:54   | 06:40 | 05:37 | 05:01 | 05:13 | 05:59 | 06:53 | 07:45 | 07:44 |  |        |  |           |  |         |  |          | 08:32 | 09:41 (3) |           |
|    | 16:32  | 16 | 10:15 (3) | 17:29 | 18:23   | 20:19 | 21:13 | 21:54 | 21:53 | 21:06 | 19:55 | 18:43 | 16:39 |  |        |  |           |  |         |  |          | 16:10 | 46        | 11:20 (1) |
| 12 | 08:38  |    | 10:00 (3) | 07:54 | 06:52   | 06:38 | 05:35 | 05:00 | 05:14 | 06:01 | 06:55 | 07:47 | 07:45 |  |        |  |           |  |         |  |          | 08:33 | 09:43 (3) |           |
|    | 16:34  | 14 | 10:14 (3) | 17:31 | 18:25   | 20:21 | 21:15 | 21:55 | 21:52 | 21:04 | 19:53 | 18:41 | 16:38 |  |        |  |           |  |         |  |          | 16:09 | 46        | 11:22 (1) |
| 13 | 08:37  |    | 10:01 (3) | 07:52 | 06:49   | 06:35 | 05:33 | 05:00 | 05:15 | 06:03 | 06:56 | 07:49 | 07:47 |  |        |  |           |  |         |  |          | 08:34 | 09:43 (3) |           |
|    | 16:36  | 12 | 10:13 (3) | 17:33 | 18:27   | 20:23 | 21:16 | 21:56 | 21:51 | 21:02 | 19:51 | 18:38 | 16:36 |  |        |  |           |  |         |  |          | 16:09 | 47        | 11:23 (1) |
| 14 | 08:37  |    | 10:03 (3) | 07:50 | 06:47   | 06:33 | 05:31 | 05:00 | 05:16 | 06:04 | 06:58 | 07:51 | 07:49 |  |        |  |           |  |         |  |          | 08:35 | 09:43 (3) |           |
|    | 16:37  | 9  | 10:12 (3) | 17:35 | 18:29   | 20:25 | 21:18 | 21:56 | 21:50 | 20:59 | 19:48 | 18:36 | 16:34 |  |        |  |           |  |         |  |          | 16:09 | 48        | 11:23 (1) |
| 15 | 08:36  |    | 10:05 (3) | 07:48 | 06:45   | 06:31 | 05:30 | 05:00 | 05:18 | 06:06 | 07:00 | 07:53 | 07:51 |  |        |  |           |  |         |  |          | 08:36 | 09:44 (3) |           |
|    | 16:39  | 6  | 10:11 (3) | 17:37 | 18:30   | 20:27 | 21:20 | 21:57 | 21:49 | 20:57 | 19:46 | 18:34 | 16:33 |  |        |  |           |  |         |  |          | 16:09 | 47        | 11:24 (1) |
| 16 | 08:35  |    | 07:46     | 06:42 | 06:28   | 05:28 | 04:59 | 04:59 | 05:19 | 06:08 | 07:01 | 07:55 | 07:53 |  |        |  |           |  |         |  |          | 08:37 | 09:43 (3) |           |
|    | 16:40  |    | 17:39     | 18:32 | 20:28   | 21:21 | 21:57 | 21:48 | 20:55 | 19:43 | 18:32 | 16:31 |       |  |        |  |           |  |         |  |          | 16:09 | 49        | 11:24 (1) |
| 17 | 08:34  |    | 07:44     | 06:40 | 06:26   | 05:27 | 04:59 | 05:20 | 06:10 | 07:03 | 07:56 | 07:55 | 08:37 |  |        |  |           |  |         |  |          | 08:37 | 09:44 (3) |           |
|    | 16:42  |    | 17:41     | 18:34 | 20:30   | 21:23 | 21:58 | 21:47 | 20:53 | 19:41 | 18:29 | 16:30 |       |  |        |  |           |  |         |  |          | 16:10 | 49        | 11:25 (1) |
| 18 | 08:33  |    | 07:42     | 06:37 | 06:24   | 05:25 | 04:59 | 05:22 | 06:11 | 07:05 | 07:58 | 07:56 |       |  |        |  |           |  |         |  |          | 08:38 | 09:45 (3) |           |
|    | 16:44  |    | 17:43     | 18:36 | 20:32   | 21:24 | 21:58 | 21:45 | 20:51 | 19:38 | 18:27 | 16:29 |       |  |        |  |           |  |         |  |          | 16:10 | 49        | 11:26 (1) |
| 19 | 08:32  |    | 07:39     | 06:35 | 06:22   | 05:23 | 04:59 | 05:23 | 06:13 | 07:07 | 08:00 | 07:58 |       |  |        |  |           |  |         |  |          | 08:39 | 09:46 (3) |           |
|    | 16:45  |    | 17:45     | 18:38 | 20:34   | 21:26 | 21:59 | 21:44 | 20:49 | 19:36 | 18:25 | 16:27 |       |  |        |  |           |  |         |  |          | 16:10 | 48        | 11:26 (1) |
| 20 | 08:31  |    | 07:37     | 06:33 | 06:19   | 05:22 | 04:59 | 05:24 | 06:15 | 07:08 | 08:02 | 08:00 |       |  |        |  |           |  |         |  |          | 08:40 | 09:46 (3) |           |
|    | 16:47  |    | 17:47     | 18:40 | 20:36   | 21:28 | 21:59 | 21:43 | 20:47 | 19:33 | 18:23 | 16:26 |       |  |        |  |           |  |         |  |          | 16:10 | 49        | 11:26 (1) |
| 21 | 08:29  |    | 07:35     | 06:30 | 06:17   | 05:21 | 05:00 | 05:26 | 06:17 | 07:10 | 08:04 | 08:02 |       |  |        |  |           |  |         |  |          | 08:40 | 09:46 (3) |           |
|    | 16:49  |    | 17:49     | 18:41 | 20:37   | 21:29 | 21:59 | 21:42 | 20:44 | 19:31 | 18:20 | 16:25 |       |  |        |  |           |  |         |  |          | 16:11 | 49        | 11:27 (1) |
| 22 | 08:28  |    | 07:33     | 06:28 | 06:15   | 05:19 | 05:00 | 05:27 | 06:18 | 07:12 | 08:06 | 08:04 |       |  |        |  |           |  |         |  |          | 08:41 | 09:46 (3) |           |
|    | 16:51  |    | 17:51     | 18:43 | 20:39   | 21:31 | 21:59 | 21:40 | 20:42 | 19:29 | 18:18 | 16:23 |       |  |        |  |           |  |         |  |          | 16:11 | 49        | 11:27 (1) |
| 23 | 08:27  |    | 07:31     | 06:25 | 06:13   | 05:18 | 05:00 | 05:29 | 06:20 | 07:14 | 08:08 | 08:05 |       |  |        |  |           |  |         |  |          | 08:41 | 09:47 (3) |           |
|    | 16:53  |    | 17:53     | 18:45 | 20:41   | 21:32 | 22:00 | 21:39 | 20:40 | 19:26 | 18:16 | 16:22 |       |  |        |  |           |  |         |  |          | 16:12 | 49        | 11:28 (1) |
| 24 | 08:26  |    | 07:29     | 06:23 | 06:10   | 05:16 | 05:00 | 05:30 | 06:22 | 07:15 | 08:09 | 08:07 |       |  |        |  |           |  |         |  |          | 08:42 | 09:47 (3) |           |
|    | 16:54  |    | 17:55     | 18:47 | 20:43   | 21:34 | 22:00 | 21:37 | 20:38 | 19:24 | 18:14 | 16:21 |       |  |        |  |           |  |         |  |          | 16:12 | 49        | 11:28 (1) |
| 25 | 08:24  |    | 07:26     | 06:21 | 06:08   | 05:15 | 05:01 | 05:32 | 06:23 | 07:17 | 07:11 | 08:09 |       |  |        |  |           |  |         |  |          | 08:42 | 09:48 (3) |           |
|    | 16:56  |    | 17:57     | 18:49 | 20:45   | 21:35 | 22:00 | 21:36 | 20:35 | 19:21 | 17:12 | 16:20 |       |  |        |  |           |  |         |  |          | 16:13 | 48        | 11:28 (1) |
| 26 | 08:23  |    | 07:24     | 06:18 | 06:05   | 05:14 | 05:01 | 05:33 | 06:25 | 07:19 | 07:13 | 08:10 |       |  |        |  |           |  |         |  |          | 08:42 | 09:49 (3) |           |
|    | 16:58  |    | 17:58     | 18:50 | 20:46   | 21:36 | 22:00 | 21:34 | 20:33 | 19:19 | 17:10 | 16:19 |       |  |        |  |           |  |         |  |          | 16:14 | 50        | 11:30 (1) |
| 27 | 08:21  |    | 07:22     | 06:16 | 06:04   | 05:13 | 05:01 | 05:35 | 06:27 | 07:21 | 07:15 | 08:12 |       |  |        |  |           |  |         |  |          | 08:43 | 09:49 (3) |           |
|    | 17:00  |    | 18:00     | 18:52 | 20:48   | 21:38 | 22:00 | 21:33 | 20:31 | 19:16 | 17:08 | 16:18 |       |  |        |  |           |  |         |  |          | 16:14 | 49        | 11:30 (1) |
| 28 | 08:20  |    | 07:20     | 06:13 | 06:02   | 05:12 | 05:02 | 05:36 | 06:29 | 07:22 | 07:17 | 08:14 |       |  |        |  |           |  |         |  |          | 08:43 | 09:50 (3) |           |
|    | 17:02  |    | 18:02     | 18:54 | 20:50   | 21:39 | 21:59 | 21:31 | 20:29 | 19:14 | 17:06 | 16:17 |       |  |        |  |           |  |         |  |          | 16:15 | 48        | 11:30 (1) |
| 29 | 08:18  |    | 07:11     | 06:00 | 05:10   | 05:03 | 05:38 | 06:30 | 07:24 | 08:15 | 09:02 | 08:43 |       |  |        |  |           |  |         |  |          | 08:43 | 09:50 (3) |           |
|    | 17:04  |    | 19:56     | 20:52 | 21:40   | 21:59 | 21:30 | 20:26 | 19:12 | 17:03 | 16:16 |       |       |  |        |  |           |  |         |  |          | 16:16 | 48        | 11:30 (1) |
| 30 | 08:17  |    | 07:08     | 05:58 | 05:09   | 05:03 | 05:39 | 06:32 | 07:26 | 08:17 | 09:04 | 08:43 |       |  |        |  |           |  |         |  |          | 08:43 | 09:51 (3) |           |
|    | 17:06  |    | 19:58     | 20:54 | 21:42</ |       |       |       |       |       |       |       |       |  |        |  |           |  |         |  |          |       |           |           |

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 EZ (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** K - Dwoweg 39, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|    | Januar                                           | Februar                | März           | April          | Mai            | Juni           | Juli           | August         | September      | Oktober        | November       | Dezember       |                |
|----|--------------------------------------------------|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1  | 08:43<br>16:19                                   | 13:07 (1)<br>13:12 (1) | 08:14<br>17:10 | 07:17<br>18:04 | 07:04<br>20:01 | 05:56<br>20:55 | 05:07<br>21:44 | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 07:28<br>19:07 | 07:25<br>16:57 | 08:18<br>16:14 |
| 2  | 08:43<br>16:20                                   |                        | 08:12<br>17:12 | 07:15<br>18:06 | 07:01<br>20:03 | 05:54<br>20:57 | 05:07<br>21:45 | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:56 | 08:20<br>16:14 |
| 3  | 08:43<br>16:22                                   |                        | 08:10<br>17:14 | 07:13<br>18:08 | 06:59<br>20:05 | 05:52<br>20:59 | 05:06<br>21:46 | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 | 07:28<br>16:54 | 08:21<br>16:13 |
| 4  | 08:42<br>16:23                                   |                        | 08:09<br>17:15 | 07:11<br>18:10 | 06:56<br>20:07 | 05:50<br>21:01 | 05:05<br>21:48 | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52 | 08:23<br>16:12 |
| 5  | 08:42<br>16:24                                   |                        | 08:07<br>17:17 | 07:08<br>18:12 | 06:54<br>20:09 | 05:48<br>21:02 | 05:04<br>21:49 | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50 | 08:24<br>16:12 |
| 6  | 08:42<br>16:25                                   |                        | 08:05<br>17:19 | 07:06<br>18:14 | 06:52<br>20:10 | 05:46<br>21:04 | 05:03<br>21:50 | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 07:34<br>16:48 | 08:25<br>16:11 |
| 7  | 08:41<br>16:27                                   |                        | 08:03<br>17:21 | 07:04<br>18:16 | 06:49<br>20:12 | 05:44<br>21:06 | 05:03<br>21:51 | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 07:38<br>18:52 | 07:36<br>16:46 | 08:27<br>16:11 |
| 8  | 08:41<br>16:28                                   |                        | 08:01<br>17:23 | 07:01<br>18:17 | 06:47<br>20:14 | 05:42<br>21:08 | 05:02<br>21:52 | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 07:38<br>16:44 | 08:28<br>16:10 |
| 9  | 08:40<br>16:29                                   |                        | 08:00<br>17:25 | 06:59<br>18:19 | 06:45<br>20:16 | 05:40<br>21:09 | 05:02<br>21:52 | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 07:40<br>16:43 | 08:29<br>16:10 |
| 10 | 08:40<br>16:31                                   |                        | 07:58<br>17:27 | 06:57<br>18:21 | 06:42<br>20:18 | 05:38<br>21:11 | 05:01<br>21:53 | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 07:42<br>16:41 | 08:30<br>16:10 |
| 11 | 08:39<br>16:32                                   |                        | 07:56<br>17:29 | 06:54<br>18:23 | 06:40<br>20:19 | 05:37<br>21:13 | 05:01<br>21:54 | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 07:43<br>16:39 | 08:32<br>16:10 |
| 12 | 08:38<br>16:34                                   |                        | 07:54<br>17:31 | 06:52<br>18:25 | 06:38<br>20:21 | 05:35<br>21:15 | 05:00<br>21:55 | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 07:45<br>16:38 | 08:33<br>16:09 |
| 13 | 08:37<br>16:35                                   |                        | 07:52<br>17:33 | 06:49<br>18:27 | 06:35<br>20:23 | 05:33<br>21:16 | 05:00<br>21:56 | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 07:47<br>16:36 | 08:34<br>16:09 |
| 14 | 08:37<br>16:37                                   |                        | 07:50<br>17:35 | 06:47<br>18:29 | 06:33<br>20:25 | 05:31<br>21:18 | 05:00<br>21:56 | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 07:49<br>16:34 | 08:35<br>16:09 |
| 15 | 08:36<br>16:39                                   |                        | 07:48<br>17:37 | 06:45<br>18:30 | 06:31<br>20:27 | 05:30<br>21:20 | 05:00<br>21:57 | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 07:51<br>16:33 | 08:36<br>16:09 |
| 16 | 08:35<br>16:40                                   |                        | 07:46<br>17:39 | 06:42<br>18:32 | 06:28<br>20:28 | 05:28<br>21:21 | 04:59<br>21:57 | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 07:53<br>16:31 | 08:37<br>16:09 |
| 17 | 08:34<br>16:42                                   |                        | 07:44<br>17:41 | 06:40<br>18:34 | 06:26<br>20:30 | 05:27<br>21:23 | 04:59<br>21:58 | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 07:55<br>16:30 | 08:37<br>16:10 |
| 18 | 08:33<br>16:44                                   |                        | 07:42<br>17:43 | 06:37<br>18:36 | 06:24<br>20:32 | 05:25<br>21:24 | 04:59<br>21:58 | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 07:56<br>16:29 | 08:38<br>16:10 |
| 19 | 08:32<br>16:45                                   |                        | 07:39<br>17:45 | 06:35<br>18:38 | 06:22<br>20:34 | 05:23<br>21:26 | 04:59<br>21:59 | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 07:58<br>16:27 | 08:39<br>16:10 |
| 20 | 08:31<br>16:47                                   |                        | 07:37<br>17:47 | 06:33<br>18:40 | 06:19<br>20:36 | 05:22<br>21:27 | 04:59<br>21:59 | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 08:00<br>16:26 | 08:40<br>16:10 |
| 21 | 08:29<br>16:49                                   |                        | 07:35<br>17:49 | 06:30<br>18:41 | 06:17<br>20:37 | 05:21<br>21:29 | 05:00<br>21:59 | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:02<br>16:25 | 08:40<br>16:11 |
| 22 | 08:28<br>16:51                                   |                        | 07:33<br>17:51 | 06:28<br>18:43 | 06:15<br>20:39 | 05:19<br>21:31 | 05:00<br>21:59 | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 08:04<br>16:23 | 08:41<br>16:11 |
| 23 | 08:27<br>16:53                                   |                        | 07:31<br>17:53 | 06:25<br>18:45 | 06:13<br>20:41 | 05:18<br>21:32 | 05:00<br>22:00 | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 08:05<br>16:22 | 08:41<br>16:12 |
| 24 | 08:26<br>16:54                                   |                        | 07:29<br>17:55 | 06:23<br>18:47 | 06:10<br>20:43 | 05:16<br>21:33 | 05:00<br>22:00 | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 08:07<br>16:21 | 08:42<br>16:12 |
| 25 | 08:24<br>16:56                                   |                        | 07:26<br>17:56 | 06:21<br>18:49 | 06:08<br>20:45 | 05:15<br>21:35 | 05:01<br>22:00 | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 08:09<br>16:20 | 08:42<br>16:13 |
| 26 | 08:23<br>16:58                                   |                        | 07:24<br>17:58 | 06:18<br>18:50 | 06:06<br>20:46 | 05:14<br>21:36 | 05:01<br>22:00 | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 08:10<br>16:19 | 08:42<br>16:14 |
| 27 | 08:21<br>17:00                                   |                        | 07:22<br>18:00 | 06:16<br>18:52 | 06:04<br>20:48 | 05:13<br>21:38 | 05:01<br>22:00 | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 08:12<br>16:18 | 08:43<br>16:14 |
| 28 | 08:20<br>17:02                                   |                        | 07:20<br>18:02 | 06:13<br>18:54 | 06:02<br>20:50 | 05:12<br>21:39 | 05:02<br>21:59 | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>17:06 | 08:14<br>16:17 | 08:43<br>16:15 |
| 29 | 08:18<br>17:04                                   |                        |                | 07:11<br>19:56 | 06:00<br>20:52 | 05:10<br>21:40 | 05:02<br>21:59 | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:03 | 08:15<br>16:16 | 08:43<br>16:16 |
| 30 | 08:17<br>17:06                                   |                        |                | 07:08<br>19:58 | 05:58<br>20:54 | 05:09<br>21:42 | 05:03<br>21:59 | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 08:17<br>16:15 | 08:43<br>16:17 |
| 31 | 08:15<br>17:08                                   |                        |                | 07:06<br>20:00 |                | 05:08<br>21:43 |                | 05:41<br>21:26 | 06:34<br>20:22 |                | 07:23<br>16:59 |                | 08:43<br>16:18 |
|    | Sonnenscheinstunden<br>astr.max.mögl.Beschattung | 252<br>5               | 274            | 367            | 419            | 491            | 507            | 509            | 458            | 382            | 329            | 261            | 236<br>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 (WEA mit erstem Schatten) | Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten) |
|--------------|-----------------------|-------------------------|----------------------|------------------------------------------------------------|-----------------------------------------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** L - Dwoweg 70, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar | Februar   | März      | April | Mai   | Juni  | Juli  | August | September | Oktober | November | Dezember |       |           |           |
|---------------------------|--------|-----------|-----------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|-------|-----------|-----------|
| 1                         | 08:43  | 13:57 (1) | 08:14     | 07:17 | 07:04 | 05:56 | 05:07 | 05:04  | 05:43     | 06:36   | 07:28    | 07:25    | 08:18 |           |           |
| 2                         | 16:19  | 15        | 14:12 (1) | 17:10 | 18:04 | 20:01 | 20:55 | 21:44  | 21:59     | 21:24   | 20:19    | 19:07    | 16:57 | 16:14     |           |
| 3                         | 08:43  | 13:59 (1) | 08:12     | 07:15 | 07:01 | 05:54 | 05:07 | 05:04  | 05:44     | 06:37   | 07:29    | 07:26    | 08:20 |           |           |
| 4                         | 16:20  | 13        | 14:12 (1) | 17:12 | 18:06 | 20:03 | 20:57 | 21:45  | 21:58     | 21:23   | 20:17    | 19:04    | 16:56 | 16:14     |           |
| 5                         | 08:43  | 14:00 (1) | 08:10     | 07:13 | 06:59 | 05:52 | 05:06 | 05:05  | 05:46     | 06:39   | 07:31    | 07:28    | 08:21 |           |           |
| 6                         | 16:22  | 12        | 14:12 (1) | 17:13 | 18:08 | 20:05 | 20:59 | 21:46  | 21:58     | 21:21   | 20:15    | 19:02    | 16:54 | 16:13     |           |
| 7                         | 08:42  | 14:01 (1) | 08:09     | 07:11 | 06:56 | 05:50 | 05:05 | 05:06  | 05:48     | 06:41   | 07:33    | 07:30    | 08:23 |           |           |
| 8                         | 16:23  | 9         | 14:10 (1) | 17:15 | 18:10 | 20:07 | 21:01 | 21:48  | 21:57     | 21:19   | 20:12    | 19:00    | 16:52 | 16:12     |           |
| 9                         | 08:42  | 14:04 (1) | 08:07     | 07:08 | 06:54 | 05:48 | 05:04 | 05:07  | 05:49     | 06:42   | 07:35    | 07:32    | 08:24 |           |           |
| 10                        | 16:24  | 6         | 14:10 (1) | 17:17 | 18:12 | 20:09 | 21:02 | 21:49  | 21:57     | 21:17   | 20:10    | 18:57    | 16:50 | 16:12     |           |
| 11                        | 08:42  |           | 08:05     | 07:06 | 06:52 | 05:46 | 05:03 | 05:08  | 05:51     | 06:44   | 07:36    | 07:34    | 08:25 |           |           |
| 12                        | 16:25  |           | 17:19     | 18:14 | 20:10 | 21:04 | 21:50 | 21:56  | 21:15     | 20:07   | 18:55    | 16:48    | 16:11 |           |           |
| 13                        | 08:41  |           | 08:03     | 07:04 | 06:49 | 05:44 | 05:03 | 05:09  | 05:53     | 06:46   | 07:38    | 07:36    | 08:27 | 13:50 (1) |           |
| 14                        | 16:27  |           | 17:21     | 18:15 | 20:12 | 21:06 | 21:51 | 21:56  | 21:13     | 20:05   | 18:52    | 16:46    | 16:11 | 6         | 13:56 (1) |
| 15                        | 08:41  |           | 08:01     | 07:01 | 06:47 | 05:42 | 05:02 | 05:10  | 05:54     | 06:48   | 07:40    | 07:38    | 08:28 |           | 13:50 (1) |
| 16                        | 16:28  |           | 17:23     | 18:17 | 20:14 | 21:08 | 21:52 | 21:55  | 21:12     | 20:03   | 18:50    | 16:44    | 16:10 | 8         | 13:58 (1) |
| 17                        | 08:40  |           | 08:00     | 06:59 | 06:45 | 05:40 | 05:02 | 05:11  | 05:56     | 06:49   | 07:42    | 07:40    | 08:29 |           | 13:48 (1) |
| 18                        | 16:29  |           | 17:25     | 18:19 | 20:16 | 21:09 | 21:52 | 21:54  | 21:10     | 20:00   | 18:48    | 16:43    | 16:10 | 12        | 14:00 (1) |
| 19                        | 08:40  |           | 07:58     | 06:56 | 06:42 | 05:38 | 05:01 | 05:12  | 05:58     | 06:51   | 07:44    | 07:42    | 08:30 |           | 13:48 (1) |
| 20                        | 16:31  |           | 17:27     | 18:21 | 20:18 | 21:11 | 21:53 | 21:54  | 21:08     | 19:58   | 18:45    | 16:41    | 16:10 | 13        | 14:01 (1) |
| 21                        | 08:39  |           | 07:56     | 06:54 | 06:40 | 05:37 | 05:01 | 05:13  | 05:59     | 06:53   | 07:45    | 07:43    | 08:32 |           | 13:47 (1) |
| 22                        | 16:32  |           | 17:29     | 18:23 | 20:19 | 21:13 | 21:54 | 21:53  | 21:06     | 19:55   | 18:43    | 16:39    | 16:09 | 15        | 14:02 (1) |
| 23                        | 08:38  |           | 07:54     | 06:52 | 06:38 | 05:35 | 05:00 | 05:14  | 06:01     | 06:55   | 07:47    | 07:45    | 08:33 |           | 13:48 (1) |
| 24                        | 16:34  |           | 17:31     | 18:25 | 20:21 | 21:15 | 21:55 | 21:52  | 21:04     | 19:53   | 18:41    | 16:38    | 16:09 | 16        | 14:04 (1) |
| 25                        | 08:37  |           | 07:52     | 06:49 | 06:35 | 05:33 | 05:00 | 05:15  | 06:03     | 06:56   | 07:49    | 07:47    | 08:34 |           | 13:48 (1) |
| 26                        | 16:35  |           | 17:33     | 18:27 | 20:23 | 21:16 | 21:56 | 21:51  | 21:02     | 19:51   | 18:38    | 16:36    | 16:09 | 16        | 14:04 (1) |
| 27                        | 08:37  |           | 07:50     | 06:47 | 06:33 | 05:31 | 05:00 | 05:16  | 06:04     | 06:58   | 07:51    | 07:49    | 08:35 |           | 13:48 (1) |
| 28                        | 16:37  |           | 17:35     | 18:29 | 20:25 | 21:18 | 21:56 | 21:50  | 20:59     | 19:48   | 18:36    | 16:34    | 16:09 | 17        | 14:05 (1) |
| 29                        | 08:36  |           | 07:48     | 06:45 | 06:31 | 05:30 | 05:00 | 05:18  | 06:06     | 07:00   | 07:53    | 07:51    | 08:36 |           | 13:48 (1) |
| 30                        | 16:39  |           | 17:37     | 18:30 | 20:27 | 21:20 | 21:57 | 21:49  | 20:57     | 19:46   | 18:34    | 16:33    | 16:09 | 18        | 14:06 (1) |
| 31                        | 08:35  |           | 07:46     | 06:42 | 06:28 | 05:28 | 04:59 | 05:19  | 06:08     | 07:01   | 07:55    | 07:53    | 08:37 |           | 13:48 (1) |
| 32                        | 16:40  |           | 17:39     | 18:32 | 20:28 | 21:21 | 21:57 | 21:48  | 20:55     | 19:43   | 18:32    | 16:31    | 16:09 | 18        | 14:06 (1) |
| 33                        | 08:34  |           | 07:44     | 06:40 | 06:26 | 05:27 | 04:59 | 05:20  | 06:10     | 07:03   | 07:56    | 07:55    | 08:37 |           | 13:48 (1) |
| 34                        | 16:42  |           | 17:41     | 18:34 | 20:30 | 21:23 | 21:58 | 21:47  | 20:53     | 19:41   | 18:29    | 16:30    | 16:09 | 19        | 14:07 (1) |
| 35                        | 08:33  |           | 07:42     | 06:37 | 06:24 | 05:25 | 04:59 | 05:22  | 06:11     | 07:05   | 07:58    | 07:56    | 08:38 |           | 13:49 (1) |
| 36                        | 16:44  |           | 17:43     | 18:36 | 20:32 | 21:24 | 21:58 | 21:45  | 20:51     | 19:38   | 18:27    | 16:29    | 16:10 | 19        | 14:08 (1) |
| 37                        | 08:32  |           | 07:39     | 06:35 | 06:21 | 05:23 | 04:59 | 05:23  | 06:13     | 07:07   | 08:00    | 07:58    | 08:39 |           | 13:49 (1) |
| 38                        | 16:45  |           | 17:45     | 18:38 | 20:34 | 21:26 | 21:59 | 21:44  | 20:49     | 19:36   | 18:25    | 16:27    | 16:10 | 19        | 14:08 (1) |
| 39                        | 08:31  |           | 07:37     | 06:33 | 06:19 | 05:22 | 04:59 | 05:24  | 06:15     | 07:08   | 08:02    | 08:00    | 08:40 |           | 13:49 (1) |
| 40                        | 16:47  |           | 17:47     | 18:40 | 20:36 | 21:27 | 21:59 | 21:43  | 20:47     | 19:33   | 18:23    | 16:26    | 16:10 | 19        | 14:08 (1) |
| 41                        | 08:29  |           | 07:35     | 06:30 | 06:17 | 05:21 | 04:59 | 05:26  | 06:17     | 07:10   | 08:04    | 08:02    | 08:40 |           | 13:50 (1) |
| 42                        | 16:49  |           | 17:49     | 18:41 | 20:37 | 21:29 | 21:59 | 21:42  | 20:44     | 19:31   | 18:20    | 16:25    | 16:11 | 19        | 14:09 (1) |
| 43                        | 08:28  |           | 07:33     | 06:28 | 06:15 | 05:19 | 05:00 | 05:27  | 06:18     | 07:12   | 08:06    | 08:04    | 08:41 |           | 13:50 (1) |
| 44                        | 16:51  |           | 17:51     | 18:43 | 20:39 | 21:31 | 21:59 | 21:40  | 20:42     | 19:29   | 18:18    | 16:23    | 16:11 | 19        | 14:09 (1) |
| 45                        | 08:27  |           | 07:31     | 06:25 | 06:13 | 05:18 | 05:00 | 05:29  | 06:20     | 07:14   | 08:08    | 08:05    | 08:41 |           | 13:51 (1) |
| 46                        | 16:53  |           | 17:53     | 18:45 | 20:41 | 21:32 | 22:00 | 21:39  | 20:40     | 19:26   | 18:16    | 16:22    | 16:12 | 19        | 14:10 (1) |
| 47                        | 08:26  |           | 07:29     | 06:23 | 06:10 | 05:16 | 05:00 | 05:30  | 06:22     | 07:15   | 08:09    | 08:07    | 08:42 |           | 13:51 (1) |
| 48                        | 16:54  |           | 17:55     | 18:47 | 20:43 | 21:33 | 22:00 | 21:37  | 20:38     | 19:24   | 18:14    | 16:21    | 16:12 | 19        | 14:10 (1) |
| 49                        | 08:24  |           | 07:26     | 06:20 | 06:08 | 05:15 | 05:01 | 05:32  | 06:23     | 07:17   | 08:11    | 08:09    | 08:42 |           | 13:51 (1) |
| 50                        | 16:56  |           | 17:56     | 18:49 | 20:45 | 21:35 | 22:00 | 21:36  | 20:35     | 19:21   | 18:12    | 16:20    | 16:13 | 20        | 14:11 (1) |
| 51                        | 08:23  |           | 07:24     | 06:18 | 06:06 | 05:14 | 05:01 | 05:33  | 06:25     | 07:19   | 08:13    | 08:10    | 08:42 |           | 13:53 (1) |
| 52                        | 16:58  |           | 17:58     | 18:50 | 20:46 | 21:36 | 22:00 | 21:34  | 20:33     | 19:19   | 18:10    | 16:19    | 16:14 | 19        | 14:12 (1) |
| 53                        | 08:21  |           | 07:22     | 06:16 | 06:04 | 05:13 | 05:01 | 05:35  | 06:27     | 07:21   | 08:15    | 08:12    | 08:43 |           | 13:53 (1) |
| 54                        | 17:00  |           | 18:00     | 18:52 | 20:48 | 21:38 | 22:00 | 21:33  | 20:31     | 19:16   | 18:08    | 16:18    | 16:14 | 19        | 14:12 (1) |
| 55                        | 08:20  |           | 07:20     | 06:13 | 06:02 | 05:12 | 05:02 | 05:36  | 06:29     | 07:22   | 08:17    | 08:14    | 08:43 |           | 13:54 (1) |
| 56                        | 17:02  |           | 18:02     | 18:54 | 20:50 | 21:39 | 21:59 | 21:31  | 20:29     | 19:14   | 18:05    | 16:17    | 16:15 | 18        | 14:12 (1) |
| 57                        | 08:18  |           | 07:11     | 06:00 | 05:10 | 05:02 | 05:38 | 06:30  | 07:24     | 08:19   | 09:15    | 08:15    | 08:43 |           | 13:55 (1) |
| 58                        | 17:04  |           | 18:04     | 19:06 | 20:52 | 21:40 | 21:59 | 21:30  | 20:26     | 19:12   | 18:03    | 16:16    | 16:16 | 17        | 14:12 (1) |
| 59                        | 08:17  |           | 07:08     | 05:58 | 05:09 | 05:03 | 05:39 | 06:32  | 07:26     | 08:21   | 09:17    | 08:17    | 08:43 |           | 13:56 (1) |
| 60                        | 17:06  |           | 18:06     | 19:08 | 20:54 | 21:42 | 21:59 | 21:28  | 20:24     | 19:09   | 18:01    | 16:15    | 16:17 | 16        | 14:12 (1) |
| 61                        | 08:15  |           | 07:06     | 05:56 | 05:08 | 05:04 | 05:41 | 06:34  | 07:28     | 08:23   | 09:19    | 08:19    | 08:43 |           | 13:56 (1) |
| 62                        | 17:08  |           | 18:08     | 19:09 | 20:55 | 21:43 | 21:59 | 21:26  | 20:22     | 19:07   | 18:00    | 16:16    | 16:18 | 15        | 14:11 (1) |
| Sonnenscheinstunden       | 252    |           | 274       | 367   | 419   | 491   | 507   | 509    | 458       | 382     | 329      | 261      | 236   |           |           |
| astr.max.mögl.Beschattung |        | 55        |           |       |       |       |       |        |           |         |          |          |       |           | 415       |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** M - Dwoweg 38, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar |     | Februar   |       | März |           | April |       | Mai |       | Juni |       |
|---------------------------|--------|-----|-----------|-------|------|-----------|-------|-------|-----|-------|------|-------|
| 1                         | 08:43  |     | 12:54 (3) | 08:14 |      | 15:14 (1) | 07:17 | 07:04 |     | 05:56 |      | 05:07 |
|                           | 16:19  | 28  | 14:35 (2) | 17:10 | 32   | 15:46 (1) | 18:04 | 20:01 |     | 20:55 |      | 21:44 |
| 2                         | 08:43  |     | 12:56 (3) | 08:12 |      | 15:14 (1) | 07:15 | 07:01 |     | 05:54 |      | 05:07 |
|                           | 16:20  | 26  | 14:36 (2) | 17:12 | 32   | 15:46 (1) | 18:06 | 20:03 |     | 20:57 |      | 21:45 |
| 3                         | 08:43  |     | 12:59 (3) | 08:10 |      | 15:15 (1) | 07:13 | 06:59 |     | 05:52 |      | 05:06 |
|                           | 16:22  | 20  | 14:36 (2) | 17:13 | 31   | 15:46 (1) | 18:08 | 20:05 |     | 20:59 |      | 21:46 |
| 4                         | 08:42  |     | 14:24 (2) | 08:09 |      | 15:15 (1) | 07:11 | 06:56 |     | 05:50 |      | 05:05 |
|                           | 16:23  | 11  | 14:35 (2) | 17:15 | 30   | 15:45 (1) | 18:10 | 20:07 |     | 21:01 |      | 21:48 |
| 5                         | 08:42  |     | 14:26 (2) | 08:07 |      | 15:17 (1) | 07:08 | 06:54 |     | 05:48 |      | 05:04 |
|                           | 16:24  | 9   | 14:35 (2) | 17:17 | 29   | 15:46 (1) | 18:12 | 20:09 |     | 21:02 |      | 21:49 |
| 6                         | 08:42  |     | 14:27 (2) | 08:05 |      | 15:18 (1) | 07:06 | 06:52 |     | 05:46 |      | 05:03 |
|                           | 16:25  | 6   | 14:33 (2) | 17:19 | 27   | 15:45 (1) | 18:14 | 20:10 |     | 21:04 |      | 21:50 |
| 7                         | 08:41  |     |           | 08:03 |      | 15:19 (1) | 07:04 | 06:49 |     | 05:44 |      | 05:03 |
|                           | 16:27  |     |           | 17:21 | 25   | 15:44 (1) | 18:15 | 20:12 |     | 21:06 |      | 21:51 |
| 8                         | 08:41  |     |           | 08:01 |      | 15:20 (1) | 07:01 | 06:47 |     | 05:42 |      | 05:02 |
|                           | 16:28  |     |           | 17:23 | 23   | 15:43 (1) | 18:17 | 20:14 |     | 21:08 |      | 21:52 |
| 9                         | 08:40  |     |           | 08:00 |      | 15:22 (1) | 06:59 | 06:45 |     | 05:40 |      | 05:02 |
|                           | 16:29  |     |           | 17:25 | 20   | 15:42 (1) | 18:19 | 20:16 |     | 21:09 |      | 21:52 |
| 10                        | 08:40  |     |           | 07:58 |      | 15:24 (1) | 06:56 | 06:42 |     | 05:38 |      | 05:01 |
|                           | 16:31  |     |           | 17:27 | 16   | 15:40 (1) | 18:21 | 20:18 |     | 21:11 |      | 21:53 |
| 11                        | 08:39  |     |           | 07:56 |      | 15:28 (1) | 06:54 | 06:40 |     | 05:37 |      | 05:01 |
|                           | 16:32  |     |           | 17:29 | 8    | 15:36 (1) | 18:23 | 20:19 |     | 21:13 |      | 21:54 |
| 12                        | 08:38  |     |           | 07:54 |      |           | 06:52 | 06:38 |     | 05:35 |      | 05:00 |
|                           | 16:34  |     |           | 17:31 |      |           | 18:25 | 20:21 |     | 21:15 |      | 21:55 |
| 13                        | 08:37  |     | 15:21 (1) | 07:52 |      |           | 06:49 | 06:35 |     | 05:33 |      | 05:00 |
|                           | 16:35  | 7   | 15:28 (1) | 17:33 |      |           | 18:27 | 20:23 |     | 21:16 |      | 21:56 |
| 14                        | 08:37  |     | 15:19 (1) | 07:50 |      |           | 06:47 | 06:33 |     | 05:31 |      | 05:00 |
|                           | 16:37  | 12  | 15:31 (1) | 17:35 |      |           | 18:29 | 20:25 |     | 21:18 |      | 21:56 |
| 15                        | 08:36  |     | 15:18 (1) | 07:48 |      |           | 06:45 | 06:31 |     | 05:30 |      | 05:00 |
|                           | 16:39  | 15  | 15:33 (1) | 17:37 |      |           | 18:30 | 20:27 |     | 21:19 |      | 21:57 |
| 16                        | 08:35  |     | 15:17 (1) | 07:46 |      |           | 06:42 | 06:28 |     | 05:28 |      | 04:59 |
|                           | 16:40  | 18  | 15:35 (1) | 17:39 |      |           | 18:32 | 20:28 |     | 21:21 |      | 21:57 |
| 17                        | 08:34  |     | 15:16 (1) | 07:44 |      |           | 06:40 | 06:26 |     | 05:27 |      | 04:59 |
|                           | 16:42  | 21  | 15:37 (1) | 17:41 |      |           | 18:34 | 20:30 |     | 21:23 |      | 21:58 |
| 18                        | 08:33  |     | 15:16 (1) | 07:42 |      |           | 06:37 | 06:24 |     | 05:25 |      | 04:59 |
|                           | 16:44  | 22  | 15:38 (1) | 17:43 |      |           | 18:36 | 20:32 |     | 21:24 |      | 21:58 |
| 19                        | 08:32  |     | 15:14 (1) | 07:39 |      |           | 06:35 | 06:21 |     | 05:23 |      | 04:59 |
|                           | 16:45  | 25  | 15:39 (1) | 17:45 |      |           | 18:38 | 20:34 |     | 21:26 |      | 21:59 |
| 20                        | 08:31  |     | 15:14 (1) | 07:37 |      |           | 06:33 | 06:19 |     | 05:22 |      | 04:59 |
|                           | 16:47  | 26  | 15:40 (1) | 17:47 |      |           | 18:40 | 20:36 |     | 21:27 |      | 21:59 |
| 21                        | 08:29  |     | 15:14 (1) | 07:35 |      |           | 06:30 | 06:17 |     | 05:21 |      | 04:59 |
|                           | 16:49  | 27  | 15:41 (1) | 17:49 |      |           | 18:41 | 20:37 |     | 21:29 |      | 21:59 |
| 22                        | 08:28  |     | 15:13 (1) | 07:33 |      |           | 06:28 | 06:15 |     | 05:19 |      | 05:00 |
|                           | 16:51  | 29  | 15:42 (1) | 17:51 |      |           | 18:43 | 20:39 |     | 21:31 |      | 21:59 |
| 23                        | 08:27  |     | 15:14 (1) | 07:31 |      |           | 06:25 | 06:13 |     | 05:18 |      | 05:00 |
|                           | 16:53  | 29  | 15:43 (1) | 17:53 |      |           | 18:45 | 20:41 |     | 21:32 |      | 22:00 |
| 24                        | 08:26  |     | 15:13 (1) | 07:29 |      |           | 06:23 | 06:10 |     | 05:16 |      | 05:00 |
|                           | 16:54  | 30  | 15:43 (1) | 17:55 |      |           | 18:47 | 20:43 |     | 21:33 |      | 22:00 |
| 25                        | 08:24  |     | 15:13 (1) | 07:26 |      |           | 06:20 | 06:08 |     | 05:15 |      | 05:01 |
|                           | 16:56  | 31  | 15:44 (1) | 17:56 |      |           | 18:49 | 20:45 |     | 21:35 |      | 22:00 |
| 26                        | 08:23  |     | 15:13 (1) | 07:24 |      |           | 06:18 | 06:06 |     | 05:14 |      | 05:01 |
|                           | 16:58  | 32  | 15:45 (1) | 17:58 |      |           | 18:50 | 20:46 |     | 21:36 |      | 22:00 |
| 27                        | 08:21  |     | 15:14 (1) | 07:22 |      |           | 06:16 | 06:04 |     | 05:13 |      | 05:01 |
|                           | 17:00  | 32  | 15:46 (1) | 18:00 |      |           | 18:52 | 20:48 |     | 21:38 |      | 22:00 |
| 28                        | 08:20  |     | 15:13 (1) | 07:20 |      |           | 06:13 | 06:02 |     | 05:12 |      | 05:02 |
|                           | 17:02  | 33  | 15:46 (1) | 18:02 |      |           | 18:54 | 20:50 |     | 21:39 |      | 21:59 |
| 29                        | 08:18  |     | 15:13 (1) |       |      |           | 07:11 | 06:00 |     | 05:10 |      | 05:02 |
|                           | 17:04  | 33  | 15:46 (1) |       |      |           | 19:56 | 20:52 |     | 21:40 |      | 21:59 |
| 30                        | 08:17  |     | 15:14 (1) |       |      |           | 07:08 | 05:58 |     | 05:09 |      | 05:03 |
|                           | 17:06  | 33  | 15:47 (1) |       |      |           | 19:58 | 20:54 |     | 21:42 |      | 21:59 |
| 31                        | 08:15  |     | 15:14 (1) |       |      |           | 07:06 |       |     | 05:08 |      |       |
|                           | 17:08  | 33  | 15:47 (1) |       |      |           | 19:59 |       |     | 21:43 |      |       |
| Sonnenscheinstunden       | 252    |     |           | 274   |      |           | 367   | 419   |     | 491   |      | 507   |
| astr.max.mögl.Beschattung |        | 588 |           |       | 273  |           |       |       |     |       |      |       |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** M - Dwoweg 38, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul   | August | September | Oktober |              | November |              | Dezember |              |
|---------------------------|-------|--------|-----------|---------|--------------|----------|--------------|----------|--------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |              | 07:25    | 14:52 (1)    | 08:18    |              |
|                           | 21:59 | 21:24  | 20:19     | 19:07   |              | 16:57    | 17 15:09 (1) | 16:14    |              |
| 2                         | 05:04 | 05:44  | 06:37     | 07:29   |              | 07:26    | 14:51 (1)    | 08:20    |              |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |              | 16:56    | 20 15:11 (1) | 16:14    |              |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |              | 07:28    | 14:50 (1)    | 08:21    |              |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |              | 16:54    | 23 15:13 (1) | 16:13    |              |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |              | 07:30    | 14:48 (1)    | 08:23    |              |
|                           | 21:57 | 21:19  | 20:12     | 19:00   |              | 16:52    | 26 15:14 (1) | 16:12    |              |
| 5                         | 05:07 | 05:49  | 06:42     | 07:35   |              | 07:32    | 14:47 (1)    | 08:24    |              |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |              | 16:50    | 28 15:15 (1) | 16:12    |              |
| 6                         | 05:08 | 05:51  | 06:44     | 07:36   |              | 07:34    | 14:47 (1)    | 08:25    | 14:13 (2)    |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |              | 16:48    | 29 15:16 (1) | 16:11    | 6 14:19 (2)  |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |              | 07:36    | 14:46 (1)    | 08:27    | 14:12 (2)    |
|                           | 21:56 | 21:13  | 20:05     | 18:52   |              | 16:46    | 30 15:16 (1) | 16:11    | 9 14:21 (2)  |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |              | 07:38    | 14:46 (1)    | 08:28    | 14:12 (2)    |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |              | 16:44    | 31 15:17 (1) | 16:10    | 11 14:23 (2) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |              | 07:40    | 14:45 (1)    | 08:29    | 12:47 (3)    |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |              | 16:43    | 32 15:17 (1) | 16:10    | 19 14:24 (2) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |              | 07:42    | 14:45 (1)    | 08:30    | 12:46 (3)    |
|                           | 21:53 | 21:08  | 19:58     | 18:45   |              | 16:41    | 32 15:17 (1) | 16:10    | 23 14:25 (2) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |              | 07:43    | 14:45 (1)    | 08:32    | 12:45 (3)    |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |              | 16:39    | 32 15:17 (1) | 16:09    | 27 14:25 (2) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |              | 07:45    | 14:45 (1)    | 08:33    | 12:45 (3)    |
|                           | 21:52 | 21:04  | 19:53     | 18:41   |              | 16:38    | 33 15:18 (1) | 16:09    | 30 14:27 (2) |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |              | 07:47    | 14:45 (1)    | 08:34    | 12:45 (3)    |
|                           | 21:51 | 21:02  | 19:50     | 18:38   |              | 16:36    | 33 15:18 (1) | 16:09    | 32 14:28 (2) |
| 14                        | 05:16 | 06:04  | 06:58     | 07:51   |              | 07:49    | 14:45 (1)    | 08:35    | 12:45 (3)    |
|                           | 21:50 | 20:59  | 19:48     | 18:36   |              | 16:34    | 33 15:18 (1) | 16:09    | 34 14:29 (2) |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |              | 07:51    | 14:45 (1)    | 08:36    | 12:45 (3)    |
|                           | 21:49 | 20:57  | 19:46     | 18:34   |              | 16:33    | 33 15:18 (1) | 16:09    | 35 14:29 (2) |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   |              | 07:53    | 14:46 (1)    | 08:37    | 12:44 (3)    |
|                           | 21:48 | 20:55  | 19:43     | 18:32   |              | 16:31    | 31 15:17 (1) | 16:09    | 36 14:29 (2) |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |              | 07:55    | 14:46 (1)    | 08:37    | 12:44 (3)    |
|                           | 21:47 | 20:53  | 19:41     | 18:29   |              | 16:30    | 31 15:17 (1) | 16:09    | 38 14:30 (2) |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |              | 07:56    | 14:47 (1)    | 08:38    | 12:45 (3)    |
|                           | 21:45 | 20:51  | 19:38     | 18:27   |              | 16:29    | 30 15:17 (1) | 16:10    | 38 14:31 (2) |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |              | 07:58    | 14:48 (1)    | 08:39    | 12:45 (3)    |
|                           | 21:44 | 20:49  | 19:36     | 18:25   |              | 16:27    | 29 15:17 (1) | 16:10    | 39 14:32 (2) |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |              | 08:00    | 14:48 (1)    | 08:40    | 12:45 (3)    |
|                           | 21:43 | 20:47  | 19:33     | 18:23   |              | 16:26    | 29 15:17 (1) | 16:10    | 40 14:32 (2) |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |              | 08:02    | 14:49 (1)    | 08:40    | 12:46 (3)    |
|                           | 21:42 | 20:44  | 19:31     | 18:20   |              | 16:25    | 27 15:16 (1) | 16:11    | 40 14:33 (2) |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |              | 08:04    | 14:50 (1)    | 08:41    | 12:46 (3)    |
|                           | 21:40 | 20:42  | 19:29     | 18:18   |              | 16:23    | 26 15:16 (1) | 16:11    | 40 14:33 (2) |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   |              | 08:05    | 14:51 (1)    | 08:41    | 12:47 (3)    |
|                           | 21:39 | 20:40  | 19:26     | 18:16   |              | 16:22    | 25 15:16 (1) | 16:12    | 40 14:34 (2) |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   |              | 08:07    | 14:53 (1)    | 08:42    | 12:47 (3)    |
|                           | 21:37 | 20:38  | 19:24     | 18:14   |              | 16:21    | 22 15:15 (1) | 16:12    | 40 14:34 (2) |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   |              | 08:09    | 14:54 (1)    | 08:42    | 12:47 (3)    |
|                           | 21:36 | 20:35  | 19:21     | 17:12   |              | 16:20    | 21 15:15 (1) | 16:13    | 39 14:34 (2) |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   |              | 08:10    | 14:56 (1)    | 08:42    | 12:49 (3)    |
|                           | 21:34 | 20:33  | 19:19     | 17:10   |              | 16:19    | 18 15:14 (1) | 16:14    | 38 14:35 (2) |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |              | 08:12    | 14:57 (1)    | 08:43    | 12:50 (3)    |
|                           | 21:33 | 20:31  | 19:16     | 17:08   |              | 16:18    | 15 15:12 (1) | 16:14    | 36 14:35 (2) |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |              | 08:14    | 14:59 (1)    | 08:43    | 12:50 (3)    |
|                           | 21:31 | 20:29  | 19:14     | 17:05   |              | 16:17    | 12 15:11 (1) | 16:15    | 36 14:35 (2) |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |              | 08:15    | 15:02 (1)    | 08:43    | 12:51 (3)    |
|                           | 21:30 | 20:26  | 19:12     | 17:03   |              | 16:16    | 8 15:10 (1)  | 16:16    | 35 14:36 (2) |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |              | 08:17    |              | 08:43    | 12:52 (3)    |
|                           | 21:28 | 20:24  | 19:09     | 17:01   |              | 16:15    |              | 16:17    | 33 14:36 (2) |
| 31                        | 05:41 | 06:34  |           | 07:23   | 14:56 (1)    |          |              | 08:43    | 12:52 (3)    |
|                           | 21:26 | 20:22  |           | 16:59   | 10 15:06 (1) |          |              | 16:18    | 31 14:35 (2) |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 10           | 261      |              | 236      |              |
| astr.max.mögl.Beschattung |       |        |           | 10      |              | 756      |              | 825      |              |

**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) |

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** N - Dwoweg 156, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar         | Februar                | März                   | April                  | Mai            | Juni           |
|---------------------------|----------------|------------------------|------------------------|------------------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10         | 15:30 (3)<br>17:12     | 07:17<br>18:04         | 05:56<br>20:01 | 05:07<br>21:44 |
| 2                         | 08:43<br>16:20 | 08:12<br>17:12         | 16:00 (2)<br>16:10 (2) | 07:15<br>18:06         | 05:54<br>20:03 | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:13         | 16:02 (2)<br>16:08 (2) | 07:13<br>18:08         | 05:52<br>20:05 | 05:06<br>21:46 |
| 4                         | 08:42<br>16:23 | 15:24 (3)<br>15:28 (3) | 08:09<br>17:15         | 07:10<br>18:10         | 05:50<br>20:07 | 05:05<br>21:48 |
| 5                         | 08:42<br>16:24 | 15:23 (3)<br>15:31 (3) | 08:07<br>17:17         | 07:08<br>18:12         | 05:48<br>20:09 | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 15:22 (3)<br>15:32 (3) | 08:05<br>17:19         | 07:06<br>18:14         | 05:46<br>20:10 | 05:03<br>21:50 |
| 7                         | 08:41<br>16:27 | 15:20 (3)<br>15:33 (3) | 08:03<br>17:21         | 07:04<br>18:15         | 05:44<br>20:12 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 15:21 (3)<br>15:35 (3) | 08:01<br>17:23         | 07:01<br>18:17         | 05:42<br>20:14 | 05:02<br>21:52 |
| 9                         | 08:40<br>16:29 | 15:20 (3)<br>15:36 (3) | 07:59<br>17:25         | 06:59<br>18:19         | 05:40<br>20:16 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 15:20 (3)<br>15:37 (3) | 07:58<br>17:27         | 06:56<br>18:21         | 05:38<br>20:18 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 15:19 (3)<br>15:38 (3) | 07:56<br>17:29         | 06:54<br>18:23         | 05:37<br>20:19 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 15:19 (3)<br>15:39 (3) | 07:54<br>17:31         | 06:52<br>18:25         | 05:35<br>20:21 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:35 | 15:19 (3)<br>15:40 (3) | 07:52<br>17:33         | 16:49 (1)<br>16:55 (1) | 06:49<br>18:27 | 05:33<br>20:23 |
| 14                        | 08:37<br>16:37 | 15:19 (3)<br>15:40 (3) | 07:50<br>17:35         | 16:46 (1)<br>16:58 (1) | 06:47<br>18:28 | 05:31<br>20:25 |
| 15                        | 08:36<br>16:39 | 15:19 (3)<br>15:41 (3) | 07:48<br>17:37         | 16:44 (1)<br>16:59 (1) | 06:45<br>18:30 | 05:30<br>20:27 |
| 16                        | 08:35<br>16:40 | 15:19 (3)<br>15:42 (3) | 07:46<br>17:39         | 16:44 (1)<br>17:01 (1) | 06:42<br>18:32 | 05:28<br>20:28 |
| 17                        | 08:34<br>16:42 | 15:19 (3)<br>15:43 (3) | 07:44<br>17:41         | 16:43 (1)<br>17:01 (1) | 06:40<br>18:34 | 05:26<br>20:30 |
| 18                        | 08:33<br>16:44 | 15:19 (3)<br>16:05 (2) | 07:41<br>17:43         | 16:43 (1)<br>17:02 (1) | 06:37<br>18:36 | 05:25<br>20:32 |
| 19                        | 08:32<br>16:45 | 15:19 (3)<br>16:06 (2) | 07:39<br>17:45         | 16:41 (1)<br>17:02 (1) | 06:35<br>18:38 | 05:23<br>20:34 |
| 20                        | 08:31<br>16:47 | 15:19 (3)<br>16:08 (2) | 07:37<br>17:47         | 16:42 (1)<br>17:02 (1) | 06:33<br>18:40 | 05:22<br>20:36 |
| 21                        | 08:29<br>16:49 | 15:20 (3)<br>16:10 (2) | 07:35<br>17:49         | 16:42 (1)<br>17:02 (1) | 06:30<br>18:41 | 05:20<br>20:37 |
| 22                        | 08:28<br>16:51 | 15:20 (3)<br>16:10 (2) | 07:33<br>17:51         | 16:43 (1)<br>17:02 (1) | 06:28<br>18:43 | 05:19<br>20:39 |
| 23                        | 08:27<br>16:53 | 15:20 (3)<br>16:11 (2) | 07:31<br>17:53         | 16:42 (1)<br>17:00 (1) | 06:25<br>18:45 | 05:18<br>20:41 |
| 24                        | 08:26<br>16:54 | 15:20 (3)<br>16:12 (2) | 07:29<br>17:55         | 16:44 (1)<br>16:59 (1) | 06:23<br>18:47 | 05:16<br>20:43 |
| 25                        | 08:24<br>16:56 | 15:21 (3)<br>16:13 (2) | 07:26<br>17:56         | 16:45 (1)<br>16:58 (1) | 06:20<br>18:49 | 05:15<br>20:45 |
| 26                        | 08:23<br>16:58 | 15:22 (3)<br>16:13 (2) | 07:24<br>17:58         | 16:48 (1)<br>16:55 (1) | 06:18<br>18:50 | 05:14<br>20:46 |
| 27                        | 08:21<br>17:00 | 15:23 (3)<br>16:13 (2) | 07:22<br>18:00         | 06:16<br>18:52         | 06:04<br>20:48 | 05:13<br>21:38 |
| 28                        | 08:20<br>17:02 | 15:23 (3)<br>16:13 (2) | 07:20<br>18:02         | 06:13<br>18:54         | 06:02<br>20:50 | 05:12<br>21:39 |
| 29                        | 08:18<br>17:04 | 15:24 (3)<br>16:13 (2) |                        | 07:11<br>19:56         | 06:00<br>20:52 | 05:10<br>21:40 |
| 30                        | 08:17<br>17:06 | 15:26 (3)<br>16:13 (2) |                        | 07:08<br>19:58         | 05:58<br>20:54 | 05:09<br>21:42 |
| 31                        | 08:15<br>17:08 | 15:28 (3)<br>16:13 (2) |                        | 07:06<br>19:59         | 05:08<br>21:43 | 05:08<br>21:59 |
| Sonnenscheinstunden       | 252            | 274                    | 260                    | 367                    | 419            | 507            |
| astr.max.mögl.Beschattung | 770            |                        |                        |                        |                |                |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** N - Dwoweg 156, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul   | August | September | Oktober |              | November |              | Dezember |              |
|---------------------------|-------|--------|-----------|---------|--------------|----------|--------------|----------|--------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |              | 07:24    |              | 08:18    | 15:01 (3)    |
|                           | 21:59 | 21:24  | 20:19     | 19:07   |              | 16:57    |              | 16:14    | 19 15:20 (3) |
| 2                         | 05:04 | 05:44  | 06:37     | 07:29   |              | 07:26    |              | 08:20    | 15:03 (3)    |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |              | 16:55    |              | 16:14    | 17 15:20 (3) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |              | 07:28    |              | 08:21    | 15:03 (3)    |
|                           | 21:58 | 21:21  | 20:14     | 19:02   |              | 16:54    |              | 16:13    | 16 15:19 (3) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |              | 07:30    |              | 08:23    | 15:05 (3)    |
|                           | 21:57 | 21:19  | 20:12     | 19:00   |              | 16:52    |              | 16:12    | 14 15:19 (3) |
| 5                         | 05:07 | 05:49  | 06:42     | 07:35   |              | 07:32    |              | 08:24    | 15:06 (3)    |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |              | 16:50    |              | 16:12    | 12 15:18 (3) |
| 6                         | 05:08 | 05:51  | 06:44     | 07:36   |              | 07:34    |              | 08:25    | 15:08 (3)    |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |              | 16:48    |              | 16:11    | 10 15:18 (3) |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |              | 07:36    |              | 08:27    | 15:09 (3)    |
|                           | 21:56 | 21:13  | 20:05     | 18:52   |              | 16:46    |              | 16:11    | 8 15:17 (3)  |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |              | 07:38    |              | 08:28    | 15:12 (3)    |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |              | 16:44    | 7 15:32 (2)  | 16:10    | 4 15:16 (3)  |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |              | 07:40    |              | 08:29    |              |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |              | 16:43    | 14 15:41 (2) | 16:10    |              |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |              | 07:42    |              | 08:30    |              |
|                           | 21:53 | 21:08  | 19:58     | 18:45   |              | 16:41    | 25 15:43 (2) | 16:10    |              |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |              | 07:43    |              | 08:32    |              |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |              | 16:39    | 30 15:43 (2) | 16:09    |              |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |              | 07:45    |              | 08:33    |              |
|                           | 21:52 | 21:04  | 19:53     | 18:41   |              | 16:38    | 34 15:44 (2) | 16:09    |              |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |              | 07:47    |              | 08:34    |              |
|                           | 21:51 | 21:01  | 19:50     | 18:38   |              | 16:36    | 38 15:45 (2) | 16:09    |              |
| 14                        | 05:16 | 06:04  | 06:58     | 07:51   |              | 07:49    |              | 08:35    |              |
|                           | 21:50 | 20:59  | 19:48     | 18:36   |              | 16:34    | 40 15:45 (2) | 16:09    |              |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |              | 07:51    |              | 08:36    |              |
|                           | 21:49 | 20:57  | 19:46     | 18:34   |              | 16:33    | 41 15:45 (2) | 16:09    |              |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   | 17:18 (1)    | 07:53    |              | 08:37    |              |
|                           | 21:48 | 20:55  | 19:43     | 18:31   | 10 17:28 (1) | 16:31    | 41 15:45 (2) | 16:09    |              |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   | 17:16 (1)    | 07:55    |              | 08:37    |              |
|                           | 21:46 | 20:53  | 19:41     | 18:29   | 14 17:30 (1) | 16:30    | 43 15:46 (2) | 16:09    |              |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   | 17:14 (1)    | 07:56    |              | 08:38    |              |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 17 17:31 (1) | 16:29    | 43 15:46 (2) | 16:10    |              |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   | 17:13 (1)    | 07:58    |              | 08:39    |              |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 19 17:32 (1) | 16:27    | 42 15:45 (2) | 16:10    |              |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   | 17:13 (1)    | 08:00    |              | 08:40    |              |
|                           | 21:43 | 20:47  | 19:33     | 18:23   | 19 17:32 (1) | 16:26    | 41 15:45 (2) | 16:10    |              |
| 21                        | 05:26 | 06:16  | 07:10     | 08:04   | 17:12 (1)    | 08:02    |              | 08:40    |              |
|                           | 21:41 | 20:44  | 19:31     | 18:20   | 20 17:32 (1) | 16:25    | 40 15:45 (2) | 16:11    |              |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   | 17:12 (1)    | 08:04    |              | 08:41    |              |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 20 17:32 (1) | 16:23    | 37 15:44 (2) | 16:11    |              |
| 23                        | 05:29 | 06:20  | 07:14     | 08:07   | 17:12 (1)    | 08:05    |              | 08:41    |              |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 20 17:32 (1) | 16:22    | 36 15:44 (2) | 16:12    |              |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 17:12 (1)    | 08:07    |              | 08:42    |              |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 19 17:31 (1) | 16:21    | 32 15:42 (2) | 16:12    |              |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 16:13 (1)    | 08:09    |              | 08:42    |              |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 18 16:31 (1) | 16:20    | 24 15:21 (3) | 16:13    |              |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 16:13 (1)    | 08:10    |              | 08:42    |              |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 17 16:30 (1) | 16:19    | 23 15:21 (3) | 16:14    |              |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   | 16:14 (1)    | 08:12    |              | 08:43    |              |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 15 16:29 (1) | 16:18    | 22 15:20 (3) | 16:14    |              |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   | 16:16 (1)    | 08:14    |              | 08:43    |              |
|                           | 21:31 | 20:29  | 19:14     | 17:05   | 11 16:27 (1) | 16:17    | 22 15:21 (3) | 16:15    |              |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   | 16:19 (1)    | 08:15    |              | 08:43    |              |
|                           | 21:30 | 20:26  | 19:12     | 17:03   | 4 16:23 (1)  | 16:16    | 21 15:21 (3) | 16:16    |              |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |              | 08:17    |              | 08:43    |              |
|                           | 21:28 | 20:24  | 19:09     | 17:01   |              | 16:15    | 20 15:21 (3) | 16:17    |              |
| 31                        | 05:41 | 06:34  |           | 07:23   |              |          |              | 08:43    |              |
|                           | 21:26 | 20:22  |           | 16:59   |              |          |              | 16:18    |              |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 223          | 261      | 716          | 100      | 236          |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe  
**Schattenrezeptor:** O - Dwoweg 190, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar         | Februar        | März                   | April                  | Mal            | Juni                   |                |                |
|---------------------------|----------------|----------------|------------------------|------------------------|----------------|------------------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10 | 07:17<br>18:04         | 17:13 (2)<br>17:30 (2) | 07:04<br>20:01 | 18:56 (1)<br>19:12 (1) | 05:56<br>20:55 | 05:07<br>21:44 |
| 2                         | 08:43<br>16:20 | 08:12<br>17:12 | 07:15<br>18:06         | 17:12 (2)<br>17:30 (2) | 07:01<br>20:03 | 18:57 (1)<br>19:10 (1) | 05:54<br>20:57 | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:13 | 07:13<br>18:08         | 17:11 (2)<br>17:30 (2) | 06:59<br>20:05 | 18:59 (1)<br>19:08 (1) | 05:52<br>20:59 | 05:06<br>21:46 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:15 | 07:10<br>18:10         | 17:12 (2)<br>17:31 (2) | 06:56<br>20:07 |                        | 05:50<br>21:01 | 05:05<br>21:47 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17 | 07:08<br>18:12         | 17:11 (2)<br>17:30 (2) | 06:54<br>20:09 |                        | 05:48<br>21:02 | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19 | 07:06<br>18:14         | 17:11 (2)<br>17:29 (2) | 06:52<br>20:10 |                        | 05:46<br>21:04 | 05:03<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21 | 07:03<br>18:15         | 17:11 (2)<br>17:31 (3) | 06:49<br>20:12 |                        | 05:44<br>21:06 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23 | 07:01<br>18:17         | 17:11 (3)<br>17:32 (3) | 06:47<br>20:14 |                        | 05:42<br>21:08 | 05:02<br>21:51 |
| 9                         | 08:40<br>16:29 | 07:59<br>17:25 | 06:59<br>18:19         | 17:10 (3)<br>17:34 (3) | 06:45<br>20:16 |                        | 05:40<br>21:09 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 07:58<br>17:27 | 06:56<br>18:21         | 17:08 (3)<br>17:33 (3) | 06:42<br>20:18 |                        | 05:38<br>21:11 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 07:56<br>17:29 | 06:54<br>18:23         | 17:08 (3)<br>17:34 (3) | 06:40<br>20:19 |                        | 05:37<br>21:13 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 07:54<br>17:31 | 06:52<br>18:25         | 17:06 (3)<br>17:34 (3) | 06:38<br>20:21 |                        | 05:35<br>21:14 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:35 | 07:52<br>17:33 | 06:49<br>18:27         | 17:06 (3)<br>17:34 (3) | 06:35<br>20:23 |                        | 05:33<br>21:16 | 05:00<br>21:55 |
| 14                        | 08:37<br>16:37 | 07:50<br>17:35 | 06:47<br>18:28         | 17:06 (3)<br>17:33 (3) | 06:33<br>20:25 |                        | 05:31<br>21:18 | 05:00<br>21:56 |
| 15                        | 08:36<br>16:39 | 07:48<br>17:37 | 06:45<br>18:30         | 17:06 (3)<br>17:33 (3) | 06:31<br>20:27 |                        | 05:30<br>21:19 | 05:00<br>21:57 |
| 16                        | 08:35<br>16:40 | 07:46<br>17:39 | 06:42<br>18:32         | 17:07 (3)<br>17:33 (3) | 06:28<br>20:28 |                        | 05:28<br>21:21 | 04:59<br>21:57 |
| 17                        | 08:34<br>16:42 | 07:44<br>17:41 | 06:40<br>18:34         | 17:06 (3)<br>17:32 (3) | 06:26<br>20:30 |                        | 05:27<br>21:23 | 04:59<br>21:58 |
| 18                        | 08:33<br>16:44 | 07:41<br>17:43 | 06:37<br>18:36         | 17:07 (3)<br>17:31 (3) | 06:24<br>20:32 |                        | 05:25<br>21:24 | 04:59<br>21:58 |
| 19                        | 08:32<br>16:45 | 07:39<br>17:45 | 06:35<br>18:38         | 17:08 (3)<br>17:29 (3) | 06:21<br>20:34 |                        | 05:23<br>21:26 | 04:59<br>21:59 |
| 20                        | 08:31<br>16:47 | 07:37<br>17:47 | 06:33<br>18:39         | 17:09 (3)<br>17:28 (3) | 06:19<br>20:36 |                        | 05:22<br>21:27 | 04:59<br>21:59 |
| 21                        | 08:29<br>16:49 | 07:35<br>17:49 | 06:30<br>18:41         | 17:11 (3)<br>17:25 (3) | 06:17<br>20:37 |                        | 05:21<br>21:29 | 04:59<br>21:59 |
| 22                        | 08:28<br>16:51 | 07:33<br>17:51 | 06:28<br>18:43         | 17:15 (3)<br>17:21 (3) | 06:15<br>20:39 |                        | 05:19<br>21:30 | 05:00<br>21:59 |
| 23                        | 08:27<br>16:53 | 07:31<br>17:53 | 06:25<br>18:45         | 18:03 (1)<br>18:12 (1) | 06:13<br>20:41 |                        | 05:18<br>21:32 | 05:00<br>21:59 |
| 24                        | 08:26<br>16:54 | 07:29<br>17:55 | 06:23<br>18:47         | 18:00 (1)<br>18:13 (1) | 06:10<br>20:43 |                        | 05:16<br>21:33 | 05:00<br>22:00 |
| 25                        | 08:24<br>16:56 | 07:26<br>17:56 | 06:20<br>18:49         | 17:59 (1)<br>18:15 (1) | 06:08<br>20:45 |                        | 05:15<br>21:35 | 05:01<br>22:00 |
| 26                        | 08:23<br>16:58 | 07:24<br>17:58 | 17:19 (2)<br>17:25 (2) | 17:57 (1)<br>18:15 (1) | 06:06<br>20:46 |                        | 05:14<br>21:36 | 05:01<br>22:00 |
| 27                        | 08:21<br>17:00 | 07:22<br>18:00 | 17:16 (2)<br>17:27 (2) | 17:56 (1)<br>18:15 (1) | 06:04<br>20:48 |                        | 05:13<br>21:38 | 05:01<br>22:00 |
| 28                        | 08:20<br>17:02 | 07:20<br>18:02 | 17:14 (2)<br>17:29 (2) | 17:55 (1)<br>18:15 (1) | 06:02<br>20:50 |                        | 05:12<br>21:39 | 05:02<br>21:59 |
| 29                        | 08:18<br>17:04 |                |                        | 18:55 (1)<br>19:15 (1) | 06:00<br>20:52 |                        | 05:10<br>21:40 | 05:02<br>21:59 |
| 30                        | 08:17<br>17:06 |                |                        | 18:56 (1)<br>19:15 (1) | 05:58<br>20:54 |                        | 05:09<br>21:42 | 05:03<br>21:59 |
| 31                        | 08:15<br>17:08 |                |                        | 18:55 (1)<br>19:13 (1) |                |                        | 05:08<br>21:43 |                |
| Sonnenscheinstunden       | 253            | 274            | 367                    | 419                    | 38             |                        | 491            | 507            |
| astr.max.mögl.Beschattung |                | 32             | 624                    |                        |                |                        |                |                |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** O - Dwoweg 190, Lehmden

### Voraussetzungen für Berechnung des Schattenwurfs

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | [Juli]         | [August]       | [September]    |     | [Oktober]              |     | [November]             | [Dezember]     |
|---------------------------|----------------|----------------|----------------|-----|------------------------|-----|------------------------|----------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 |     | 07:28<br>19:07         | 28  | 17:46 (3)<br>18:14 (3) | 07:24<br>16:57 |
| 2                         | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 |     | 07:29<br>19:04         | 27  | 17:45 (3)<br>18:12 (3) | 07:26<br>16:55 |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 |     | 07:31<br>19:02         | 26  | 17:46 (3)<br>18:12 (3) | 07:28<br>16:54 |
| 4                         | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 |     | 07:33<br>19:00         | 25  | 17:46 (3)<br>18:11 (3) | 07:30<br>16:52 |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 |     | 07:35<br>18:57         | 23  | 17:47 (3)<br>18:10 (3) | 07:32<br>16:50 |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 |     | 07:36<br>18:55         | 20  | 17:48 (3)<br>18:08 (3) | 07:34<br>16:48 |
| 7                         | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 |     | 07:38<br>18:52         | 19  | 17:47 (2)<br>18:06 (3) | 07:36<br>16:46 |
| 8                         | 05:10<br>21:55 | 05:54<br>21:11 | 06:48<br>20:03 |     | 07:40<br>18:50         | 19  | 17:46 (2)<br>18:05 (2) | 07:38<br>16:44 |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 9   | 18:53 (1)<br>19:02 (1) | 19  | 17:46 (2)<br>18:05 (2) | 07:40<br>16:43 |
| 10                        | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 13  | 18:50 (1)<br>19:03 (1) | 19  | 17:46 (2)<br>18:05 (2) | 07:42<br>16:41 |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 16  | 18:49 (1)<br>19:05 (1) | 18  | 17:46 (2)<br>18:04 (2) | 07:43<br>16:39 |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 17  | 18:48 (1)<br>19:05 (1) | 18  | 17:46 (2)<br>18:04 (2) | 07:45<br>16:38 |
| 13                        | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 19  | 18:46 (1)<br>19:05 (1) | 16  | 17:47 (2)<br>18:03 (2) | 07:47<br>16:36 |
| 14                        | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 19  | 18:46 (1)<br>19:05 (1) | 13  | 17:48 (2)<br>18:01 (2) | 07:49<br>16:34 |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 19  | 18:46 (1)<br>19:05 (1) | 9   | 17:49 (2)<br>17:58 (2) | 07:51<br>16:33 |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 19  | 18:46 (1)<br>19:05 (1) |     |                        | 07:53<br>16:31 |
| 17                        | 05:20<br>21:46 | 06:10<br>20:53 | 07:03<br>19:41 | 18  | 18:45 (1)<br>19:03 (1) |     |                        | 07:55<br>16:30 |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 16  | 18:46 (1)<br>19:02 (1) |     |                        | 07:58<br>16:29 |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 14  | 18:47 (1)<br>19:01 (1) |     |                        | 08:00<br>16:27 |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 10  | 18:48 (1)<br>18:58 (1) |     |                        | 08:02<br>16:26 |
| 21                        | 05:26<br>21:41 | 06:16<br>20:44 | 07:10<br>19:31 | 1   | 18:52 (1)<br>18:53 (1) |     |                        | 08:04<br>16:25 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 13  | 17:57 (3)<br>18:10 (3) |     |                        | 08:06<br>16:23 |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 18  | 17:53 (3)<br>18:11 (3) |     |                        | 08:07<br>16:22 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 20  | 17:52 (3)<br>18:12 (3) |     |                        | 08:09<br>16:21 |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 23  | 17:50 (3)<br>18:13 (3) |     |                        | 08:11<br>16:20 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 25  | 17:49 (3)<br>18:14 (3) |     |                        | 08:13<br>16:19 |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 27  | 17:47 (3)<br>18:14 (3) |     |                        | 08:15<br>16:18 |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 27  | 17:47 (3)<br>18:14 (3) |     |                        | 08:17<br>16:17 |
| 29                        | 05:38<br>21:29 | 06:30<br>20:26 | 07:24<br>19:12 | 28  | 17:46 (3)<br>18:14 (3) |     |                        | 08:19<br>16:16 |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 28  | 17:46 (3)<br>18:14 (3) |     |                        | 08:21<br>16:15 |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                |     | 07:23<br>16:59         |     |                        | 08:23<br>16:18 |
| Sonnenscheinstunden       | 509            | 458            | 382            | 399 | 329                    | 299 | 261                    | 236            |
| astr.max.mögl.Beschattung |                |                |                |     |                        |     |                        |                |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** P - Weidenstr. 73, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                                                     | Januar         | Februar        | März           | April          | Mai                | Juni           | Juli           | August         | September      | Oktober                | November       | Dzember        |
|-----------------------------------------------------|----------------|----------------|----------------|----------------|--------------------|----------------|----------------|----------------|----------------|------------------------|----------------|----------------|
| 1                                                   | 08:43<br>16:19 | 08:14<br>17:10 | 07:17<br>18:04 | 07:04<br>20:01 | 19:09 (3)<br>20:55 | 05:07<br>21:44 | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 19:30 (1)<br>19:44 (1) | 07:28<br>19:07 | 07:24<br>16:14 |
| 2                                                   | 08:43<br>16:20 | 08:12<br>17:12 | 07:15<br>18:06 | 07:01<br>20:03 | 19:07 (3)<br>20:57 | 05:07<br>21:45 | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 19:42 (1)<br>19:43 (1) | 07:29<br>19:04 | 06:20<br>16:14 |
| 3                                                   | 08:42<br>16:22 | 08:10<br>17:13 | 07:13<br>18:08 | 06:59<br>20:05 | 19:07 (3)<br>20:59 | 05:06<br>21:46 | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 | 19:09 (3)<br>19:43 (1) | 07:31<br>19:02 | 06:21<br>16:13 |
| 4                                                   | 08:42<br>16:23 | 08:09<br>17:15 | 07:10<br>18:10 | 06:56<br>20:07 | 19:07 (3)<br>21:01 | 05:06<br>21:47 | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 19:06 (3)<br>19:42 (1) | 07:33<br>19:00 | 06:23<br>16:12 |
| 5                                                   | 08:42<br>16:24 | 08:07<br>17:17 | 07:08<br>18:12 | 06:54<br>20:08 | 19:07 (3)<br>21:02 | 05:04<br>21:49 | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 19:04 (3)<br>19:41 (1) | 07:35<br>18:57 | 06:24<br>16:10 |
| 6                                                   | 08:42<br>16:25 | 08:05<br>17:19 | 07:06<br>18:14 | 06:52<br>20:10 | 19:07 (3)<br>21:04 | 05:03<br>21:50 | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 19:03 (3)<br>19:40 (1) | 07:36<br>18:55 | 06:25<br>16:11 |
| 7                                                   | 08:41<br>16:27 | 08:03<br>17:21 | 07:03<br>18:15 | 06:49<br>20:12 | 19:06 (3)<br>21:06 | 05:03<br>21:51 | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 19:02 (3)<br>19:36 (1) | 07:38<br>18:52 | 06:27<br>16:11 |
| 8                                                   | 08:41<br>16:28 | 08:01<br>17:23 | 07:01<br>18:17 | 06:47<br>20:14 | 19:09 (3)<br>21:08 | 05:02<br>21:51 | 05:10<br>21:55 | 05:54<br>21:11 | 06:48<br>20:03 | 19:01 (3)<br>19:21 (3) | 07:40<br>18:50 | 06:28<br>16:10 |
| 9                                                   | 08:40<br>16:29 | 07:59<br>17:25 | 06:59<br>18:19 | 06:45<br>20:16 | 19:11 (3)<br>21:09 | 05:02<br>21:52 | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 19:01 (3)<br>19:21 (3) | 07:42<br>18:48 | 06:29<br>16:10 |
| 10                                                  | 08:39<br>16:31 | 07:58<br>17:27 | 06:56<br>18:21 | 06:42<br>20:18 | 19:13 (1)<br>21:11 | 05:01<br>21:53 | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 19:00 (3)<br>19:20 (3) | 07:44<br>18:45 | 06:30<br>16:10 |
| 11                                                  | 08:39<br>16:32 | 07:56<br>17:29 | 06:54<br>18:23 | 06:40<br>20:19 | 19:10 (1)<br>21:13 | 05:01<br>21:54 | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 19:01 (3)<br>19:19 (3) | 07:45<br>18:43 | 06:32<br>16:09 |
| 12                                                  | 08:38<br>16:34 | 07:54<br>17:31 | 06:52<br>18:25 | 06:37<br>20:21 | 19:11 (1)<br>21:14 | 05:00<br>21:55 | 05:14<br>21:52 | 06:01<br>21:04 | 06:54<br>19:53 | 19:01 (3)<br>19:18 (3) | 07:47<br>18:41 | 06:33<br>16:09 |
| 13                                                  | 08:37<br>16:35 | 07:52<br>17:33 | 06:49<br>18:27 | 06:35<br>20:23 | 19:12 (1)<br>21:16 | 05:00<br>21:55 | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 19:01 (3)<br>19:16 (3) | 07:49<br>18:38 | 06:34<br>16:09 |
| 14                                                  | 08:37<br>16:36 | 07:50<br>17:35 | 06:47<br>18:28 | 06:33<br>20:25 | 19:13 (1)<br>21:18 | 05:00<br>21:56 | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 19:03 (3)<br>19:15 (3) | 07:51<br>18:35 | 06:35<br>16:09 |
| 15                                                  | 08:36<br>16:37 | 07:48<br>17:37 | 06:45<br>18:30 | 06:31<br>20:27 | 19:14 (1)<br>21:19 | 05:00<br>21:57 | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 19:06 (3)<br>19:11 (3) | 07:53<br>18:34 | 06:36<br>16:09 |
| 16                                                  | 08:35<br>16:40 | 07:46<br>17:39 | 06:42<br>18:32 | 06:28<br>20:28 | 19:15 (1)<br>21:21 | 05:00<br>21:57 | 05:18<br>21:48 | 06:06<br>20:55 | 07:01<br>19:43 | 19:07 (3)<br>19:13 (3) | 07:54<br>18:31 | 06:37<br>16:09 |
| 17                                                  | 08:34<br>16:42 | 07:44<br>17:41 | 06:40<br>18:34 | 06:25<br>20:30 | 19:16 (1)<br>21:23 | 05:00<br>21:58 | 05:19<br>21:46 | 06:08<br>20:53 | 07:03<br>19:41 | 19:08 (3)<br>19:15 (3) | 07:56<br>18:29 | 06:38<br>16:09 |
| 18                                                  | 08:33<br>16:44 | 07:41<br>17:43 | 06:37<br>18:36 | 06:21<br>20:32 | 19:17 (1)<br>21:24 | 05:00<br>21:58 | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 19:09 (3)<br>19:16 (3) | 07:58<br>18:27 | 06:39<br>16:10 |
| 19                                                  | 08:32<br>16:45 | 07:39<br>17:45 | 06:35<br>18:39 | 06:19<br>20:34 | 19:18 (1)<br>21:26 | 05:00<br>21:58 | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 19:10 (3)<br>19:17 (3) | 08:00<br>18:25 | 06:40<br>16:10 |
| 20                                                  | 08:30<br>16:47 | 07:37<br>17:47 | 06:33<br>18:39 | 06:17<br>20:36 | 19:19 (1)<br>21:27 | 05:00<br>21:59 | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 19:11 (3)<br>19:18 (3) | 08:02<br>18:23 | 06:41<br>16:10 |
| 21                                                  | 08:29<br>16:49 | 07:35<br>17:49 | 06:30<br>18:41 | 06:17<br>20:37 | 19:20 (1)<br>21:29 | 05:00<br>21:59 | 05:26<br>21:41 | 06:16<br>20:44 | 07:10<br>19:31 | 19:12 (3)<br>19:19 (3) | 08:04<br>18:20 | 06:42<br>16:11 |
| 22                                                  | 08:28<br>16:51 | 07:33<br>17:51 | 06:28<br>18:43 | 06:15<br>20:39 | 19:21 (1)<br>21:32 | 05:00<br>21:59 | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 19:13 (3)<br>19:20 (3) | 08:06<br>18:16 | 06:43<br>16:12 |
| 23                                                  | 08:27<br>16:53 | 07:31<br>17:53 | 06:25<br>18:45 | 06:13<br>20:41 | 19:22 (1)<br>21:33 | 05:00<br>21:59 | 05:28<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 19:14 (3)<br>19:21 (3) | 08:07<br>18:16 | 06:44<br>16:12 |
| 24                                                  | 08:26<br>16:54 | 07:29<br>17:55 | 06:23<br>18:47 | 06:10<br>20:43 | 19:23 (1)<br>21:34 | 05:00<br>22:00 | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 19:15 (3)<br>19:22 (3) | 08:09<br>18:14 | 06:45<br>16:12 |
| 25                                                  | 08:24<br>16:56 | 07:26<br>17:56 | 06:20<br>18:49 | 06:08<br>20:45 | 19:24 (1)<br>21:35 | 05:00<br>22:00 | 05:32<br>21:36 | 06:23<br>20:36 | 07:17<br>19:21 | 19:16 (3)<br>19:23 (3) | 08:11<br>18:12 | 06:46<br>16:13 |
| 26                                                  | 08:23<br>16:58 | 07:24<br>17:58 | 06:18<br>18:50 | 06:06<br>20:46 | 19:25 (1)<br>21:36 | 05:00<br>22:00 | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 19:24 (3)<br>19:31 (3) | 08:13<br>18:10 | 06:47<br>16:14 |
| 27                                                  | 08:21<br>17:00 | 07:22<br>18:00 | 06:16<br>18:52 | 06:04<br>20:48 | 19:26 (1)<br>21:37 | 05:00<br>22:00 | 05:34<br>21:33 | 06:27<br>20:31 | 07:22<br>19:16 | 19:25 (3)<br>19:32 (3) | 08:15<br>18:08 | 06:48<br>16:14 |
| 28                                                  | 08:20<br>17:02 | 07:20<br>18:02 | 06:13<br>18:54 | 06:02<br>20:49 | 19:27 (1)<br>21:38 | 05:00<br>22:00 | 05:36<br>21:31 | 06:29<br>20:28 | 07:23<br>19:14 | 19:26 (3)<br>19:33 (3) | 08:17<br>18:09 | 06:49<br>16:15 |
| 29                                                  | 08:18<br>17:04 | 07:11<br>18:04 | 06:11<br>18:56 | 06:00<br>20:52 | 19:28 (1)<br>21:39 | 05:00<br>22:00 | 05:37<br>21:29 | 06:30<br>20:26 | 07:24<br>19:12 | 19:27 (3)<br>19:34 (3) | 08:19<br>18:07 | 06:50<br>16:16 |
| 30                                                  | 08:17<br>17:06 | 07:08<br>18:06 | 06:10<br>19:01 | 05:58<br>20:54 | 19:29 (1)<br>21:40 | 05:00<br>22:00 | 05:38<br>21:28 | 06:31<br>20:24 | 07:25<br>19:10 | 19:28 (3)<br>19:35 (3) | 08:21<br>18:05 | 06:51<br>16:17 |
| 31                                                  | 08:15<br>17:08 | 07:06<br>18:09 | 06:09<br>19:09 | 05:57<br>20:54 | 19:30 (1)<br>21:41 | 05:00<br>22:00 | 05:40<br>21:26 | 06:32<br>20:22 | 07:26<br>19:14 | 19:29 (3)<br>19:36 (3) | 08:23<br>18:03 | 06:52<br>16:18 |
| Sonnenscheinstunden<br>astr. max. mögl. Beschattung | 253            | 274            | 367            | 419            | 491                | 507            | 509            | 456            | 34             | 382                    | 396            | 236            |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** Q - Strothweg 20, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                              | Januar         | Februar        | März           | April          | Mai            | Juni           | Juli           | August         | September      | Oktober        | November       | Dezember       |
|------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1                            | 08:43<br>16:19 | 08:14<br>17:10 | 07:17<br>18:04 | 07:04<br>20:01 | 05:56<br>20:55 | 05:08<br>21:44 | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 07:28<br>19:07 | 07:24<br>16:57 | 08:18<br>16:14 |
| 2                            | 08:43<br>16:21 | 08:12<br>17:12 | 07:15<br>18:06 | 07:01<br>20:03 | 05:54<br>20:57 | 05:07<br>21:45 | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:56 | 08:20<br>16:14 |
| 3                            | 08:42<br>16:22 | 08:10<br>17:14 | 07:13<br>18:08 | 06:59<br>20:05 | 05:52<br>20:59 | 05:06<br>21:46 | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 | 07:31<br>19:02 | 07:28<br>16:54 | 08:21<br>16:13 |
| 4                            | 08:42<br>16:23 | 08:09<br>17:15 | 07:10<br>18:10 | 06:56<br>20:07 | 05:50<br>21:01 | 05:05<br>21:47 | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52 | 08:23<br>16:12 |
| 5                            | 08:42<br>16:24 | 08:07<br>17:17 | 07:08<br>18:12 | 06:54<br>20:08 | 05:48<br>21:02 | 05:04<br>21:48 | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50 | 08:24<br>16:12 |
| 6                            | 08:42<br>16:25 | 08:05<br>17:19 | 07:06<br>18:14 | 06:52<br>20:10 | 05:46<br>21:04 | 05:03<br>21:50 | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 07:34<br>16:48 | 08:25<br>16:11 |
| 7                            | 08:41<br>16:27 | 08:03<br>17:21 | 07:03<br>18:15 | 06:49<br>20:12 | 05:44<br>21:06 | 05:03<br>21:50 | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 07:38<br>18:52 | 07:36<br>16:46 | 08:27<br>16:11 |
| 8                            | 08:41<br>16:28 | 08:01<br>17:23 | 07:01<br>18:17 | 06:47<br>20:14 | 05:42<br>21:08 | 05:02<br>21:51 | 05:10<br>21:55 | 05:54<br>21:11 | 06:48<br>20:03 | 07:40<br>18:50 | 07:38<br>16:44 | 08:28<br>16:10 |
| 9                            | 08:40<br>16:29 | 07:59<br>17:25 | 06:59<br>18:19 | 06:45<br>20:16 | 05:40<br>21:09 | 05:02<br>21:52 | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 07:40<br>16:43 | 08:29<br>16:10 |
| 10                           | 08:39<br>16:31 | 07:58<br>17:27 | 06:56<br>18:21 | 06:42<br>20:18 | 05:38<br>21:11 | 05:01<br>21:53 | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 07:42<br>16:41 | 08:30<br>16:10 |
| 11                           | 08:39<br>16:32 | 07:56<br>17:29 | 06:54<br>18:23 | 06:40<br>20:19 | 05:37<br>21:13 | 05:01<br>21:54 | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 07:43<br>16:39 | 08:31<br>16:10 |
| 12                           | 08:38<br>16:34 | 07:54<br>17:31 | 06:52<br>18:25 | 06:38<br>20:21 | 05:35<br>21:14 | 05:00<br>21:55 | 05:14<br>21:52 | 06:01<br>21:03 | 06:55<br>19:53 | 07:47<br>18:41 | 07:45<br>16:38 | 08:33<br>16:09 |
| 13                           | 08:37<br>16:36 | 07:52<br>17:33 | 06:49<br>18:27 | 06:35<br>20:23 | 05:33<br>21:16 | 05:00<br>21:55 | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 07:49<br>18:38 | 07:47<br>16:36 | 08:34<br>16:09 |
| 14                           | 08:36<br>16:37 | 07:50<br>17:35 | 06:47<br>18:28 | 06:33<br>20:25 | 05:31<br>21:18 | 05:00<br>21:56 | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 07:49<br>16:34 | 08:35<br>16:09 |
| 15                           | 08:36<br>16:39 | 07:48<br>17:37 | 06:45<br>18:30 | 06:31<br>20:27 | 05:30<br>21:19 | 05:00<br>21:57 | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 07:51<br>16:33 | 08:36<br>16:09 |
| 16                           | 08:35<br>16:40 | 07:46<br>17:39 | 06:42<br>18:32 | 06:28<br>20:28 | 05:28<br>21:21 | 04:59<br>21:57 | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:54<br>18:32 | 07:53<br>16:31 | 08:36<br>16:09 |
| 17                           | 08:34<br>16:42 | 07:44<br>17:41 | 06:40<br>18:34 | 06:26<br>20:30 | 05:27<br>21:23 | 04:59<br>21:58 | 05:20<br>21:46 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 07:54<br>16:30 | 08:37<br>16:10 |
| 18                           | 08:33<br>16:44 | 07:41<br>17:43 | 06:37<br>18:36 | 06:24<br>20:32 | 05:25<br>21:24 | 04:59<br>21:58 | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 07:56<br>16:29 | 08:38<br>16:10 |
| 19                           | 08:32<br>16:45 | 07:39<br>17:45 | 06:35<br>18:38 | 06:22<br>20:34 | 05:23<br>21:26 | 04:59<br>21:58 | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 07:58<br>16:27 | 08:39<br>16:10 |
| 20                           | 08:30<br>16:47 | 07:37<br>17:47 | 06:33<br>18:39 | 06:19<br>20:36 | 05:22<br>21:27 | 04:59<br>21:59 | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 08:00<br>16:26 | 08:39<br>16:10 |
| 21                           | 08:29<br>16:49 | 07:35<br>17:49 | 06:30<br>18:41 | 06:17<br>20:37 | 05:21<br>21:29 | 05:00<br>21:59 | 05:26<br>21:41 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:02<br>16:25 | 08:40<br>16:11 |
| 22                           | 08:28<br>16:51 | 07:33<br>17:51 | 06:28<br>18:43 | 06:15<br>20:39 | 05:19<br>21:30 | 05:00<br>21:59 | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 08:03<br>16:23 | 08:41<br>16:11 |
| 23                           | 08:27<br>16:53 | 07:31<br>17:53 | 06:25<br>18:45 | 06:13<br>20:41 | 05:18<br>21:32 | 05:00<br>21:59 | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:07<br>18:16 | 08:05<br>16:22 | 08:41<br>16:12 |
| 24                           | 08:26<br>16:54 | 07:29<br>17:55 | 06:23<br>18:47 | 06:10<br>20:43 | 05:16<br>21:33 | 05:00<br>21:59 | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 08:07<br>16:21 | 08:41<br>16:12 |
| 25                           | 08:24<br>16:56 | 07:26<br>17:56 | 06:20<br>18:49 | 06:08<br>20:45 | 05:15<br>21:35 | 05:01<br>22:00 | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 08:09<br>16:20 | 08:42<br>16:13 |
| 26                           | 08:23<br>16:58 | 07:24<br>17:58 | 06:18<br>18:50 | 06:06<br>20:46 | 05:14<br>21:36 | 05:01<br>22:00 | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 08:10<br>16:19 | 08:42<br>16:14 |
| 27                           | 08:21<br>17:00 | 07:22<br>18:00 | 06:16<br>18:52 | 06:04<br>20:48 | 05:13<br>21:38 | 05:01<br>21:59 | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 08:12<br>16:18 | 08:42<br>16:14 |
| 28                           | 08:20<br>17:02 | 07:20<br>18:02 | 06:13<br>18:54 | 06:02<br>20:50 | 05:12<br>21:39 | 05:02<br>21:59 | 05:36<br>21:31 | 06:29<br>20:28 | 07:22<br>19:14 | 08:17<br>17:05 | 08:14<br>16:17 | 08:43<br>16:15 |
| 29                           | 08:18<br>17:04 |                | 07:11<br>19:56 | 06:00<br>20:52 | 05:11<br>21:40 | 05:03<br>21:59 | 05:38<br>21:29 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:03 | 08:15<br>16:16 | 08:43<br>16:16 |
| 30                           | 08:17<br>17:06 |                | 07:08<br>19:58 | 05:58<br>20:54 | 05:09<br>21:42 | 05:03<br>21:59 | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 08:17<br>16:15 | 08:43<br>16:17 |
| 31                           | 08:15<br>17:08 |                | 07:06<br>19:59 |                | 05:08<br>21:43 |                | 05:41<br>21:26 | 06:34<br>20:22 |                | 07:23<br>16:59 |                | 08:43<br>16:18 |
| Sonnenscheinstunden          | 253            | 274            | 367            | 419            | 491            | 507            | 509            | 458            | 382            | 329            | 261            | 236            |
| astr. max. mögl. Beschattung |                |                |                |                |                |                |                |                |                |                |                |                |

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

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

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** R - Hohe Looe 2-8 (BÜFA GmbH)  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                              | [Januar | [Februar | [März | [April | [Mai  | [Juni | [Juli     | [August   | [September | [Oktober  | [November | [Dezember |       |       |
|------------------------------|---------|----------|-------|--------|-------|-------|-----------|-----------|------------|-----------|-----------|-----------|-------|-------|
| 1                            | 08:43   | 08:14    | 07:17 | 07:04  | 05:56 | 05:08 | 05:04     | 05:36 (1) | 05:43      | 06:13 (2) | 06:36     | 07:28     | 07:25 | 08:18 |
| 2                            | 16:20   | 17:10    | 18:04 | 20:01  | 20:55 | 21:44 | 21:59     | 05:37 (1) | 21:25      | 6         | 06:19 (2) | 20:19     | 19:07 | 16:58 |
| 3                            | 08:43   | 08:12    | 07:15 | 07:01  | 05:54 | 05:07 | 05:05     | 05:37     | 05:44      | 06:14 (2) | 06:37     | 07:29     | 07:26 | 08:20 |
| 4                            | 16:21   | 17:12    | 18:06 | 20:03  | 20:57 | 21:45 | 21:58     | 05:38     | 05:46      | 06:18 (2) | 06:39     | 07:31     | 07:28 | 08:21 |
| 5                            | 08:42   | 08:10    | 07:13 | 06:59  | 05:52 | 05:06 | 05:05     | 05:39     | 05:46      | 06:16 (2) | 06:39     | 07:31     | 07:28 | 08:21 |
| 6                            | 16:22   | 17:14    | 18:08 | 20:05  | 20:59 | 21:46 | 21:58     | 05:40     | 05:48      | 06:17 (2) | 06:40     | 07:32     | 07:29 | 08:22 |
| 7                            | 08:42   | 08:09    | 07:11 | 06:57  | 05:50 | 05:05 | 05:06     | 05:41     | 05:48      | 06:18 (2) | 06:41     | 07:33     | 07:30 | 08:23 |
| 8                            | 16:23   | 17:16    | 18:10 | 20:07  | 21:01 | 21:48 | 21:57     | 05:43     | 05:50      | 06:19 (2) | 06:42     | 07:34     | 07:31 | 08:24 |
| 9                            | 08:42   | 08:07    | 07:08 | 06:54  | 05:48 | 05:04 | 05:07     | 05:44     | 05:51      | 06:20 (2) | 06:43     | 07:35     | 07:32 | 08:24 |
| 10                           | 16:24   | 17:18    | 18:12 | 20:09  | 21:02 | 21:49 | 21:57     | 05:46     | 05:53      | 06:21 (2) | 06:44     | 07:36     | 07:33 | 08:25 |
| 11                           | 08:42   | 08:05    | 07:06 | 06:52  | 05:46 | 05:04 | 05:06     | 05:47     | 05:54      | 06:22 (2) | 06:45     | 07:37     | 07:34 | 08:26 |
| 12                           | 16:25   | 17:19    | 18:14 | 20:10  | 21:04 | 21:50 | 21:56     | 05:49     | 05:56      | 06:23 (2) | 06:46     | 07:38     | 07:35 | 08:27 |
| 13                           | 08:41   | 08:03    | 07:04 | 06:49  | 05:44 | 05:03 | 05:09     | 05:48     | 05:55      | 06:24 (2) | 06:47     | 07:39     | 07:36 | 08:27 |
| 14                           | 16:27   | 17:21    | 18:16 | 20:12  | 21:06 | 21:51 | 21:56     | 05:51     | 05:58      | 06:25 (2) | 06:48     | 07:40     | 07:37 | 08:28 |
| 15                           | 08:41   | 08:01    | 07:01 | 06:47  | 05:42 | 05:02 | 05:10     | 05:50     | 05:57      | 06:26 (2) | 06:49     | 07:40     | 07:38 | 08:28 |
| 16                           | 16:28   | 17:23    | 18:17 | 20:14  | 21:08 | 21:52 | 21:55     | 05:52     | 05:59      | 06:27 (2) | 06:50     | 07:41     | 07:39 | 08:29 |
| 17                           | 08:40   | 08:00    | 06:59 | 06:45  | 05:40 | 05:02 | 05:11     | 05:51     | 05:58      | 06:28 (2) | 06:51     | 07:42     | 07:40 | 08:29 |
| 18                           | 16:30   | 17:25    | 18:19 | 20:16  | 21:09 | 21:52 | 21:54     | 05:53     | 05:59      | 06:29 (2) | 06:52     | 07:43     | 07:41 | 08:30 |
| 19                           | 08:40   | 07:58    | 06:57 | 06:42  | 05:39 | 05:01 | 05:12     | 05:54     | 05:59      | 06:30 (2) | 06:53     | 07:44     | 07:42 | 08:30 |
| 20                           | 16:31   | 17:27    | 18:21 | 20:18  | 21:11 | 2     | 05:07 (2) | 21:53     | 05:59      | 06:31 (2) | 06:54     | 07:45     | 07:43 | 08:31 |
| 21                           | 08:39   | 07:56    | 06:54 | 06:40  | 05:37 | 05:03 | 05:13     | 05:55     | 05:59      | 06:32 (2) | 06:55     | 07:46     | 07:44 | 08:32 |
| 22                           | 16:33   | 17:29    | 18:23 | 20:19  | 21:13 | 5     | 05:08 (2) | 21:54     | 05:59      | 06:33 (2) | 06:56     | 07:47     | 07:45 | 08:33 |
| 23                           | 08:38   | 07:54    | 06:52 | 06:38  | 05:35 | 05:02 | 05:14     | 05:56     | 05:59      | 06:34 (2) | 06:57     | 07:47     | 07:45 | 08:33 |
| 24                           | 16:34   | 17:31    | 18:25 | 20:21  | 21:15 | 7     | 05:09 (2) | 21:55     | 05:59      | 06:35 (2) | 06:58     | 07:48     | 07:46 | 08:34 |
| 25                           | 08:37   | 07:52    | 06:49 | 06:35  | 05:33 | 05:00 | 05:15     | 05:57     | 05:59      | 06:36 (2) | 06:59     | 07:49     | 07:47 | 08:34 |
| 26                           | 16:36   | 17:33    | 18:27 | 20:23  | 21:16 | 10    | 05:10 (2) | 21:56     | 05:59      | 06:37 (2) | 07:00     | 07:50     | 07:48 | 08:35 |
| 27                           | 08:37   | 07:50    | 06:47 | 06:33  | 05:32 | 05:00 | 05:17     | 05:58     | 05:59      | 06:38 (2) | 07:01     | 07:51     | 07:49 | 08:35 |
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| 29                           | 08:36   | 07:48    | 06:45 | 06:31  | 05:30 | 05:00 | 05:18     | 05:59     | 05:59      | 06:40 (2) | 07:03     | 07:53     | 07:51 | 08:36 |
| 30                           | 16:39   | 17:37    | 18:30 | 20:27  | 21:20 | 13    | 05:10 (2) | 21:57     | 05:59      | 06:41 (2) | 07:04     | 07:54     | 07:52 | 08:37 |
| 31                           | 08:35   | 07:46    | 06:42 | 06:28  | 05:28 | 05:00 | 05:19     | 05:59     | 05:59      | 06:42 (2) | 07:05     | 07:55     | 07:53 | 08:37 |
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| 33                           | 08:34   | 07:44    | 06:40 | 06:26  | 05:27 | 05:00 | 05:19     | 05:59     | 05:59      | 06:44 (2) | 07:07     | 07:57     | 07:55 | 08:37 |
| 34                           | 16:42   | 17:41    | 18:34 | 20:30  | 21:23 | 15    | 05:10 (2) | 21:56     | 05:59      | 06:45 (2) | 07:08     | 07:58     | 07:56 | 08:38 |
| 35                           | 08:33   | 07:42    | 06:37 | 06:24  | 05:26 | 05:00 | 05:19     | 05:59     | 05:59      | 06:46 (2) | 07:09     | 07:59     | 07:57 | 08:38 |
| 36                           | 16:44   | 17:43    | 18:36 | 20:32  | 21:24 | 14    | 05:10 (2) | 21:56     | 05:59      | 06:47 (2) | 07:10     | 08:00     | 07:58 | 08:39 |
| 37                           | 08:32   | 07:39    | 06:35 | 06:22  | 05:24 | 05:00 | 05:19     | 05:59     | 05:59      | 06:48 (2) | 07:11     | 08:01     | 07:59 | 08:39 |
| 38                           | 16:46   | 17:45    | 18:38 | 20:34  | 21:26 | 14    | 05:11 (2) | 21:59     | 05:59      | 06:49 (2) | 07:12     | 08:02     | 08:00 | 08:40 |
| 39                           | 08:31   | 07:37    | 06:33 | 06:19  | 05:22 | 05:00 | 05:19     | 05:59     | 05:59      | 06:50 (2) | 07:13     | 08:03     | 08:01 | 08:40 |
| 40                           | 16:47   | 17:47    | 18:40 | 20:36  | 21:27 | 13    | 05:09 (2) | 21:59     | 05:59      | 06:51 (2) | 07:14     | 08:04     | 08:02 | 08:40 |
| 41                           | 08:29   | 07:35    | 06:30 | 06:17  | 05:21 | 05:00 | 05:19     | 05:59     | 05:59      | 06:52 (2) | 07:15     | 08:05     | 08:03 | 08:40 |
| 42                           | 16:49   | 17:49    | 18:41 | 20:37  | 21:29 | 12    | 05:08 (2) | 21:59     | 05:59      | 06:53 (2) | 07:16     | 08:06     | 08:04 | 08:41 |
| 43                           | 08:28   | 07:33    | 06:28 | 06:15  | 05:19 | 05:00 | 05:19     | 05:59     | 05:59      | 06:54 (2) | 07:17     | 08:07     | 08:05 | 08:41 |
| 44                           | 16:51   | 17:51    | 18:43 | 20:39  | 21:31 | 11    | 05:09 (2) | 21:59     | 05:59      | 06:55 (2) | 07:18     | 08:08     | 08:06 | 08:41 |
| 45                           | 08:27   | 07:31    | 06:25 | 06:13  | 05:18 | 05:00 | 05:19     | 05:59     | 05:59      | 06:56 (2) | 07:19     | 08:09     | 08:07 | 08:41 |
| 46                           | 16:53   | 17:53    | 18:45 | 20:41  | 21:32 | 8     | 05:07 (2) | 22:00     | 05:59      | 06:57 (2) | 07:20     | 08:10     | 08:08 | 08:41 |
| 47                           | 08:26   | 07:29    | 06:23 | 06:11  | 05:17 | 05:00 | 05:19     | 05:59     | 05:59      | 06:58 (2) | 07:21     | 08:11     | 08:09 | 08:42 |
| 48                           | 16:55   | 17:55    | 18:47 | 20:43  | 21:33 | 6     | 05:06 (2) | 22:00     | 05:59      | 06:59 (2) | 07:22     | 08:12     | 08:10 | 08:42 |
| 49                           | 08:24   | 07:26    | 06:21 | 06:08  | 05:15 | 05:01 | 05:19     | 05:59     | 05:59      | 07:00 (2) | 07:23     | 08:13     | 08:11 | 08:42 |
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| 51                           | 08:23   | 07:24    | 06:18 | 06:06  | 05:14 | 05:01 | 05:33 (1) | 21:33     | 05:59      | 07:02 (2) | 07:25     | 08:15     | 08:13 | 08:43 |
| 52                           | 16:58   | 17:59    | 18:51 | 20:46  | 21:36 | 22:00 | 05:37 (1) | 21:34     | 05:59      | 07:03 (2) | 07:26     | 08:16     | 08:14 | 08:43 |
| 53                           | 08:21   | 07:22    | 06:16 | 06:04  | 05:13 | 05:02 | 05:34 (1) | 21:35     | 05:59      | 07:04 (2) | 07:27     | 08:17     | 08:15 | 08:43 |
| 54                           | 17:00   | 18:00    | 18:52 | 20:48  | 21:38 | 22:00 | 05:38 (1) | 21:33     | 05:59      | 07:05 (2) | 07:28     | 08:18     | 08:16 | 08:43 |
| 55                           | 08:20   | 07:20    | 06:13 | 06:02  | 05:12 | 05:02 | 05:34 (1) | 21:36     | 05:59      | 07:06 (2) | 07:29     | 08:19     | 08:17 | 08:43 |
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| 57                           | 08:18   | 07:11    | 06:00 | 05:00  | 04:11 | 05:03 | 05:35 (1) | 21:30     | 05:59      | 07:08 (2) | 07:31     | 08:21     | 08:19 | 08:43 |
| 58                           | 17:04   | 18:04    | 18:56 | 20:52  | 21:40 | 21:59 | 05:38 (1) | 21:30     | 05:59      | 07:09 (2) | 07:32     | 08:22     | 08:20 | 08:43 |
| 59                           | 08:17   | 07:09    | 06:00 | 05:00  | 04:10 | 05:03 | 05:36 (1) | 21:29     | 05:59      | 07:10 (2) | 07:33     | 08:23     | 08:21 | 08:43 |
| 60                           | 17:06   | 18:06    | 18:58 | 20:54  | 21:42 | 21:59 | 05:38 (1) | 21:28     | 05:59      | 07:11 (2) | 07:34     | 08:24     | 08:22 | 08:43 |
| 61                           | 08:15   | 07:06    | 06:00 | 05:00  | 04:09 | 05:00 | 05:38 (1) | 21:27     | 05:59      | 07:12 (2) | 07:35     | 08:25     | 08:23 | 08:43 |
| 62                           | 17:08   | 18:08    | 18:59 | 20:54  | 21:43 | 21:59 | 05:38 (1) | 21:26     | 05:59      | 07:13 (2) | 07:36     | 08:26     | 08:24 | 08:43 |
| Sonnenscheinstunden          | 253     | 274      | 367   | 419    | 491   | 507   | 509       | 458       | 362        | 329       | 261       | 236       |       |       |
| astr. max. mögl. Beschattung |         |          |       |        | 156   | 77    | 150       | 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) Schattendenende      (WEA mit erstem Schatten)      (WEA mit letztem Schatten)

## SHADOW - Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe **Schattenrezeptor:** S - Wilhelmshavener Str. 88, Liethe  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar | Februar | März  | April | Mal       | Juni  | Juli  | August | September | Oktober   | November | Dzember |
|---------------------------|--------|---------|-------|-------|-----------|-------|-------|--------|-----------|-----------|----------|---------|
| 1                         | 08:43  | 08:14   | 07:17 | 07:04 | 05:56     | 05:08 | 05:04 | 05:43  | 06:36     | 07:28     | 07:25    | 08:18   |
|                           | 16:20  | 17:10   | 18:04 | 20:01 | 20:55     | 21:44 | 21:59 | 21:25  | 20:19     | 19:07     | 16:58    | 16:14   |
| 2                         | 08:43  | 08:12   | 07:15 | 07:01 | 07:25 (2) | 05:54 | 05:07 | 05:05  | 06:37     | 07:29     | 07:27    | 08:20   |
|                           | 16:21  | 17:12   | 18:06 | 20:03 | 20:57     | 21:45 | 21:58 | 21:23  | 20:17     | 19:04     | 16:56    | 16:14   |
| 3                         | 08:43  | 08:10   | 07:13 | 06:59 | 07:22 (2) | 05:52 | 05:06 | 05:05  | 06:39     | 07:14 (2) | 07:31    | 08:21   |
|                           | 16:22  | 17:14   | 18:08 | 20:05 | 20:59     | 21:47 | 21:58 | 21:21  | 20:15     | 19:02     | 16:54    | 16:13   |
| 4                         | 08:42  | 08:09   | 07:11 | 06:57 | 07:20 (2) | 05:50 | 05:05 | 05:06  | 06:41     | 07:13 (2) | 07:33    | 08:23   |
|                           | 16:23  | 17:16   | 18:10 | 20:07 | 21:01     | 21:48 | 21:58 | 21:19  | 20:12     | 19:00     | 16:52    | 16:12   |
| 5                         | 08:42  | 08:07   | 07:08 | 06:54 | 07:18 (2) | 05:48 | 05:04 | 05:07  | 06:43     | 07:11 (2) | 07:35    | 08:24   |
|                           | 16:24  | 17:18   | 18:12 | 20:09 | 21:03     | 21:49 | 21:57 | 21:17  | 20:10     | 18:57     | 16:50    | 16:12   |
| 6                         | 08:42  | 08:05   | 07:06 | 06:52 | 07:15 (2) | 05:46 | 05:04 | 05:08  | 06:44     | 07:11 (2) | 07:37    | 08:26   |
|                           | 16:25  | 17:19   | 18:14 | 20:10 | 21:04     | 21:50 | 21:56 | 21:15  | 20:07     | 18:55     | 16:48    | 16:11   |
| 7                         | 08:41  | 08:03   | 07:04 | 06:49 | 07:15 (2) | 05:44 | 05:03 | 05:09  | 06:46     | 07:13 (2) | 07:38    | 08:27   |
|                           | 16:27  | 17:21   | 18:16 | 20:12 | 21:06     | 21:51 | 21:56 | 21:14  | 20:05     | 18:53     | 16:46    | 16:11   |
| 8                         | 08:41  | 08:01   | 07:01 | 06:47 | 07:15 (2) | 05:42 | 05:02 | 05:10  | 06:48     | 07:14 (2) | 07:40    | 08:28   |
|                           | 16:28  | 17:23   | 18:17 | 20:14 | 21:08     | 21:52 | 21:55 | 21:12  | 20:03     | 18:50     | 16:45    | 16:10   |
| 9                         | 08:40  | 08:00   | 06:59 | 06:45 | 07:16 (2) | 05:40 | 05:02 | 05:11  | 06:49     | 07:15 (2) | 07:42    | 08:29   |
|                           | 16:30  | 17:25   | 18:19 | 20:16 | 21:09     | 21:53 | 21:54 | 21:10  | 20:00     | 18:48     | 16:43    | 16:10   |
| 10                        | 08:40  | 07:58   | 06:57 | 06:42 | 07:24 (2) | 05:39 | 05:01 | 05:12  | 06:51     | 07:18 (2) | 07:44    | 08:31   |
|                           | 16:31  | 17:27   | 18:21 | 20:18 | 21:11     | 21:53 | 21:54 | 21:08  | 19:58     | 18:45     | 16:41    | 16:10   |
| 11                        | 08:39  | 07:56   | 06:54 | 06:40 | 05:37     | 05:01 | 05:13 | 05:59  | 06:53     | 07:16     | 07:44    | 08:32   |
|                           | 16:33  | 17:29   | 18:23 | 20:19 | 21:13     | 21:54 | 21:53 | 21:06  | 19:55     | 18:43     | 16:39    | 16:10   |
| 12                        | 08:38  | 07:54   | 06:52 | 06:38 | 05:35     | 05:01 | 05:14 | 06:01  | 06:55     | 07:17     | 07:45    | 08:33   |
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| 14                        | 08:37  | 07:50   | 06:47 | 06:33 | 05:32     | 05:00 | 05:17 | 06:05  | 06:58     | 07:21     | 07:49    | 08:35   |
|                           | 16:37  | 17:35   | 18:29 | 20:25 | 21:18     | 21:56 | 21:50 | 21:00  | 19:48     | 18:36     | 16:35    | 16:09   |
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| 16                        | 08:35  | 07:46   | 06:42 | 06:28 | 05:28     | 05:00 | 05:19 | 06:08  | 06:42 (1) | 07:02     | 07:55    | 08:37   |
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| 18                        | 08:33  | 07:42   | 06:37 | 06:24 | 05:25     | 04:59 | 05:22 | 06:11  | 06:41 (1) | 07:05     | 07:58    | 08:38   |
|                           | 16:44  | 17:43   | 18:36 | 20:32 | 21:24     | 21:58 | 21:45 | 20:51  | 06:54 (1) | 19:38     | 18:27    | 16:10   |
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| 23                        | 08:27  | 07:31   | 06:25 | 06:13 | 05:18     | 05:00 | 05:29 | 06:20  | 06:48 (1) | 07:14     | 08:08    | 08:41   |
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|                           | 17:06  | 18:06   | 18:58 | 20:54 | 21:42     | 21:59 | 21:28 | 20:24  | 07:41     | 19:32     | 18:28    | 16:19   |
| 31                        | 08:15  | 07:15   | 06:07 | 05:56 | 05:09     | 05:04 | 05:41 | 06:34  | 07:43     | 19:33     | 18:29    | 16:20   |
|                           | 17:08  | 18:08   | 18:59 | 20:56 | 21:44     | 21:59 | 21:26 | 20:22  | 07:45     | 19:34     | 18:30    | 16:21   |
| Sonnenscheinstunden       | 253    | 274     | 367   | 419   | 491       | 507   | 509   | 458    | 382       | 329       | 261      | 236     |
| astr.max.mögl.Beschattung |        |         |       | 145   |           |       |       | 78     | 70        |           |          |         |

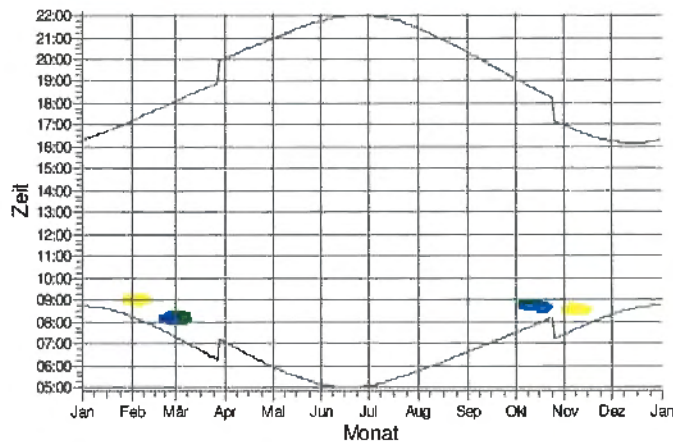
**Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):**

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

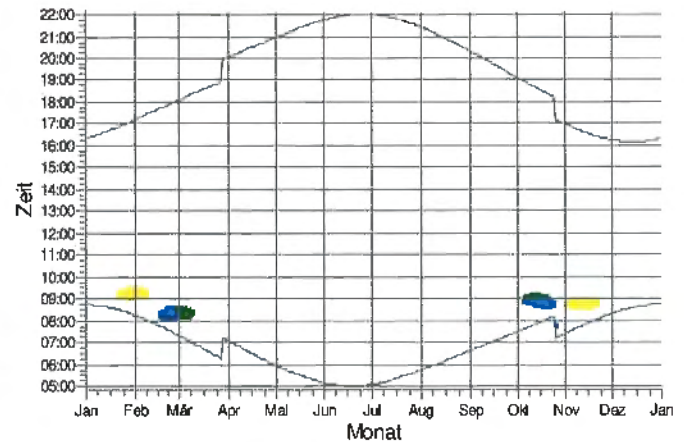
## SHADOW - Grafischer Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

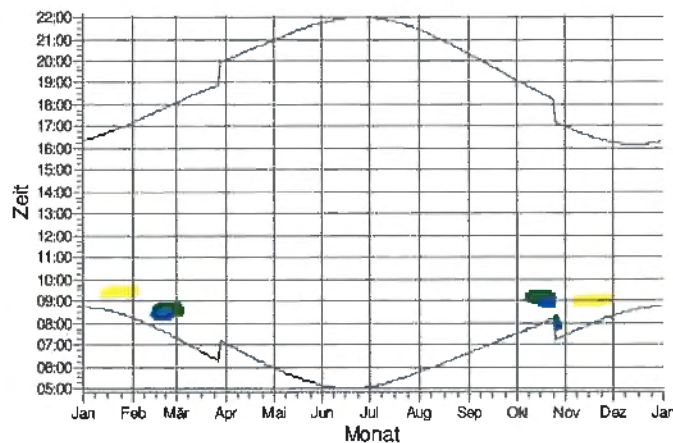
A: Lehmden Str. 99, Lehmden



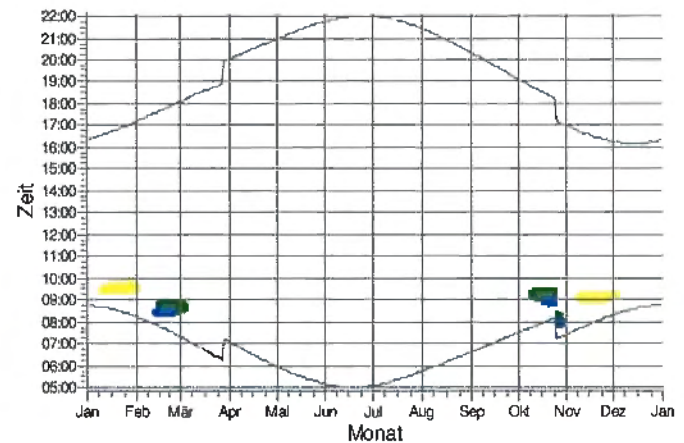
B: Lehmden Str. 103, Lehmden



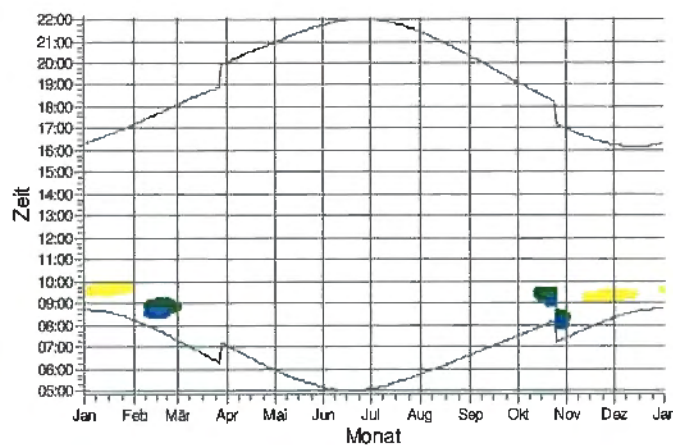
C: Lehmden Str. 109, Lehmden



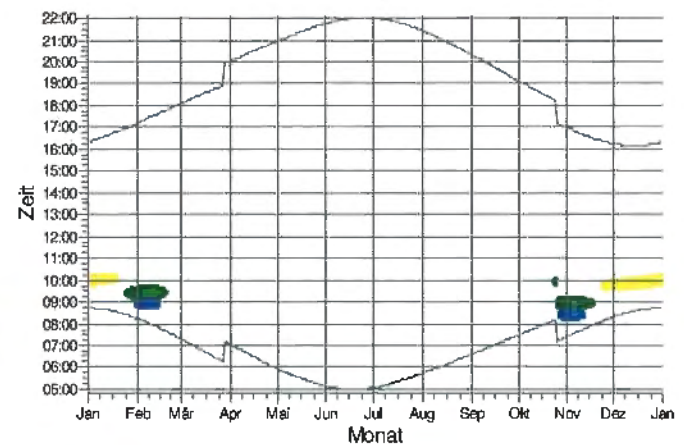
D: Lehmden Str. 109a, Lehmden



E: Lehmden Str. 121, Lehmden



F: Lehmden Str. 125, Lehmden



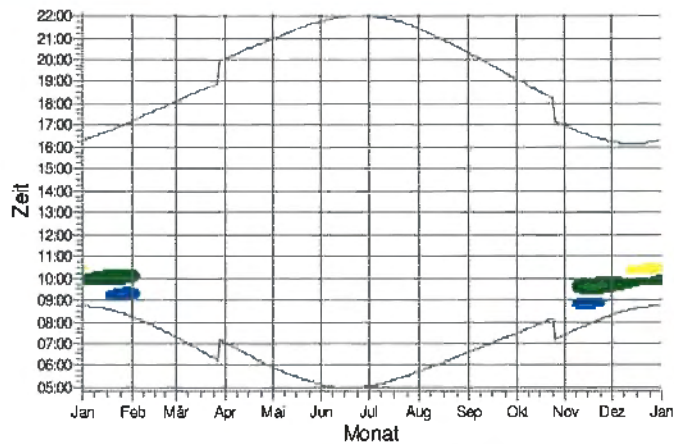
WEA

1: Enercon E-82 E2 TES (2,3 MW)  
2: Enercon E-82 E2 TES (2,3 MW)

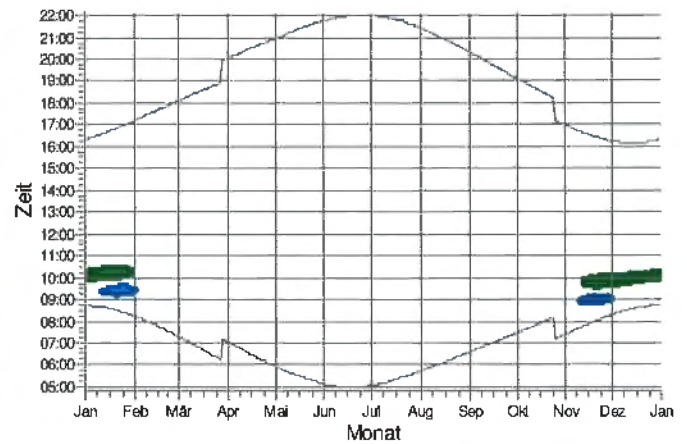
3: Enercon E-82 E2 TES (2,3 MW)

**SHADOW - Grafischer Kalender****Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

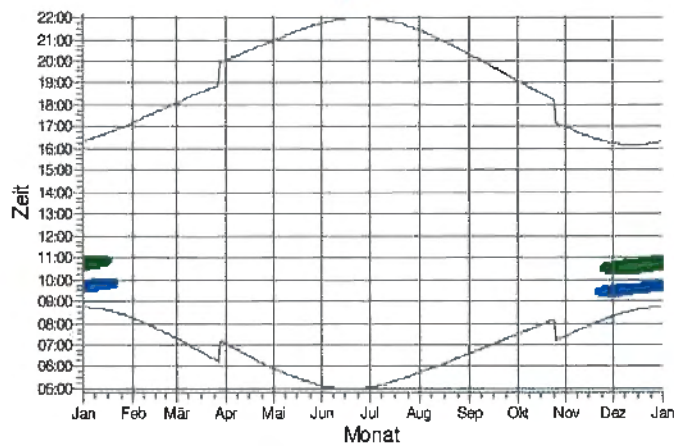
G: Lehmden Str. 143, Lehmden



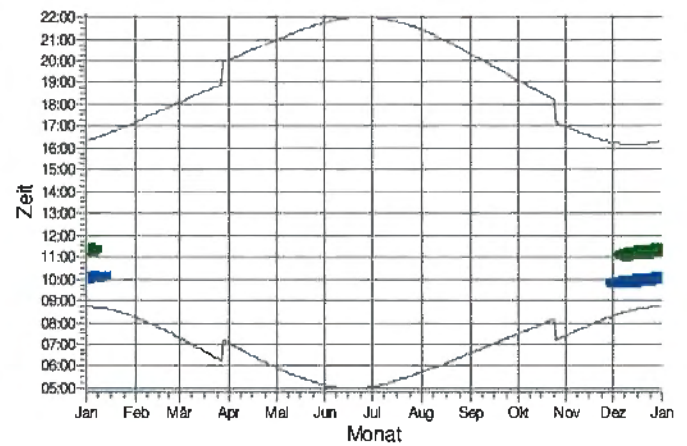
H: Lehmden Str. 145, Lehmden



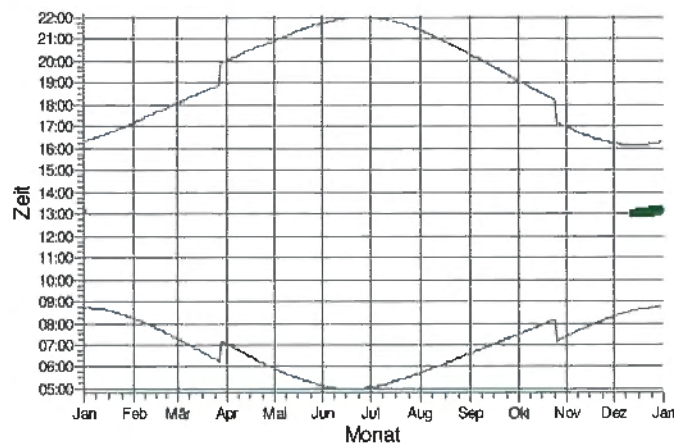
I: Dwoweg 1, Lehmden



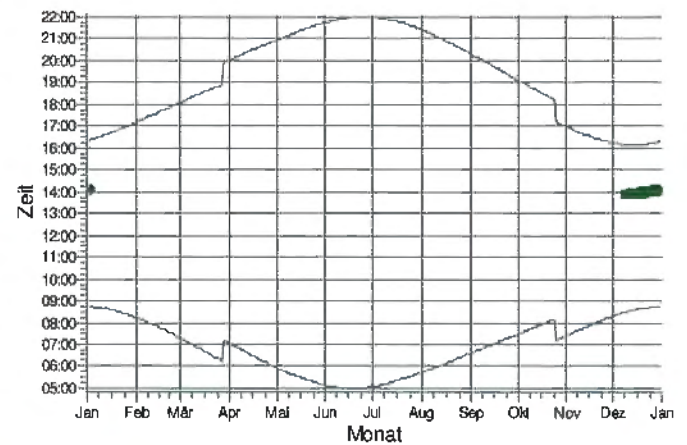
J: Dwoweg 11, Lehmden



K: Dwoweg 39, Lehmden



L: Dwoweg 70, Lehmden



WEA



1: Enercon E-82 E2 TES (2,3 MW)

2: Enercon E-82 E2 TES (2,3 MW)

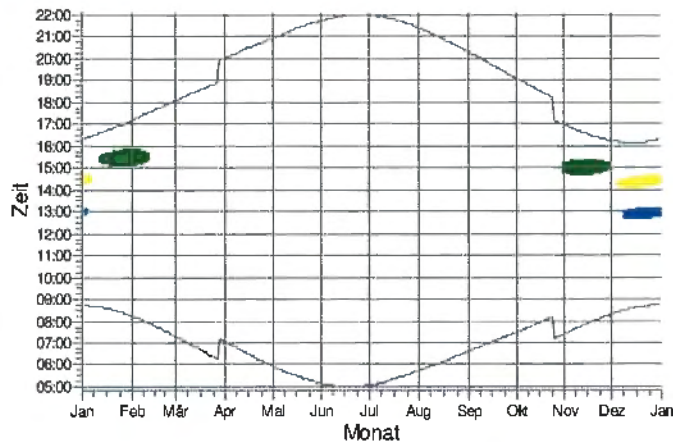


3: Enercon E-82 E2 TES (2,3 MW)

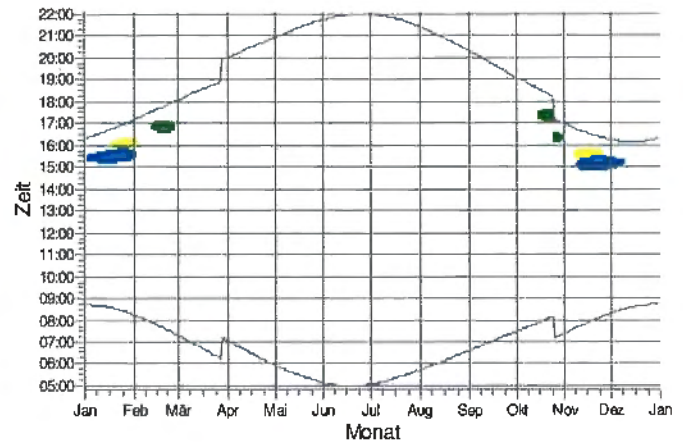
## SHADOW - Grafischer Kalender

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

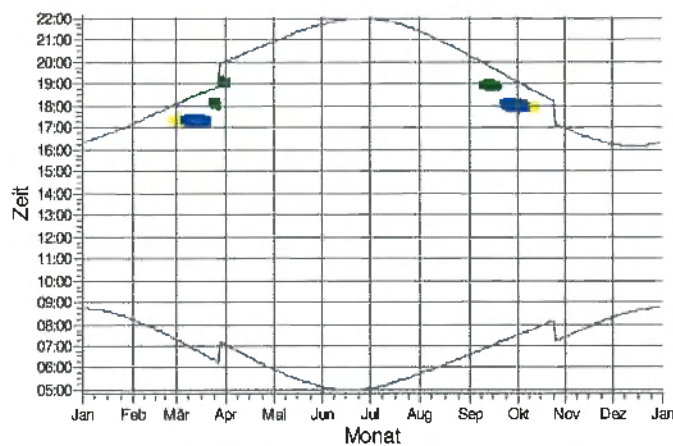
M: Dwoweg 38, Lehmden



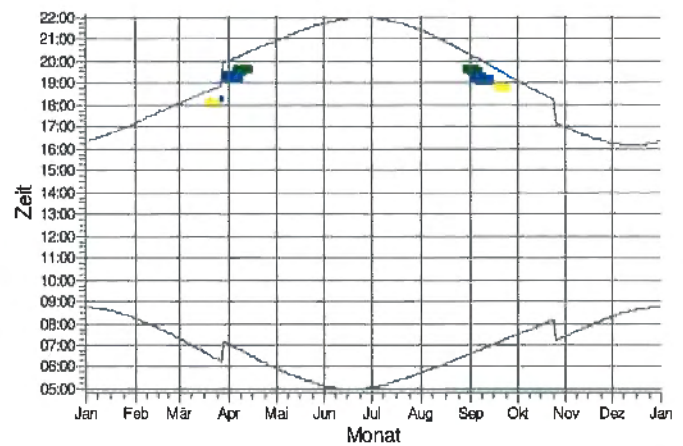
N: Dwoweg 156, Lehmden



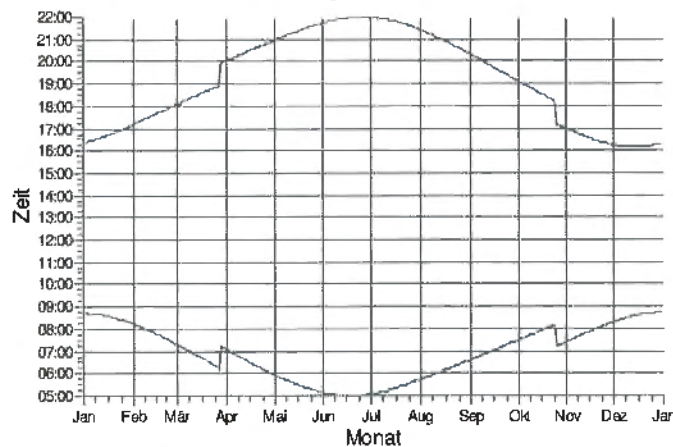
O: Dwoweg 190, Lehmden



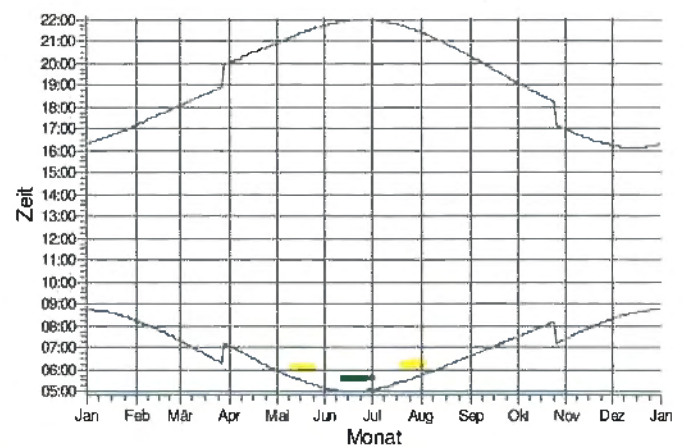
P: Weidenstr. 73, Kleibrok



Q: Strohweg 20, Kleibrok



R: Hohe Looe 2-8 (BÜFA GmbH)



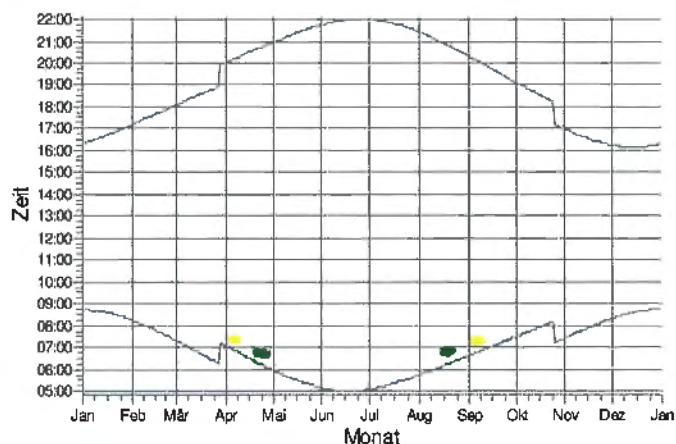
WEA

- 1: Enercon E-82 E2 TES (2,3 MW)
- 2: Enercon E-82 E2 TES (2,3 MW)

- 3: Enercon E-82 E2 TES (2,3 MW)

**SHADOW - Grafischer Kalender****Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

S: Wilhelmshavener Str. 88, Liethe



WEA



1: Enercon E-82 E2 TES (2,3 MW)

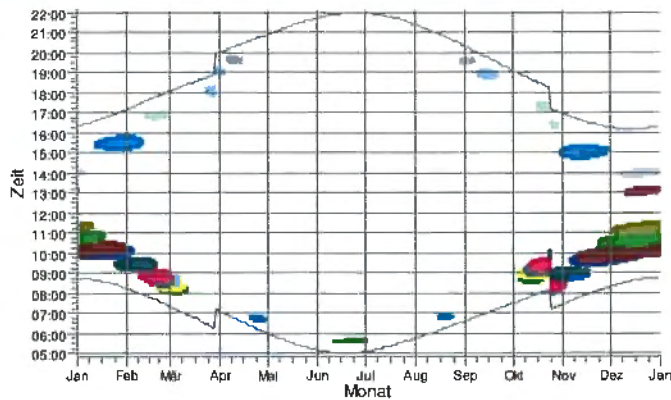


2: Enercon E-82 E2 TES (2,3 MW)

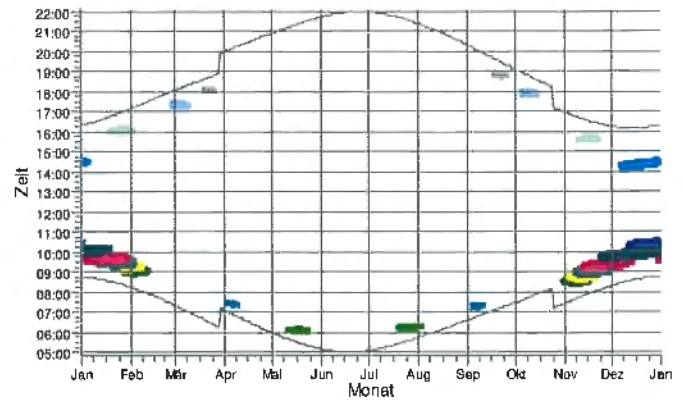
## SHADOW - Grafischer Kalender pro WEA

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe

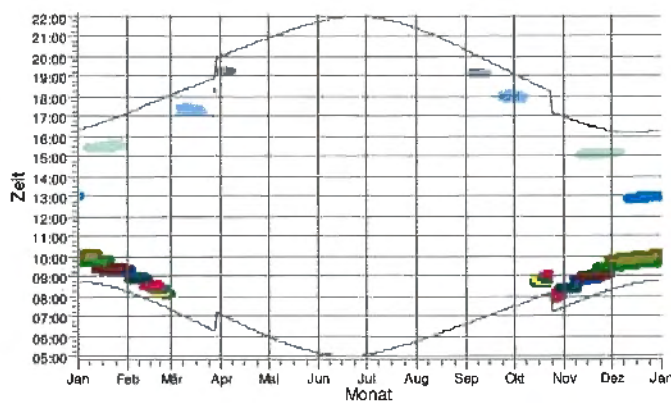
1: Enercon E-82 E2 TES (2,3 MW)



2: Enercon E-82 E2 TES (2,3 MW)



3: Enercon E-82 E2 TES (2,3 MW)



### Schattenrezeptoren

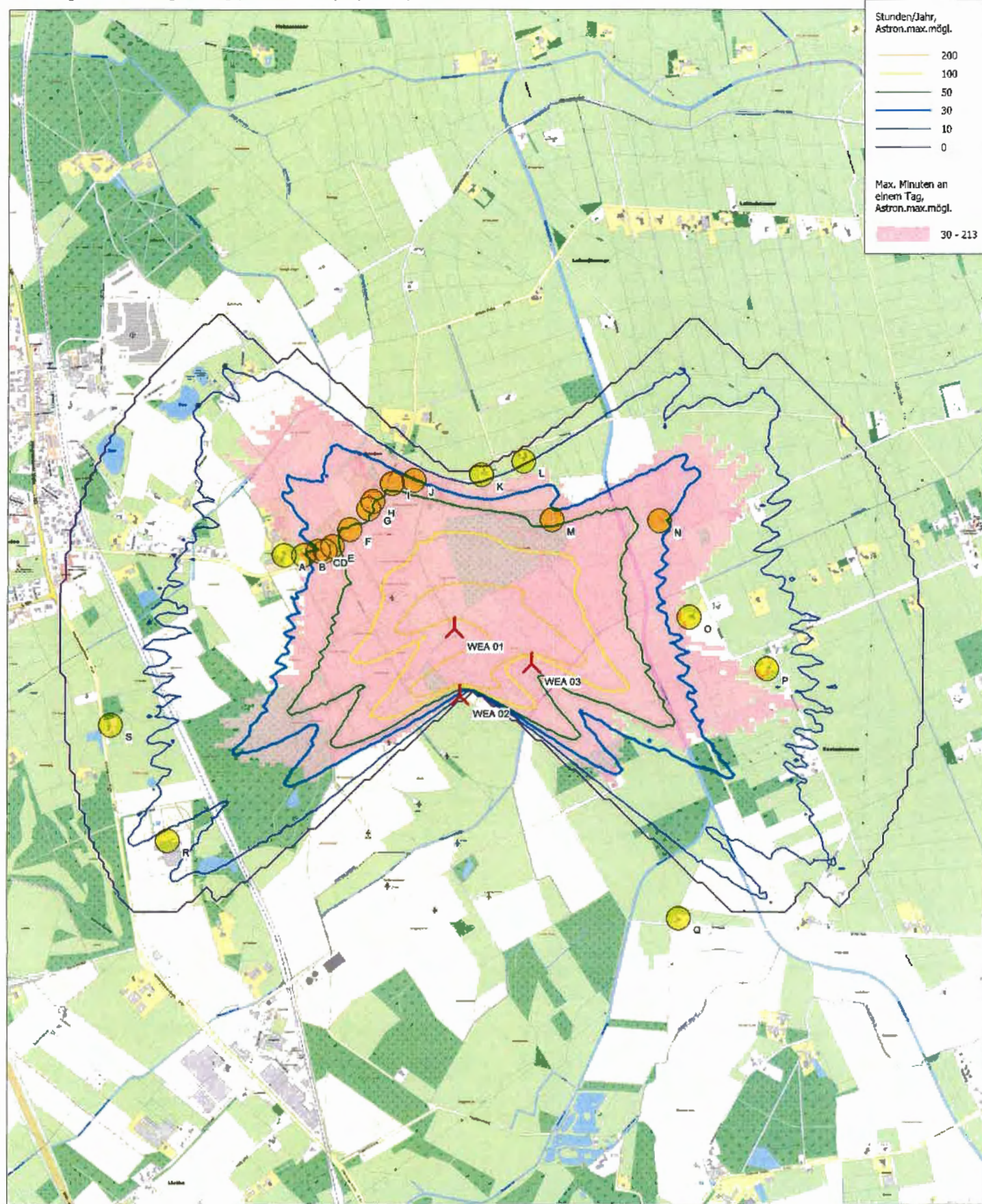
|                               |                              |
|-------------------------------|------------------------------|
| A: Lehmden Str. 99, Lehmden   | G: Lehmden Str. 143, Lehmden |
| B: Lehmden Str. 103, Lehmden  | H: Lehmden Str. 145, Lehmden |
| C: Lemder Str. 109, Lehmden   | I: Dwoweg 1, Lehmden         |
| D: Lehmden Str. 109a, Lehmden | J: Dwoweg 11, Lehmden        |
| E: Lehmden Str. 121, Lehmden  | K: Dwoweg 39, Lehmden        |
| F: Lehmden Str. 125, Lehmden  | L: Dwoweg 70, Lehmden        |

|                               |                                    |
|-------------------------------|------------------------------------|
| M: Dwoweg 38, Lehmden         | N: Dwoweg 156, Lehmden             |
| O: Dwoweg 190, Lehmden        | P: Weidenstr. 73, Kleibrok         |
| R: Hohe Looze 2-8 (BÜFA GmbH) | S: Wilhelmshavener Str. 88, Liethe |

|                               |                                    |
|-------------------------------|------------------------------------|
| M: Dwoweg 38, Lehmden         | N: Dwoweg 156, Lehmden             |
| O: Dwoweg 190, Lehmden        | P: Weidenstr. 73, Kleibrok         |
| R: Hohe Looze 2-8 (BÜFA GmbH) | S: Wilhelmshavener Str. 88, Liethe |

## SHADOW - Karte

**Berechnung:** Zusatzbelastung durch 3 gepl. WEA E-82 E2 (TES) mit 108,4 m Nabenhöhe



Karte: AKS LGLN Rastede, Maßstab 1:15.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 446.200 Nord: 5.904.126  
Höhe der Schattenkarte: Höhenlinien: Orographie Lehmden Liethe final bearb..wpo (7)

Neue WEA

Schattenrezeptor

## SHADOW - Hauptergebnis

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

### Voraussetzungen für Berechnung des Schattenwurfs

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °  
Tage zwischen Berechnungen 1 Tag(e)  
Berechnungszeitsprung 1 Minuten  
Die dargestellten Zeiten sind die astronomisch maximal mögliche  
Beschattungsdauer, berechnet unter folgenden Annahmen:  
Die Sonne scheint täglich von Sonnenauf- bis -untergang  
Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung  
Die Windenergieanlage/n ist/sind immer in Betrieb

Eine WEA wird nicht berücksichtigt, wenn sie von keinem Teil der  
Rezeptorfläche aus sichtbar ist. Die Sichtbarkeitsberechnung basiert auf  
den folgenden Annahmen:

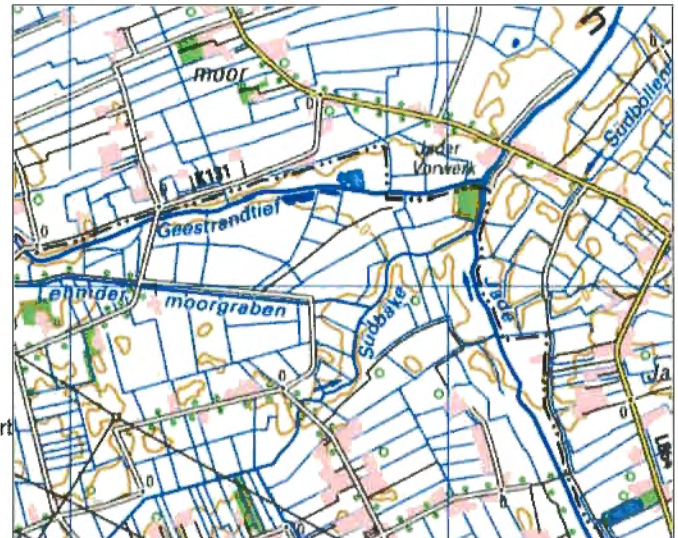
Verwendete Höhenlinien: Höhenlinien: Orographie Lehmden Liethe final bearb.

Hindernisse in Berechnung nicht verwendet

Augenhöhe: 1,5 m

Rasterauflösung: 10,0 m

Alle Koordinatenangaben in  
UTM (north)-ETRS89 Zone: 32



Maßstab 1:40.000  
▲ Neue WEA    ★ Existierende WEA    ● Schattenrezeptor

### WEA

|              | Ost     | Nord      | Z    | Beschreibung    | WEA-Typ |            | Typ              | Nennleistung<br>[kW] | Rotor-<br>durchmesser<br>[m] | Nabenhöhe<br>[m] | Schattendaten                |                  |
|--------------|---------|-----------|------|-----------------|---------|------------|------------------|----------------------|------------------------------|------------------|------------------------------|------------------|
|              |         |           |      |                 | Aktuell | Hersteller |                  |                      |                              |                  | Beschatt.-<br>Bereich<br>[m] | U/min<br>[U/min] |
|              |         |           | [m]  |                 |         |            |                  |                      |                              |                  |                              |                  |
| vorh. WEA 01 | 446.169 | 5.902.942 | 4,6  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 02 | 445.948 | 5.902.888 | 7,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 03 | 445.754 | 5.902.988 | 6,0  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 04 | 446.040 | 5.903.162 | 4,2  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 05 | 445.758 | 5.903.563 | 5,8  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 06 | 445.994 | 5.903.518 | 2,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 07 | 445.881 | 5.903.323 | 4,5  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 08 | 445.675 | 5.903.205 | 6,7  | NEG Micon N...  | Nein    | NEG MICON  | NM52/900-900/200 | 900                  | 52,2                         | 73,8             | 2.500                        | 22,4             |
| vorh. WEA 09 | 445.769 | 5.904.164 | 14,0 | Enercon E-58... | Ja      | ENERCON    | E-58/10.58-1.000 | 1.000                | 58,0                         | 70,5             | 1.347                        | 24,0             |
| WEA 01       | 446.026 | 5.904.036 | 4,6  | Enercon E-82... | Ja      | ENERCON    | E-82 E2-2.300    | 2.300                | 82,0                         | 108,4            | 1.598                        | 18,0             |
| WEA 02       | 446.048 | 5.903.762 | 3,3  | Enercon E-82... | Ja      | ENERCON    | E-82 E2-2.300    | 2.300                | 82,0                         | 108,4            | 1.598                        | 18,0             |
| WEA 03       | 446.341 | 5.903.894 | 1,7  | Enercon E-82... | Ja      | ENERCON    | E-82 E2-2.300    | 2.300                | 82,0                         | 108,4            | 1.598                        | 18,0             |

### Schattenrezeptor-Eingabe

| Nr. | Name                            | Ost     | Nord      | Z    | Breite | Höhe | Höhe<br>über Grund | Azimutwinkel<br>(von Süd) | Neigung des<br>Fensters | Ausrichtungsmodus   |
|-----|---------------------------------|---------|-----------|------|--------|------|--------------------|---------------------------|-------------------------|---------------------|
|     |                                 |         |           |      |        |      |                    |                           |                         |                     |
|     |                                 |         |           | [m]  | [m]    | [m]  | [m]                | [°]                       | [°]                     |                     |
| A   | Lehmden Str. 99, Lehmden        | 445.329 | 5.904.337 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| B   | Lehmden Str. 103, Lehmden       | 445.408 | 5.904.336 | 10,0 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| C   | Lehmden Str. 109, Lehmden       | 445.468 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| D   | Lehmden Str. 109a, Lehmden      | 445.496 | 5.904.353 | 9,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| E   | Lehmden Str. 121, Lehmden       | 445.526 | 5.904.374 | 9,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| F   | Lehmden Str. 125, Lehmden       | 445.595 | 5.904.441 | 7,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| G   | Lehmden Str. 143, Lehmden       | 445.672 | 5.904.525 | 6,1  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| H   | Lehmden Str. 145, Lehmden       | 445.690 | 5.904.555 | 5,7  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| I   | Dwowed 1, Lehmden               | 445.768 | 5.904.628 | 3,8  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| J   | Dwowed 11, Lehmden              | 445.858 | 5.904.642 | 2,9  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| K   | Dwowed 39, Lehmden              | 446.133 | 5.904.664 | 1,6  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| L   | Dwowed 70, Lehmden              | 446.305 | 5.904.720 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| M   | Dwowed 38, Lehmden              | 446.420 | 5.904.481 | 5,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| N   | Dwowed 156, Lehmden             | 446.860 | 5.904.477 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| O   | Dwowed 190, Lehmden             | 446.981 | 5.904.084 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| P   | Weidenstr. 73, Kleibrok         | 447.300 | 5.903.875 | 1,5  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| Q   | Strothweg 20, Kleibrok          | 446.944 | 5.902.853 | 1,0  | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| R   | Hohe Looe 2-8 (BÜFA GmbH)       | 444.858 | 5.903.170 | 16,8 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |
| S   | Wilhelmshavener Str. 88, Liethe | 444.625 | 5.903.643 | 17,5 | 0,1    | 0,1  | 2,0                | 0,0                       | 90,0                    | "Gewächshaus-Modus" |

**SHADOW - Hauptergebnis****Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA**Berechnungsergebnisse**

Schattenrezeptor

| Nr. | Name                            | astron. max. mögl. Beschattungsdauer |                |                             |
|-----|---------------------------------|--------------------------------------|----------------|-----------------------------|
|     |                                 | Stunden/Jahr                         | Schattentage/a | Max.Schatten<br>Stunden/Tag |
|     |                                 | [Std./Jahr]                          | [Tage/Jahr]    | [Std./Tag]                  |
| A   | Lehmder Str. 99, Lehmnden       | 31:59                                | 114            | 0:29                        |
| B   | Lehmder Str. 103, Lehmnden      | 35:41                                | 94             | 0:33                        |
| C   | Lehmder Str. 109, Lehmnden      | 49:06                                | 99             | 0:54                        |
| D   | Lehmder Str. 109a, Lehmnden     | 57:56                                | 105            | 1:04                        |
| E   | Lehmder Str. 121, Lehmnden      | 73:08                                | 122            | 1:21                        |
| F   | Lehmder Str. 125, Lehmnden      | 92:24                                | 120            | 1:29                        |
| G   | Lehmder Str. 143, Lehmnden      | 83:50                                | 92             | 1:07                        |
| H   | Lehmder Str. 145, Lehmnden      | 72:00                                | 86             | 1:00                        |
| I   | Dwowed 1, Lehmnden              | 44:28                                | 64             | 0:51                        |
| J   | Dwowed 11, Lehmnden             | 30:32                                | 50             | 0:50                        |
| K   | Dwowed 39, Lehmnden             | 26:27                                | 64             | 0:38                        |
| L   | Dwowed 70, Lehmnden             | 18:16                                | 74             | 0:20                        |
| M   | Dwowed 38, Lehmnden             | 46:59                                | 117            | 0:40                        |
| N   | Dwowed 156, Lehmnden            | 41:59                                | 131            | 0:49                        |
| O   | Dwowed 190, Lehmnden            | 31:44                                | 145            | 0:28                        |
| P   | Weidenstr. 73, Kleibrok         | 17:25                                | 106            | 0:28                        |
| Q   | Strothweg 20, Kleibrok          | 21:56                                | 147            | 0:16                        |
| R   | Hohe Looe 2-8 (BÜFA GmbH)       | 19:08                                | 139            | 0:16                        |
| S   | Wilhelmshavener Str. 88, Liethe | 9:24                                 | 93             | 0:13                        |

Gesamtmenge der max. mögl. Beschattung an Rezeptoren pro WEA

| Nr. | Name                                | Maximal     | Erwartet    |
|-----|-------------------------------------|-------------|-------------|
|     |                                     | [Std./Jahr] | [Std./Jahr] |
|     | vorh. WEA 01 NEG Micon NM52         | 5:27        |             |
|     | vorh. WEA 02 NEG Micon NM52         | 4:01        |             |
|     | vorh. WEA 03 NEG Micon NM52         | 4:46        |             |
|     | vorh. WEA 04 NEG Micon NM52         | 7:11        |             |
|     | vorh. WEA 05 NEG Micon NM52         | 7:35        |             |
|     | vorh. WEA 06 NEG Micon NM52         | 17:48       |             |
|     | vorh. WEA 07 NEG Micon NM52         | 5:34        |             |
|     | vorh. WEA 08 NEG Micon NM52         | 6:55        |             |
|     | vorh. WEA 09 Enercon E-58/10.58     | 213:02      |             |
|     | WEA 01 Enercon E-82 E2 TES (2,3 MW) | 212:52      |             |
|     | WEA 02 Enercon E-82 E2 TES (2,3 MW) | 108:09      |             |
|     | WEA 03 Enercon E-82 E2 TES (2,3 MW) | 126:32      |             |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: A - Lehmden Str. 99, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar         | Februar                       | März                    | April                         | Mai            | Juni           |
|---------------------------|----------------|-------------------------------|-------------------------|-------------------------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 09:28 (vorh. WEA 06)<br>17:10 | 08:51 (WEA 02)<br>17:10 | 07:59 (WEA 01)<br>20:01       | 05:56<br>20:55 | 05:08<br>21:44 |
| 2                         | 08:43<br>16:21 | 09:30 (vorh. WEA 06)<br>17:12 | 08:51 (WEA 02)<br>17:12 | 07:56 (vorh. WEA 09)<br>20:03 | 05:54<br>20:57 | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 09:35 (vorh. WEA 06)<br>17:14 | 08:51 (WEA 02)<br>17:14 | 07:55 (vorh. WEA 09)<br>20:05 | 05:52<br>20:59 | 05:06<br>21:47 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:16                | 08:52 (WEA 02)<br>17:16 | 07:55 (vorh. WEA 09)<br>20:07 | 05:50<br>21:01 | 05:05<br>21:48 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17                | 08:52 (WEA 02)<br>17:17 | 07:53 (vorh. WEA 09)<br>20:09 | 05:48<br>21:03 | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19                | 08:52 (WEA 02)<br>17:19 | 07:53 (vorh. WEA 09)<br>20:10 | 05:46<br>21:04 | 05:04<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21                | 08:52 (WEA 02)<br>17:21 | 07:52 (vorh. WEA 09)<br>20:12 | 05:44<br>21:06 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23                | 08:53 (WEA 02)<br>17:23 | 07:52 (vorh. WEA 09)<br>20:14 | 05:42<br>21:08 | 05:02<br>21:52 |
| 9                         | 08:40<br>16:30 | 08:00<br>17:25                | 08:54 (WEA 02)<br>17:25 | 07:53 (vorh. WEA 09)<br>20:16 | 05:40<br>21:09 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 07:58<br>17:27                | 08:55 (WEA 02)<br>17:27 | 07:52 (vorh. WEA 09)<br>20:18 | 05:38<br>21:11 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 07:56<br>17:29                | 08:57 (WEA 02)<br>17:29 | 07:53 (vorh. WEA 09)<br>20:19 | 05:37<br>21:13 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 07:54<br>17:31                | 09:02 (WEA 02)<br>17:31 | 07:53 (vorh. WEA 09)<br>20:21 | 05:35<br>21:15 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:36 | 07:52<br>17:33                | 09:04 (WEA 02)<br>17:33 | 07:54 (vorh. WEA 09)<br>20:23 | 05:33<br>21:16 | 05:00<br>21:56 |
| 14                        | 08:37<br>16:37 | 07:50<br>17:35                | 06:47<br>18:29          | 07:56 (vorh. WEA 09)<br>20:25 | 05:31<br>21:18 | 05:00<br>21:56 |
| 15                        | 08:36<br>16:39 | 07:48<br>17:37                | 06:45<br>18:30          | 08:14 (vorh. WEA 09)<br>20:27 | 05:30<br>21:20 | 05:00<br>21:57 |
| 16                        | 08:35<br>16:40 | 07:46<br>17:39                | 06:42<br>18:32          | 07:57 (vorh. WEA 09)<br>20:28 | 05:28<br>21:21 | 04:59<br>21:57 |
| 17                        | 08:34<br>16:42 | 07:44<br>17:41                | 06:40<br>18:34          | 08:08 (vorh. WEA 09)<br>20:26 | 05:26<br>21:23 | 04:59<br>21:58 |
| 18                        | 08:33<br>16:44 | 07:42<br>17:43                | 06:37<br>18:36          | 06:24<br>20:30                | 05:25<br>21:24 | 04:59<br>21:58 |
| 19                        | 08:32<br>16:46 | 07:39<br>17:45                | 06:35<br>18:38          | 06:22<br>20:34                | 05:24<br>21:26 | 04:59<br>21:59 |
| 20                        | 08:31<br>16:47 | 07:37<br>17:47                | 06:33<br>18:40          | 06:19<br>20:36                | 05:22<br>21:28 | 04:59<br>21:59 |
| 21                        | 08:29<br>16:49 | 07:35<br>17:49                | 06:30<br>18:41          | 06:17<br>20:37                | 05:21<br>21:29 | 05:00<br>21:59 |
| 22                        | 08:28<br>16:51 | 07:33<br>17:51                | 06:28<br>18:43          | 06:15<br>20:39                | 05:19<br>21:31 | 05:00<br>21:59 |
| 23                        | 08:27<br>16:53 | 07:31<br>17:53                | 06:25<br>18:45          | 06:13<br>20:41                | 05:18<br>21:32 | 05:00<br>22:00 |
| 24                        | 08:26<br>16:55 | 07:29<br>17:55                | 06:23<br>18:47          | 06:11<br>20:43                | 05:16<br>21:34 | 05:00<br>22:00 |
| 25                        | 08:24<br>16:56 | 07:26<br>17:57                | 06:21<br>18:49          | 06:08<br>20:45                | 05:15<br>21:35 | 05:01<br>22:00 |
| 26                        | 08:23<br>16:58 | 07:24<br>17:58                | 06:18<br>18:51          | 06:06<br>20:46                | 05:14<br>21:36 | 05:01<br>22:00 |
| 27                        | 08:21<br>17:00 | 07:22<br>18:00                | 06:16<br>18:52          | 06:04<br>20:48                | 05:13<br>21:38 | 05:01<br>22:00 |
| 28                        | 08:20<br>17:02 | 07:20<br>18:02                | 06:13<br>18:54          | 06:02<br>20:50                | 05:12<br>21:39 | 05:02<br>21:59 |
| 29                        | 08:18<br>17:04 | 07:18<br>18:04                | 07:11<br>19:56          | 06:00<br>20:52                | 05:11<br>21:40 | 05:03<br>21:59 |
| 30                        | 08:17<br>17:06 | 07:16<br>18:06                | 07:08<br>19:58          | 05:58<br>20:54                | 05:09<br>21:42 | 05:03<br>21:59 |
| 31                        | 08:15<br>17:08 | 07:14<br>18:08                | 07:06<br>20:00          |                               | 05:08<br>21:43 |                |
| Sonnenscheinstunden       | 253            | 274                           | 367                     | 419                           | 491            | 507            |
| astr.max.mögl.Beschattung | 91             | 382                           | 386                     |                               |                |                |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: A - Lehmden Str. 99, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul            | August         | September      |                      | Oktober        |                      | November       |                      | Dazember       |
|---------------------------|----------------|----------------|----------------|----------------------|----------------|----------------------|----------------|----------------------|----------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 |                      | 07:28<br>19:07 | 08:33 (vorh. WEA 09) | 07:25<br>16:58 | 08:25 (WEA 02)       | 08:18<br>16:14 |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 |                      | 07:29<br>19:04 | 08:31 (vorh. WEA 09) | 07:26<br>16:56 | 08:23 (WEA 02)       | 08:20<br>16:14 |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 |                      | 07:31<br>19:02 | 08:30 (vorh. WEA 09) | 07:28<br>16:54 | 08:23 (WEA 02)       | 08:21<br>16:13 |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 |                      | 07:33<br>19:00 | 08:30 (vorh. WEA 09) | 07:30<br>16:52 | 08:22 (WEA 02)       | 08:23<br>16:12 |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 |                      | 07:35<br>18:57 | 08:29 (vorh. WEA 09) | 07:32<br>16:50 | 08:22 (WEA 02)       | 08:24<br>16:12 |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 |                      | 07:37<br>18:55 | 08:29 (vorh. WEA 09) | 07:34<br>16:48 | 08:21 (WEA 02)       | 08:26<br>16:11 |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 |                      | 07:38<br>18:52 | 08:29 (vorh. WEA 09) | 07:36<br>16:46 | 08:21 (WEA 02)       | 08:27<br>16:11 |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 |                      | 07:40<br>18:50 | 08:28 (vorh. WEA 09) | 07:38<br>16:44 | 08:21 (WEA 02)       | 08:28<br>16:10 |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 |                      | 07:42<br>18:48 | 08:29 (vorh. WEA 09) | 07:40<br>16:43 | 08:22 (WEA 02)       | 08:29<br>16:10 |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 |                      | 07:44<br>18:45 | 08:29 (vorh. WEA 09) | 07:42<br>16:41 | 08:22 (WEA 02)       | 08:31<br>16:10 |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 |                      | 07:46<br>18:43 | 08:30 (vorh. WEA 09) | 07:44<br>16:39 | 08:23 (WEA 02)       | 08:32<br>16:10 |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 |                      | 07:47<br>18:41 | 08:31 (vorh. WEA 09) | 07:45<br>16:38 | 08:24 (WEA 02)       | 08:33<br>16:09 |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 |                      | 07:49<br>18:38 | 08:32 (vorh. WEA 09) | 07:47<br>16:36 | 08:25 (WEA 02)       | 08:34<br>16:09 |
| 14                        | 05:16<br>21:50 | 06:05<br>21:00 | 06:58<br>19:48 |                      | 07:51<br>18:36 | 08:33 (WEA 01)       | 07:49<br>16:35 | 08:26 (WEA 02)       | 08:35<br>16:09 |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 |                      | 07:53<br>18:34 | 08:32 (WEA 03)       | 07:51<br>16:33 | 08:28 (WEA 02)       | 08:36<br>16:09 |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:02<br>19:43 |                      | 07:55<br>18:32 | 08:31 (WEA 03)       | 07:53<br>16:31 | 08:31 (WEA 02)       | 08:37<br>16:09 |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 |                      | 07:56<br>18:29 | 08:30 (WEA 03)       | 07:55<br>16:30 | 08:30 (vorh. WEA 06) | 08:37<br>16:10 |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 |                      | 07:58<br>18:27 | 08:30 (WEA 03)       | 07:56<br>16:29 | 08:30 (vorh. WEA 06) | 08:38<br>16:10 |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 |                      | 08:00<br>18:25 | 08:30 (WEA 03)       | 07:58<br>16:27 | 08:31 (vorh. WEA 06) | 08:39<br>16:10 |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:34 |                      | 08:02<br>18:23 | 08:30 (WEA 03)       | 08:00<br>16:26 | 08:30 (vorh. WEA 06) | 08:40<br>16:10 |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 |                      | 08:04<br>18:20 | 08:31 (WEA 03)       | 08:02<br>16:25 | 08:31 (vorh. WEA 06) | 08:40<br>16:11 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 |                      | 08:06<br>18:18 | 08:33 (WEA 03)       | 08:04<br>16:23 | 08:33 (vorh. WEA 06) | 08:41<br>16:11 |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 |                      | 08:08<br>18:16 | 08:37 (WEA 03)       | 08:05<br>16:22 | 08:35 (vorh. WEA 06) | 08:41<br>16:12 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 |                      | 08:09<br>18:14 |                      | 08:07<br>16:21 | 08:36 (vorh. WEA 06) | 08:42<br>16:12 |
| 25                        | 05:32<br>21:36 | 06:24<br>20:35 | 07:17<br>19:21 |                      | 08:11<br>17:12 |                      | 08:09<br>16:20 | 08:38 (vorh. WEA 06) | 08:42<br>16:13 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 |                      | 08:13<br>17:10 |                      | 08:10<br>16:19 | 08:39 (vorh. WEA 06) | 08:42<br>16:14 |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 |                      | 08:15<br>17:08 |                      | 08:12<br>16:18 | 08:43 (vorh. WEA 06) | 08:43<br>16:14 |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:38 (vorh. WEA 09) | 07:17<br>17:06 |                      | 08:14<br>16:17 | 08:43 (vorh. WEA 06) | 08:43<br>16:15 |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:36 (vorh. WEA 09) | 07:19<br>17:04 |                      | 08:15<br>16:16 | 08:43 (vorh. WEA 06) | 08:43<br>16:16 |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:34 (vorh. WEA 09) | 07:21<br>17:02 | 08:29 (WEA 02)       | 08:17<br>16:15 | 08:43 (vorh. WEA 06) | 08:43<br>16:17 |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 08:55 (vorh. WEA 09) | 07:23<br>17:00 | 08:25 (WEA 02)       |                | 08:43 (vorh. WEA 06) | 08:43<br>16:18 |
| Sonnenscheinstunden       | 509            | 458            | 382            |                      | 329            |                      | 261            |                      | 236            |
| astr.max.mögl.Beschattung |                |                | 52             |                      | 534            |                      | 268            |                      | 206            |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: B - Lehmden Str. 103, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar         | Februar        | März                    | April                         | Mai            | Juni           |
|---------------------------|----------------|----------------|-------------------------|-------------------------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10 | 09:02 (WEA 02)<br>17:10 | 08:08 (WEA 01)<br>20:01       | 05:56<br>20:55 | 05:08<br>21:44 |
| 2                         | 08:43<br>16:21 | 08:12<br>17:12 | 09:03 (WEA 02)<br>18:06 | 08:07 (WEA 01)<br>20:03       | 05:54<br>20:57 | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:14 | 09:03 (WEA 02)<br>18:08 | 08:08 (WEA 01)<br>20:05       | 05:52<br>20:59 | 05:06<br>21:47 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:16 | 09:05 (WEA 02)<br>18:10 | 08:08 (vorh. WEA 09)<br>20:07 | 05:50<br>21:01 | 05:05<br>21:48 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17 | 09:05 (WEA 02)<br>18:12 | 08:07 (vorh. WEA 09)<br>20:09 | 05:48<br>21:02 | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19 | 09:06 (WEA 02)<br>18:14 | 08:07 (vorh. WEA 09)<br>20:10 | 05:46<br>21:04 | 05:04<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21 | 09:08 (WEA 02)<br>18:16 | 08:06 (vorh. WEA 09)<br>20:12 | 05:44<br>21:06 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23 | 09:10 (WEA 02)<br>18:17 | 08:07 (vorh. WEA 09)<br>20:14 | 05:42<br>21:08 | 05:02<br>21:52 |
| 9                         | 08:40<br>16:30 | 08:00<br>17:25 | 09:20 (WEA 02)<br>18:19 | 08:39 (vorh. WEA 09)<br>20:16 | 05:40<br>21:09 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 07:58<br>17:27 | 06:59<br>18:21          | 08:08 (vorh. WEA 09)<br>20:18 | 05:38<br>21:11 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 07:56<br>17:29 | 06:54<br>18:23          | 08:09 (vorh. WEA 09)<br>20:19 | 05:37<br>21:13 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 07:54<br>17:31 | 06:52<br>18:25          | 08:36 (vorh. WEA 09)<br>20:21 | 05:35<br>21:15 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:36 | 07:52<br>17:33 | 06:49<br>18:27          | 08:11 (vorh. WEA 09)<br>20:23 | 05:33<br>21:16 | 05:00<br>21:56 |
| 14                        | 08:37<br>16:37 | 07:50<br>17:35 | 06:47<br>18:29          | 08:32 (vorh. WEA 09)<br>20:25 | 05:31<br>21:18 | 05:00<br>21:56 |
| 15                        | 08:36<br>16:39 | 07:48<br>17:37 | 06:45<br>18:30          | 08:13 (vorh. WEA 09)<br>20:27 | 05:30<br>21:20 | 05:00<br>21:57 |
| 16                        | 08:35<br>16:40 | 07:46<br>17:39 | 06:42<br>18:32          | 08:16 (vorh. WEA 09)<br>20:28 | 05:28<br>21:21 | 04:59<br>21:57 |
| 17                        | 08:34<br>16:42 | 07:44<br>17:41 | 06:40<br>18:34          | 08:25 (vorh. WEA 09)<br>20:30 | 05:27<br>21:23 | 04:59<br>21:58 |
| 18                        | 08:33<br>16:44 | 07:42<br>17:43 | 06:37<br>18:36          | 08:18 (WEA 03)<br>20:32       | 05:25<br>21:24 | 04:59<br>21:58 |
| 19                        | 08:32<br>16:46 | 07:39<br>17:45 | 06:35<br>18:38          | 08:08 (WEA 03)<br>20:34       | 05:24<br>21:26 | 04:59<br>21:59 |
| 20                        | 08:31<br>16:47 | 07:37<br>17:47 | 06:33<br>18:40          | 08:21 (WEA 03)<br>20:36       | 05:22<br>21:28 | 04:59<br>21:59 |
| 21                        | 08:29<br>16:49 | 07:35<br>17:49 | 06:30<br>18:41          | 08:07 (WEA 03)<br>20:37       | 05:21<br>21:29 | 05:00<br>21:59 |
| 22                        | 08:28<br>16:51 | 07:33<br>17:51 | 06:28<br>18:43          | 09:07 (WEA 02)<br>20:39       | 05:19<br>21:31 | 05:00<br>21:59 |
| 23                        | 08:27<br>16:53 | 07:31<br>17:53 | 06:25<br>18:45          | 09:16 (WEA 02)<br>20:41       | 05:18<br>21:32 | 05:00<br>22:00 |
| 24                        | 08:26<br>16:54 | 07:29<br>17:55 | 06:23<br>18:47          | 09:05 (WEA 02)<br>20:43       | 05:16<br>21:34 | 05:00<br>22:00 |
| 25                        | 08:24<br>16:56 | 07:26<br>17:57 | 06:21<br>18:49          | 09:20 (WEA 02)<br>20:45       | 05:15<br>21:35 | 05:01<br>22:00 |
| 26                        | 08:23<br>16:58 | 07:24<br>17:58 | 06:18<br>18:50          | 09:03 (WEA 02)<br>20:46       | 05:14<br>21:36 | 05:01<br>22:00 |
| 27                        | 08:21<br>17:00 | 07:22<br>18:00 | 06:16<br>18:52          | 09:22 (WEA 02)<br>20:48       | 05:13<br>21:38 | 05:01<br>22:00 |
| 28                        | 08:20<br>17:02 | 07:20<br>18:02 | 06:13<br>18:54          | 09:02 (WEA 02)<br>20:50       | 05:12<br>21:39 | 05:02<br>21:59 |
| 29                        | 08:18<br>17:04 | 07:18<br>18:04 | 06:11<br>18:56          | 09:24 (WEA 02)<br>20:52       | 05:11<br>21:40 | 05:03<br>21:59 |
| 30                        | 08:17<br>17:06 | 07:16<br>18:06 | 06:08<br>18:58          | 09:03 (WEA 02)<br>20:54       | 05:09<br>21:42 | 05:03<br>21:59 |
| 31                        | 08:15<br>17:08 | 07:14<br>18:08 | 06:06<br>19:00          | 09:25 (WEA 02)<br>20:56       | 05:08<br>21:43 | 05:08<br>21:59 |
| Sonnenscheinstunden       | 253            | 274            | 367                     | 419                           | 491            | 507            |
| astr.max.mögl.Beschattung | 203            | 441            | 417                     |                               |                |                |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: B - Lehmden Str. 103, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | July           | August         | September      |                      | Oktober        |                                              | November       |                | Dezember       |
|---------------------------|----------------|----------------|----------------|----------------------|----------------|----------------------------------------------|----------------|----------------|----------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 |                      | 07:28<br>19:07 | 08:49 (vorh. WEA 09)<br>09:13 (vorh. WEA 09) | 07:25<br>16:58 |                | 08:18<br>16:14 |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 |                      | 07:29<br>19:04 | 08:47 (vorh. WEA 09)<br>09:13 (vorh. WEA 09) | 07:26<br>16:56 | 08:43 (WEA 02) | 08:20<br>16:14 |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 |                      | 07:31<br>19:02 | 08:46 (vorh. WEA 09)<br>09:14 (vorh. WEA 09) | 07:28<br>16:54 | 08:39 (WEA 02) | 08:21<br>16:13 |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 |                      | 07:33<br>19:00 | 08:45 (vorh. WEA 09)<br>09:15 (vorh. WEA 09) | 07:30<br>16:52 | 08:37 (WEA 02) | 08:23<br>16:12 |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 |                      | 07:35<br>18:57 | 08:44 (vorh. WEA 09)<br>09:15 (vorh. WEA 09) | 07:32<br>16:50 | 08:36 (WEA 02) | 08:24<br>16:12 |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 |                      | 07:37<br>18:55 | 08:44 (vorh. WEA 09)<br>09:16 (vorh. WEA 09) | 07:34<br>16:48 | 08:35 (WEA 02) | 08:26<br>16:11 |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 |                      | 07:38<br>18:52 | 08:43 (vorh. WEA 09)<br>09:16 (vorh. WEA 09) | 07:36<br>16:46 | 08:34 (WEA 02) | 08:27<br>16:11 |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 |                      | 07:40<br>18:50 | 08:42 (vorh. WEA 09)<br>09:15 (vorh. WEA 09) | 07:38<br>16:44 | 08:34 (WEA 02) | 08:28<br>16:10 |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 |                      | 07:42<br>18:48 | 08:42 (vorh. WEA 09)<br>09:15 (vorh. WEA 09) | 07:40<br>16:43 | 08:33 (WEA 02) | 08:29<br>16:10 |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 |                      | 07:44<br>18:45 | 08:42 (WEA 01)<br>09:15 (vorh. WEA 09)       | 07:42<br>16:41 | 08:33 (WEA 02) | 08:31<br>16:10 |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 |                      | 07:45<br>18:43 | 08:42 (WEA 01)<br>09:14 (vorh. WEA 09)       | 07:44<br>16:39 | 08:33 (WEA 02) | 08:32<br>16:10 |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 |                      | 07:47<br>18:41 | 08:41 (WEA 01)<br>09:14 (vorh. WEA 09)       | 07:45<br>16:38 | 08:33 (WEA 02) | 08:33<br>16:09 |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 |                      | 07:49<br>18:38 | 08:41 (WEA 01)<br>09:13 (vorh. WEA 09)       | 07:47<br>16:36 | 08:34 (WEA 02) | 08:34<br>16:09 |
| 14                        | 05:16<br>21:50 | 06:05<br>21:00 | 06:58<br>19:48 |                      | 07:51<br>18:36 | 08:41 (WEA 01)<br>09:12 (vorh. WEA 09)       | 07:49<br>16:35 | 08:34 (WEA 02) | 08:35<br>16:09 |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 |                      | 07:53<br>18:34 | 08:39 (WEA 03)<br>09:11 (vorh. WEA 09)       | 07:51<br>16:33 | 08:35 (WEA 02) | 08:36<br>16:09 |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 |                      | 07:55<br>18:32 | 08:38 (WEA 03)<br>09:09 (vorh. WEA 09)       | 07:53<br>16:31 | 08:35 (WEA 02) | 08:37<br>16:09 |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 |                      | 07:56<br>18:29 | 08:36 (WEA 03)<br>09:06 (WEA 01)             | 07:55<br>16:30 | 08:36 (WEA 02) | 08:37<br>16:10 |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 |                      | 07:58<br>18:27 | 08:36 (WEA 03)<br>09:05 (WEA 01)             | 07:56<br>16:29 | 08:37 (WEA 02) | 08:38<br>16:10 |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 |                      | 08:00<br>18:25 | 08:35 (WEA 03)<br>09:03 (WEA 01)             | 07:58<br>16:27 | 08:38 (WEA 02) | 08:39<br>16:10 |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:34 |                      | 08:02<br>18:23 | 08:35 (WEA 03)<br>09:02 (WEA 01)             | 08:00<br>16:26 | 08:40 (WEA 02) | 08:40<br>16:10 |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 |                      | 08:04<br>18:20 | 08:36 (WEA 03)<br>09:00 (WEA 01)             | 08:02<br>16:25 | 08:42 (WEA 02) | 08:40<br>16:11 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 |                      | 08:06<br>18:18 | 08:36 (WEA 03)<br>08:56 (WEA 01)             | 08:04<br>16:23 | 08:51 (WEA 02) | 08:41<br>16:11 |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 |                      | 08:08<br>18:16 | 08:37 (WEA 03)<br>08:51 (WEA 03)             | 08:05<br>16:22 |                | 08:41<br>16:12 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 |                      | 08:09<br>18:14 | 08:38 (WEA 03)<br>08:50 (WEA 03)             | 08:07<br>16:21 |                | 08:42<br>16:12 |
| 25                        | 05:32<br>21:36 | 06:24<br>20:35 | 07:17<br>19:21 |                      | 07:11<br>17:12 | 07:41 (WEA 03)<br>07:47 (WEA 03)             | 08:09<br>16:20 |                | 08:42<br>16:13 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 |                      | 07:13<br>17:10 |                                              | 08:10<br>16:19 |                | 08:42<br>16:14 |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 |                      | 07:15<br>17:08 |                                              | 08:12<br>16:18 |                | 08:43<br>16:14 |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:59 (vorh. WEA 09) | 07:17<br>17:06 |                                              | 08:14<br>16:17 |                | 08:43<br>16:15 |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 09:03 (vorh. WEA 09) | 07:19<br>17:04 |                                              | 08:15<br>16:16 |                | 08:43<br>16:16 |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:54 (vorh. WEA 09) | 07:21<br>17:01 |                                              | 08:17<br>16:15 |                | 08:43<br>16:17 |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 09:08 (vorh. WEA 09) | 07:23<br>17:00 |                                              |                |                | 08:43<br>16:18 |
| Sonnenscheinstunden       | 509            | 458            | 382            |                      | 329            |                                              | 261            |                | 236            |
| astr.max.mögl.Beschattung |                |                | 38             |                      | 684            |                                              | 358            |                |                |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: C - Lemder Str. 109, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar         | Februar                 | März                          | April          | Mal                           | Junl           |
|---------------------------|----------------|-------------------------|-------------------------------|----------------|-------------------------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10          | 09:19 (WEA 02)<br>17:10       | 07:17<br>18:04 | 08:23 (WEA 01)<br>20:01       | 05:56<br>21:44 |
| 2                         | 08:43<br>16:21 | 08:12<br>17:12          | 09:20 (WEA 02)<br>17:12       | 07:15<br>18:06 | 08:23 (WEA 01)<br>20:03       | 05:54<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:14          | 09:21 (WEA 02)<br>17:14       | 07:13<br>18:08 | 08:24 (WEA 01)<br>20:05       | 05:52<br>21:46 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:16          | 09:24 (WEA 02)<br>17:16       | 07:11<br>18:10 | 08:26 (WEA 01)<br>20:07       | 05:50<br>21:48 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17          | 09:33 (WEA 02)<br>17:17       | 07:08<br>18:12 | 08:27 (WEA 01)<br>20:09       | 05:48<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19          | 09:36 (WEA 02)<br>17:19       | 07:06<br>18:14 | 08:34 (vorh. WEA 09)<br>20:10 | 05:46<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21          | 09:37 (WEA 02)<br>17:21       | 07:04<br>18:16 | 08:34 (vorh. WEA 09)<br>20:12 | 05:44<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23          | 09:38 (WEA 02)<br>17:23       | 07:01<br>18:17 | 08:36 (vorh. WEA 09)<br>20:14 | 05:42<br>21:52 |
| 9                         | 08:40<br>16:30 | 08:00<br>17:25          | 09:39 (WEA 02)<br>17:25       | 06:59<br>18:19 | 08:38 (vorh. WEA 09)<br>20:16 | 05:40<br>21:52 |
| 10                        | 08:40<br>16:31 | 07:58<br>17:27          | 09:40 (WEA 02)<br>17:27       | 06:57<br>18:21 | 08:41 (vorh. WEA 09)<br>20:18 | 05:38<br>21:53 |
| 11                        | 08:39<br>16:32 | 07:56<br>17:29          | 09:41 (WEA 02)<br>17:29       | 06:54<br>18:23 | 08:53 (vorh. WEA 09)<br>20:19 | 05:37<br>21:54 |
| 12                        | 08:38<br>16:34 | 07:54<br>17:31          | 09:42 (WEA 02)<br>17:31       | 06:52<br>18:25 | 08:53 (vorh. WEA 09)<br>20:21 | 05:35<br>21:55 |
| 13                        | 08:37<br>16:36 | 09:18 (WEA 02)<br>17:33 | 08:21 (WEA 03)<br>17:33       | 06:49<br>18:27 | 06:35<br>20:23                | 05:33<br>21:56 |
| 14                        | 08:37<br>16:37 | 09:17 (WEA 02)<br>17:35 | 08:24 (WEA 03)<br>17:35       | 06:47<br>18:29 | 06:33<br>20:25                | 05:31<br>21:56 |
| 15                        | 08:36<br>16:39 | 09:16 (WEA 02)<br>17:37 | 08:28 (WEA 03)<br>17:37       | 06:45<br>18:30 | 06:31<br>20:27                | 05:30<br>21:57 |
| 16                        | 08:35<br>16:40 | 09:16 (WEA 02)<br>17:39 | 08:15 (WEA 03)<br>17:39       | 06:42<br>18:32 | 06:28<br>20:28                | 05:28<br>21:57 |
| 17                        | 08:34<br>16:42 | 09:15 (WEA 02)<br>17:41 | 08:14 (WEA 03)<br>17:41       | 06:40<br>18:34 | 06:26<br>20:30                | 05:27<br>21:58 |
| 18                        | 08:33<br>16:44 | 09:15 (WEA 02)<br>17:43 | 09:03 (vorh. WEA 09)<br>17:43 | 06:37<br>18:36 | 06:24<br>20:32                | 05:25<br>21:58 |
| 19                        | 08:32<br>16:46 | 09:15 (WEA 02)<br>17:45 | 08:14 (WEA 03)<br>17:45       | 06:35<br>18:38 | 06:22<br>20:34                | 05:24<br>21:59 |
| 20                        | 08:31<br>16:47 | 09:14 (WEA 02)<br>17:47 | 09:06 (vorh. WEA 09)<br>17:47 | 06:33<br>18:40 | 06:19<br>20:36                | 05:22<br>21:59 |
| 21                        | 08:29<br>16:49 | 09:15 (WEA 02)<br>17:49 | 08:13 (WEA 03)<br>17:49       | 06:30<br>18:41 | 06:17<br>20:37                | 05:21<br>21:59 |
| 22                        | 08:28<br>16:51 | 09:14 (WEA 02)<br>17:51 | 09:07 (vorh. WEA 09)<br>17:51 | 06:28<br>18:43 | 06:15<br>20:39                | 05:19<br>21:59 |
| 23                        | 08:27<br>16:53 | 09:14 (WEA 02)<br>17:53 | 08:15 (WEA 03)<br>17:53       | 06:25<br>18:45 | 06:13<br>20:41                | 05:18<br>22:00 |
| 24                        | 08:26<br>16:54 | 09:14 (WEA 02)<br>17:55 | 09:09 (vorh. WEA 09)<br>17:55 | 06:23<br>18:47 | 06:11<br>20:43                | 05:16<br>22:00 |
| 25                        | 08:24<br>16:56 | 09:15 (WEA 02)<br>17:57 | 08:17 (WEA 03)<br>17:57       | 06:21<br>18:49 | 06:08<br>20:45                | 05:15<br>22:00 |
| 26                        | 08:23<br>16:58 | 09:15 (WEA 02)<br>17:58 | 09:09 (vorh. WEA 09)<br>17:58 | 06:18<br>18:50 | 06:06<br>20:46                | 05:14<br>22:00 |
| 27                        | 08:21<br>17:00 | 09:16 (WEA 02)<br>18:00 | 08:21 (WEA 01)<br>18:00       | 06:16<br>18:52 | 06:04<br>20:48                | 05:13<br>22:00 |
| 28                        | 08:20<br>17:02 | 09:16 (WEA 02)<br>18:02 | 08:22 (WEA 01)<br>18:02       | 06:13<br>18:54 | 06:02<br>20:50                | 05:12<br>21:59 |
| 29                        | 08:18<br>17:04 | 09:16 (WEA 02)<br>18:04 | 09:08 (vorh. WEA 09)<br>18:04 | 07:11<br>19:56 | 06:00<br>20:52                | 05:11<br>21:59 |
| 30                        | 08:17<br>17:06 | 09:17 (WEA 02)<br>18:06 | 09:09 (vorh. WEA 09)<br>18:06 | 07:08<br>19:58 | 05:58<br>20:54                | 05:09<br>21:59 |
| 31                        | 08:15<br>17:08 | 09:18 (WEA 02)<br>18:08 | 09:10 (vorh. WEA 09)<br>18:08 | 07:06<br>20:00 | 05:08<br>21:43                | 05:08<br>21:59 |
| Sonnenscheinstunden       | 253            | 274                     | 367                           | 419            | 491                           | 507            |
| astr.max.mögl.Beschattung | 378            | 763                     | 319                           |                |                               |                |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: C - Lemder Str. 109, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul            | August         | September      | Oktober        |                      | November       | Dezember       |
|---------------------------|----------------|----------------|----------------|----------------|----------------------|----------------|----------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 | 07:28<br>19:07 |                      | 07:25<br>16:58 | 08:18<br>16:14 |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 |                      | 07:26<br>16:56 | 08:20<br>16:14 |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 | 09:22 (vorh. WEA 09) | 07:28<br>16:54 | 08:21<br>16:13 |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 09:17 (vorh. WEA 09) | 07:30<br>16:52 | 08:23<br>16:12 |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 | 07:35<br>18:57 | 09:14 (vorh. WEA 09) | 07:32<br>16:50 | 08:24<br>16:12 |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:37<br>18:55 | 09:12 (vorh. WEA 09) | 07:34<br>16:48 | 08:26<br>16:11 |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 | 07:38<br>18:52 | 09:11 (vorh. WEA 09) | 07:36<br>16:46 | 08:27<br>16:11 |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 09:04 (WEA 01)       | 07:38<br>16:44 | 08:28<br>16:10 |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 09:39 (vorh. WEA 09) | 07:40<br>16:43 | 08:29<br>16:10 |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 09:01 (WEA 01)       | 07:42<br>16:41 | 08:31<br>16:10 |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 09:40 (vorh. WEA 09) | 07:44<br>16:39 | 08:32<br>16:10 |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 08:59 (WEA 01)       | 07:45<br>16:38 | 08:33<br>16:09 |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 08:56 (WEA 01)       | 07:47<br>16:36 | 08:34<br>16:09 |
| 14                        | 05:16<br>21:50 | 06:05<br>21:00 | 06:58<br>19:48 | 07:51<br>18:36 | 08:55 (WEA 01)       | 07:49<br>16:35 | 08:35<br>16:09 |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 09:41 (vorh. WEA 09) | 07:51<br>16:33 | 08:36<br>16:09 |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 08:54 (WEA 01)       | 07:53<br>16:31 | 08:37<br>16:09 |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 08:47 (WEA 03)       | 07:55<br>16:30 | 08:37<br>16:10 |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 09:40 (vorh. WEA 09) | 07:56<br>16:29 | 08:38<br>16:10 |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 08:46 (WEA 03)       | 07:58<br>16:27 | 08:39<br>16:10 |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:34 | 08:02<br>18:23 | 09:39 (vorh. WEA 09) | 08:00<br>16:26 | 08:40<br>16:10 |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:44 (WEA 03)       | 08:02<br>16:25 | 08:40<br>16:11 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 09:37 (vorh. WEA 09) | 08:04<br>16:23 | 08:41<br>16:11 |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 08:43 (WEA 03)       | 08:05<br>16:22 | 08:41<br>16:12 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 09:36 (vorh. WEA 09) | 08:07<br>16:21 | 08:42<br>16:12 |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 09:33 (vorh. WEA 09) | 08:09<br>16:20 | 08:42<br>16:12 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 07:44 (WEA 03)       | 08:10<br>16:19 | 08:43<br>16:14 |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 08:32 (vorh. WEA 09) | 08:12<br>16:18 | 08:43<br>16:14 |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>17:06 | 08:25 (vorh. WEA 09) | 08:14<br>16:17 | 08:43<br>16:15 |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:04 | 07:48 (WEA 03)       | 08:15<br>16:16 | 08:43<br>16:16 |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 07:57 (WEA 03)       | 08:17<br>16:15 | 08:43<br>16:17 |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 08:23<br>16:59 |                      |                | 08:43<br>16:18 |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 1043                 | 443            | 236            |
| astr.max.mögl.Beschattung |                |                |                |                |                      |                |                |

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

|              |                       |                         |                      |                                  |                            |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|----------------------------|
| 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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: D - Lehmden Str. 109a, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar         | Februar                 | März                    | April          | Mai                           | Juni           |
|---------------------------|----------------|-------------------------|-------------------------|----------------|-------------------------------|----------------|
| 1                         | 08:43<br>16:19 | 08:14<br>17:10          | 09:26 (WEA 02)<br>17:10 | 07:17<br>18:04 | 08:28 (WEA 01)<br>20:01       | 05:08<br>21:44 |
| 2                         | 08:43<br>16:21 | 08:12<br>17:12          | 09:27 (WEA 02)<br>17:12 | 07:15<br>18:06 | 08:28 (WEA 01)<br>20:03       | 05:07<br>21:45 |
| 3                         | 08:43<br>16:22 | 08:10<br>17:14          | 09:30 (WEA 02)<br>17:14 | 07:13<br>18:08 | 08:30 (WEA 01)<br>20:05       | 05:06<br>21:46 |
| 4                         | 08:42<br>16:23 | 08:09<br>17:16          | 09:36 (WEA 02)<br>17:16 | 07:11<br>18:10 | 08:32 (WEA 01)<br>20:07       | 05:05<br>21:48 |
| 5                         | 08:42<br>16:24 | 08:07<br>17:17          | 09:39 (WEA 02)<br>17:17 | 07:08<br>18:12 | 08:35 (WEA 01)<br>20:09       | 05:04<br>21:49 |
| 6                         | 08:42<br>16:25 | 08:05<br>17:19          | 09:41 (WEA 02)<br>17:19 | 07:06<br>18:14 | 08:44 (vorh. WEA 09)<br>20:10 | 05:04<br>21:50 |
| 7                         | 08:41<br>16:27 | 08:03<br>17:21          | 09:43 (WEA 02)<br>17:21 | 07:04<br>18:16 | 08:45 (vorh. WEA 09)<br>20:12 | 05:03<br>21:51 |
| 8                         | 08:41<br>16:28 | 08:01<br>17:23          | 09:45 (WEA 02)<br>17:23 | 07:01<br>18:17 | 08:48 (vorh. WEA 09)<br>20:14 | 05:02<br>21:52 |
| 9                         | 08:40<br>16:30 | 09:24 (WEA 02)<br>17:25 | 09:29 (WEA 02)<br>17:25 | 06:59<br>18:19 | 08:51 (vorh. WEA 09)<br>20:16 | 05:02<br>21:52 |
| 10                        | 08:40<br>16:31 | 09:22 (WEA 02)<br>17:27 | 09:27 (WEA 02)<br>17:27 | 06:57<br>18:21 | 09:05 (vorh. WEA 09)<br>20:18 | 05:01<br>21:53 |
| 11                        | 08:39<br>16:32 | 09:21 (WEA 02)<br>17:29 | 09:29 (WEA 02)<br>17:29 | 06:54<br>18:23 | 09:06 (vorh. WEA 09)<br>20:19 | 05:01<br>21:54 |
| 12                        | 08:38<br>16:34 | 09:20 (WEA 02)<br>17:31 | 09:28 (WEA 02)<br>17:31 | 06:52<br>18:25 | 09:07 (vorh. WEA 09)<br>20:21 | 05:00<br>21:55 |
| 13                        | 08:37<br>16:36 | 09:20 (WEA 02)<br>17:33 | 09:29 (WEA 02)<br>17:33 | 06:49<br>18:27 | 09:08 (vorh. WEA 09)<br>20:23 | 05:00<br>21:56 |
| 14                        | 08:37<br>16:37 | 09:19 (WEA 02)<br>17:35 | 09:30 (WEA 02)<br>17:35 | 06:47<br>18:29 | 09:09 (vorh. WEA 09)<br>20:25 | 05:00<br>21:56 |
| 15                        | 08:36<br>16:39 | 09:19 (WEA 02)<br>17:37 | 09:31 (WEA 02)<br>17:37 | 06:45<br>18:30 | 09:10 (vorh. WEA 09)<br>20:27 | 05:00<br>21:57 |
| 16                        | 08:35<br>16:40 | 09:19 (WEA 02)<br>17:39 | 09:32 (WEA 02)<br>17:39 | 06:42<br>18:32 | 09:11 (vorh. WEA 09)<br>20:28 | 04:59<br>21:57 |
| 17                        | 08:34<br>16:42 | 09:19 (WEA 02)<br>17:41 | 09:33 (WEA 02)<br>17:41 | 06:40<br>18:34 | 09:12 (vorh. WEA 09)<br>20:30 | 04:59<br>21:58 |
| 18                        | 08:33<br>16:44 | 09:19 (WEA 02)<br>17:43 | 09:34 (WEA 02)<br>17:43 | 06:37<br>18:36 | 09:13 (vorh. WEA 09)<br>20:32 | 04:59<br>21:58 |
| 19                        | 08:32<br>16:46 | 09:19 (WEA 02)<br>17:45 | 09:35 (WEA 02)<br>17:45 | 06:35<br>18:38 | 09:14 (vorh. WEA 09)<br>20:34 | 04:59<br>21:59 |
| 20                        | 08:31<br>16:47 | 09:19 (WEA 02)<br>17:47 | 09:36 (WEA 02)<br>17:47 | 06:33<br>18:40 | 09:15 (vorh. WEA 09)<br>20:36 | 04:59<br>21:59 |
| 21                        | 08:29<br>16:49 | 09:19 (WEA 02)<br>17:49 | 09:37 (WEA 02)<br>17:49 | 06:30<br>18:41 | 09:16 (vorh. WEA 09)<br>20:37 | 05:00<br>21:59 |
| 22                        | 08:28<br>16:51 | 09:19 (WEA 02)<br>17:51 | 09:38 (WEA 02)<br>17:51 | 06:28<br>18:43 | 09:17 (vorh. WEA 09)<br>20:39 | 05:00<br>21:59 |
| 23                        | 08:27<br>16:53 | 09:19 (WEA 02)<br>17:53 | 09:39 (WEA 02)<br>17:53 | 06:25<br>18:45 | 09:18 (vorh. WEA 09)<br>20:41 | 05:00<br>22:00 |
| 24                        | 08:26<br>16:54 | 09:19 (WEA 02)<br>17:55 | 09:40 (WEA 02)<br>17:55 | 06:23<br>18:47 | 09:19 (vorh. WEA 09)<br>20:43 | 05:00<br>22:00 |
| 25                        | 08:24<br>16:56 | 09:20 (WEA 02)<br>17:57 | 09:41 (WEA 02)<br>17:57 | 06:21<br>18:49 | 09:20 (vorh. WEA 09)<br>20:45 | 05:01<br>22:00 |
| 26                        | 08:23<br>16:58 | 09:20 (WEA 02)<br>17:58 | 09:42 (WEA 02)<br>17:58 | 06:18<br>18:50 | 09:21 (vorh. WEA 09)<br>20:46 | 05:01<br>22:00 |
| 27                        | 08:21<br>17:00 | 09:21 (WEA 02)<br>18:00 | 09:43 (WEA 02)<br>18:00 | 06:16<br>18:52 | 09:22 (vorh. WEA 09)<br>20:48 | 05:01<br>22:00 |
| 28                        | 08:20<br>17:02 | 09:21 (WEA 02)<br>18:02 | 09:44 (WEA 02)<br>18:02 | 06:13<br>18:54 | 09:23 (vorh. WEA 09)<br>20:50 | 05:02<br>21:59 |
| 29                        | 08:18<br>17:04 | 09:22 (WEA 02)<br>18:04 | 09:45 (WEA 02)<br>18:04 | 07:11<br>19:56 | 09:24 (vorh. WEA 09)<br>20:52 | 05:03<br>21:59 |
| 30                        | 08:17<br>17:06 | 09:24 (WEA 02)<br>18:06 | 09:47 (WEA 02)<br>18:06 | 07:08<br>19:58 | 09:25 (vorh. WEA 09)<br>20:54 | 05:03<br>21:59 |
| 31                        | 08:15<br>17:08 | 09:24 (WEA 02)<br>18:08 | 09:48 (WEA 02)<br>18:08 | 07:06<br>20:00 | 09:26 (vorh. WEA 09)<br>20:56 | 05:04<br>21:59 |
| Sonnenscheinstunden       | 253            | 274                     | 367                     | 419            | 491                           | 507            |
| astr.max.mögl.Beschattung | 457            | 953                     | 319                     |                |                               |                |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: D - Lehmden Str. 109a, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober |                         | November |                   | Dezember |                   |
|---------------------------|-------|--------|-----------|---------|-------------------------|----------|-------------------|----------|-------------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |                         | 07:25    |                   | 08:18    | 09:03 (WEA 02)    |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |                         | 16:58    |                   | 16:14    | 12 09:15 (WEA 02) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |                         | 07:26    |                   | 08:20    | 09:05 (WEA 02)    |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |                         | 16:56    |                   | 16:14    | 10 09:15 (WEA 02) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |                         | 07:28    |                   | 08:21    | 09:08 (WEA 02)    |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |                         | 16:54    |                   | 16:13    | 6 09:14 (WEA 02)  |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   | 09:30 (vorh. WEA 09)    | 07:30    |                   | 08:23    |                   |
|                           | 21:58 | 21:19  | 20:12     | 19:00   | 10 09:40 (vorh. WEA 09) | 16:52    |                   | 16:12    |                   |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   | 09:26 (vorh. WEA 09)    | 07:32    |                   | 08:24    |                   |
|                           | 21:57 | 21:17  | 20:10     | 18:57   | 18 09:44 (vorh. WEA 09) | 16:50    |                   | 16:12    |                   |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   | 09:23 (vorh. WEA 09)    | 07:34    |                   | 08:26    |                   |
|                           | 21:56 | 21:15  | 20:07     | 18:55   | 23 09:46 (vorh. WEA 09) | 16:48    |                   | 16:11    |                   |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   | 09:21 (vorh. WEA 09)    | 07:36    |                   | 08:27    |                   |
|                           | 21:56 | 21:14  | 20:05     | 18:52   | 27 09:48 (vorh. WEA 09) | 16:46    |                   | 16:11    |                   |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   | 09:19 (vorh. WEA 09)    | 07:38    | 09:01 (WEA 02)    | 08:28    |                   |
|                           | 21:55 | 21:12  | 20:03     | 18:50   | 30 09:49 (vorh. WEA 09) | 16:44    | 7 09:08 (WEA 02)  | 16:10    |                   |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   | 09:08 (WEA 01)          | 07:40    | 08:58 (WEA 02)    | 08:29    |                   |
|                           | 21:54 | 21:10  | 20:00     | 18:48   | 42 09:50 (vorh. WEA 09) | 16:43    | 12 09:10 (WEA 02) | 16:10    |                   |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   | 09:05 (WEA 01)          | 07:42    | 08:56 (WEA 02)    | 08:31    |                   |
|                           | 21:54 | 21:08  | 19:58     | 18:45   | 46 09:51 (vorh. WEA 09) | 16:41    | 16 09:12 (WEA 02) | 16:10    |                   |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   | 09:03 (WEA 01)          | 07:44    | 08:55 (WEA 02)    | 08:32    |                   |
|                           | 21:53 | 21:06  | 19:55     | 18:43   | 48 09:51 (vorh. WEA 09) | 16:39    | 18 09:13 (WEA 02) | 16:10    |                   |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   | 09:02 (WEA 01)          | 07:45    | 08:54 (WEA 02)    | 08:33    |                   |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 50 09:52 (vorh. WEA 09) | 16:38    | 20 09:14 (WEA 02) | 16:09    |                   |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   | 09:00 (WEA 01)          | 07:47    | 08:54 (WEA 02)    | 08:34    |                   |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 52 09:52 (vorh. WEA 09) | 16:36    | 21 09:15 (WEA 02) | 16:09    |                   |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   | 09:00 (WEA 01)          | 07:49    | 08:53 (WEA 02)    | 08:35    |                   |
|                           | 21:50 | 21:00  | 19:48     | 18:36   | 53 09:53 (vorh. WEA 09) | 16:35    | 23 09:16 (WEA 02) | 16:09    |                   |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   | 08:59 (WEA 01)          | 07:51    | 08:53 (WEA 02)    | 08:36    |                   |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 54 09:53 (vorh. WEA 09) | 16:33    | 23 09:16 (WEA 02) | 16:09    |                   |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   | 08:58 (WEA 01)          | 07:53    | 08:53 (WEA 02)    | 08:37    |                   |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 55 09:53 (vorh. WEA 09) | 16:31    | 24 09:17 (WEA 02) | 16:09    |                   |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   | 08:51 (WEA 03)          | 07:55    | 08:53 (WEA 02)    | 08:37    |                   |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 61 09:52 (vorh. WEA 09) | 16:30    | 24 09:17 (WEA 02) | 16:10    |                   |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   | 08:49 (WEA 03)          | 07:56    | 08:53 (WEA 02)    | 08:38    |                   |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 62 09:51 (vorh. WEA 09) | 16:29    | 25 09:18 (WEA 02) | 16:10    |                   |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   | 08:48 (WEA 03)          | 07:58    | 08:53 (WEA 02)    | 08:39    |                   |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 63 09:51 (vorh. WEA 09) | 16:27    | 25 09:18 (WEA 02) | 16:10    |                   |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   | 08:47 (WEA 03)          | 08:00    | 08:54 (WEA 02)    | 08:40    |                   |
|                           | 21:43 | 20:47  | 19:34     | 18:23   | 64 09:51 (vorh. WEA 09) | 16:26    | 24 09:18 (WEA 02) | 16:10    |                   |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   | 08:46 (WEA 03)          | 08:02    | 08:54 (WEA 02)    | 08:40    |                   |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 64 09:50 (vorh. WEA 09) | 16:25    | 24 09:18 (WEA 02) | 16:11    |                   |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   | 08:46 (WEA 03)          | 08:04    | 08:55 (WEA 02)    | 08:41    |                   |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 63 09:49 (vorh. WEA 09) | 16:23    | 23 09:18 (WEA 02) | 16:11    |                   |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   | 08:46 (WEA 03)          | 08:05    | 08:56 (WEA 02)    | 08:41    |                   |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 62 09:48 (vorh. WEA 09) | 16:22    | 22 09:18 (WEA 02) | 16:12    |                   |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 08:46 (WEA 03)          | 08:07    | 08:56 (WEA 02)    | 08:42    |                   |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 61 09:47 (vorh. WEA 09) | 16:21    | 22 09:18 (WEA 02) | 16:12    |                   |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 07:46 (WEA 03)          | 08:09    | 08:57 (WEA 02)    | 08:42    |                   |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 60 08:46 (vorh. WEA 09) | 16:20    | 21 09:18 (WEA 02) | 16:13    |                   |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 07:47 (WEA 03)          | 08:10    | 08:58 (WEA 02)    | 08:42    |                   |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 58 08:45 (vorh. WEA 09) | 16:19    | 20 09:18 (WEA 02) | 16:14    |                   |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   | 07:47 (WEA 03)          | 08:12    | 08:58 (WEA 02)    | 08:43    |                   |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 56 08:43 (vorh. WEA 09) | 16:18    | 19 09:17 (WEA 02) | 16:14    |                   |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   | 07:48 (WEA 03)          | 08:14    | 09:00 (WEA 02)    | 08:43    |                   |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 46 08:41 (vorh. WEA 09) | 16:17    | 17 09:17 (WEA 02) | 16:15    |                   |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   | 07:50 (WEA 03)          | 08:15    | 09:01 (WEA 02)    | 08:43    |                   |
|                           | 21:30 | 20:26  | 19:12     | 17:04   | 25 08:38 (vorh. WEA 09) | 16:16    | 16 09:17 (WEA 02) | 16:16    |                   |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   | 08:28 (vorh. WEA 09)    | 08:17    | 09:02 (WEA 02)    | 08:43    |                   |
|                           | 21:28 | 20:24  | 19:09     | 17:01   | 5 08:33 (vorh. WEA 09)  | 16:15    | 15 09:17 (WEA 02) | 16:17    |                   |
| 31                        | 05:41 | 06:34  |           | 07:23   |                         |          |                   | 08:43    |                   |
|                           | 21:26 | 20:22  |           | 16:59   |                         |          |                   | 16:18    |                   |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 1258                    | 261      | 451               | 236      | 28                |
| 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) | Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten) | Sonnenuntergang (SS:MM) | Minuten mit Schatten | Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten) |
|--------------|-----------------------|------------------------------------------------------------|-------------------------|----------------------|-----------------------------------------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: E - Lehmden Str. 121, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Januar                    |       | Februar        |       | März                 |                      | April |       | Mai   |  | Juni |  |
|---------------------------|-------|----------------|-------|----------------------|----------------------|-------|-------|-------|--|------|--|
| 1                         | 08:43 | 09:28 (WEA 02) | 08:14 | 07:17                | 08:45 (WEA 01)       | 07:04 | 05:56 | 05:08 |  |      |  |
|                           | 16:19 | 09:38 (WEA 02) | 17:10 | 18:04                | 09:35 (vorh. WEA 09) | 20:01 | 20:55 | 21:44 |  |      |  |
| 2                         | 08:43 | 09:28 (WEA 02) | 08:12 | 07:15                | 08:50 (WEA 01)       | 07:01 | 05:54 | 05:07 |  |      |  |
|                           | 16:21 | 09:39 (WEA 02) | 17:12 | 18:06                | 09:31 (vorh. WEA 09) | 20:03 | 20:57 | 21:45 |  |      |  |
| 3                         | 08:43 | 09:28 (WEA 02) | 08:10 | 07:13                | 09:13 (vorh. WEA 09) | 06:59 | 05:52 | 05:06 |  |      |  |
|                           | 16:22 | 09:41 (WEA 02) | 17:14 | 18:08                | 09:28 (vorh. WEA 09) | 20:05 | 20:59 | 21:46 |  |      |  |
| 4                         | 08:42 | 09:27 (WEA 02) | 08:09 | 09:18 (vorh. WEA 09) |                      | 06:56 | 05:50 | 05:05 |  |      |  |
|                           | 16:23 | 09:41 (WEA 02) | 17:16 | 18:10                | 09:29 (vorh. WEA 09) | 20:07 | 21:01 | 21:48 |  |      |  |
| 5                         | 08:42 | 09:28 (WEA 02) | 08:07 | 09:15 (vorh. WEA 09) |                      | 06:54 | 05:48 | 05:04 |  |      |  |
|                           | 16:24 | 09:43 (WEA 02) | 17:17 | 18:12                | 09:32 (vorh. WEA 09) | 20:09 | 21:02 | 21:49 |  |      |  |
| 6                         | 08:42 | 09:27 (WEA 02) | 08:05 | 09:12 (vorh. WEA 09) |                      | 06:52 | 05:46 | 05:03 |  |      |  |
|                           | 16:25 | 09:44 (WEA 02) | 17:19 | 18:14                | 09:35 (vorh. WEA 09) | 20:10 | 21:04 | 21:50 |  |      |  |
| 7                         | 08:41 | 09:27 (WEA 02) | 08:03 | 09:38 (vorh. WEA 09) |                      | 06:49 | 05:44 | 05:03 |  |      |  |
|                           | 16:27 | 09:44 (WEA 02) | 17:21 | 18:16                | 09:36 (vorh. WEA 09) | 20:12 | 21:06 | 21:51 |  |      |  |
| 8                         | 08:41 | 09:27 (WEA 02) | 08:01 | 09:09 (vorh. WEA 09) |                      | 06:47 | 05:42 | 05:02 |  |      |  |
|                           | 16:28 | 09:46 (WEA 02) | 17:23 | 18:17                | 09:38 (vorh. WEA 09) | 20:14 | 21:08 | 21:52 |  |      |  |
| 9                         | 08:40 | 09:27 (WEA 02) | 08:00 | 08:31 (WEA 03)       |                      | 06:45 | 05:40 | 05:02 |  |      |  |
|                           | 16:30 | 09:46 (WEA 02) | 17:25 | 18:19                | 09:39 (vorh. WEA 09) | 20:16 | 21:09 | 21:52 |  |      |  |
| 10                        | 08:40 | 09:27 (WEA 02) | 07:58 | 08:28 (WEA 03)       |                      | 06:42 | 05:38 | 05:01 |  |      |  |
|                           | 16:31 | 09:47 (WEA 02) | 17:27 | 18:21                | 09:40 (vorh. WEA 09) | 20:18 | 21:11 | 21:53 |  |      |  |
| 11                        | 08:39 | 09:26 (WEA 02) | 07:56 | 08:26 (WEA 03)       |                      | 06:40 | 05:37 | 05:01 |  |      |  |
|                           | 16:32 | 09:48 (WEA 02) | 17:29 | 18:23                | 09:41 (vorh. WEA 09) | 20:19 | 21:13 | 21:54 |  |      |  |
| 12                        | 08:38 | 09:26 (WEA 02) | 07:54 | 08:25 (WEA 03)       |                      | 06:38 | 05:35 | 05:00 |  |      |  |
|                           | 16:34 | 09:48 (WEA 02) | 17:31 | 18:25                | 09:42 (vorh. WEA 09) | 20:21 | 21:15 | 21:55 |  |      |  |
| 13                        | 08:37 | 09:26 (WEA 02) | 07:52 | 08:23 (WEA 03)       |                      | 06:35 | 05:33 | 05:00 |  |      |  |
|                           | 16:36 | 09:49 (WEA 02) | 17:33 | 18:27                | 09:42 (vorh. WEA 09) | 20:23 | 21:16 | 21:56 |  |      |  |
| 14                        | 08:37 | 09:26 (WEA 02) | 07:50 | 08:23 (WEA 03)       |                      | 06:33 | 05:31 | 05:00 |  |      |  |
|                           | 16:37 | 09:50 (WEA 02) | 17:35 | 18:29                | 09:43 (vorh. WEA 09) | 20:25 | 21:18 | 21:56 |  |      |  |
| 15                        | 08:36 | 09:27 (WEA 02) | 07:48 | 08:23 (WEA 03)       |                      | 06:31 | 05:30 | 05:00 |  |      |  |
|                           | 16:39 | 09:51 (WEA 02) | 17:37 | 18:30                | 09:43 (vorh. WEA 09) | 20:27 | 21:20 | 21:57 |  |      |  |
| 16                        | 08:35 | 09:27 (WEA 02) | 07:46 | 08:23 (WEA 03)       |                      | 06:28 | 05:28 | 04:59 |  |      |  |
|                           | 16:40 | 09:51 (WEA 02) | 17:39 | 18:32                | 09:44 (vorh. WEA 09) | 20:28 | 21:21 | 21:57 |  |      |  |
| 17                        | 08:34 | 09:27 (WEA 02) | 07:44 | 08:23 (WEA 03)       |                      | 06:26 | 05:27 | 04:59 |  |      |  |
|                           | 16:42 | 09:52 (WEA 02) | 17:41 | 18:34                | 09:44 (vorh. WEA 09) | 20:30 | 21:23 | 21:58 |  |      |  |
| 18                        | 08:33 | 09:28 (WEA 02) | 07:42 | 08:23 (WEA 03)       |                      | 06:24 | 05:25 | 04:59 |  |      |  |
|                           | 16:44 | 09:53 (WEA 02) | 17:43 | 18:36                | 09:44 (vorh. WEA 09) | 20:32 | 21:24 | 21:58 |  |      |  |
| 19                        | 08:32 | 09:28 (WEA 02) | 07:39 | 08:24 (WEA 03)       |                      | 06:22 | 05:24 | 04:59 |  |      |  |
|                           | 16:46 | 09:53 (WEA 02) | 17:45 | 18:38                | 09:44 (vorh. WEA 09) | 20:34 | 21:26 | 21:59 |  |      |  |
| 20                        | 08:31 | 09:28 (WEA 02) | 07:37 | 08:24 (WEA 03)       |                      | 06:19 | 05:22 | 04:59 |  |      |  |
|                           | 16:47 | 09:53 (WEA 02) | 17:47 | 18:40                | 09:43 (vorh. WEA 09) | 20:36 | 21:28 | 21:59 |  |      |  |
| 21                        | 08:29 | 09:29 (WEA 02) | 07:35 | 08:25 (WEA 03)       |                      | 06:17 | 05:21 | 05:00 |  |      |  |
|                           | 16:49 | 09:53 (WEA 02) | 17:49 | 18:41                | 09:43 (vorh. WEA 09) | 20:37 | 21:29 | 21:59 |  |      |  |
| 22                        | 08:28 | 09:29 (WEA 02) | 07:33 | 08:27 (WEA 03)       |                      | 06:15 | 05:19 | 05:00 |  |      |  |
|                           | 16:51 | 09:53 (WEA 02) | 17:51 | 18:43                | 09:43 (vorh. WEA 09) | 20:39 | 21:31 | 21:59 |  |      |  |
| 23                        | 08:27 | 09:30 (WEA 02) | 07:31 | 08:31 (WEA 03)       |                      | 06:13 | 05:18 | 05:00 |  |      |  |
|                           | 16:53 | 09:53 (WEA 02) | 17:53 | 18:45                | 09:43 (vorh. WEA 09) | 20:41 | 21:32 | 22:00 |  |      |  |
| 24                        | 08:26 | 09:30 (WEA 02) | 07:29 | 08:38 (WEA 01)       |                      | 06:10 | 05:16 | 05:00 |  |      |  |
|                           | 16:54 | 09:53 (WEA 02) | 17:55 | 18:47                | 09:41 (vorh. WEA 09) | 20:43 | 21:34 | 22:00 |  |      |  |
| 25                        | 08:24 | 09:31 (WEA 02) | 07:26 | 08:39 (WEA 01)       |                      | 06:08 | 05:15 | 05:01 |  |      |  |
|                           | 16:56 | 09:53 (WEA 02) | 17:57 | 18:49                | 09:40 (vorh. WEA 09) | 20:45 | 21:35 | 22:00 |  |      |  |
| 26                        | 08:23 | 09:32 (WEA 02) | 07:24 | 08:40 (WEA 01)       |                      | 06:06 | 05:14 | 05:01 |  |      |  |
|                           | 16:58 | 09:52 (WEA 02) | 17:58 | 18:50                | 09:40 (vorh. WEA 09) | 20:46 | 21:36 | 22:00 |  |      |  |
| 27                        | 08:21 | 09:33 (WEA 02) | 07:22 | 08:40 (WEA 01)       |                      | 06:04 | 05:13 | 05:01 |  |      |  |
|                           | 17:00 | 09:52 (WEA 02) | 18:00 | 18:52                | 09:38 (vorh. WEA 09) | 20:48 | 21:38 | 22:00 |  |      |  |
| 28                        | 08:20 | 09:34 (WEA 02) | 07:20 | 08:42 (WEA 01)       |                      | 06:02 | 05:12 | 05:02 |  |      |  |
|                           | 17:02 | 09:51 (WEA 02) | 18:02 | 18:54                | 09:36 (vorh. WEA 09) | 20:50 | 21:39 | 21:59 |  |      |  |
| 29                        | 08:18 | 09:36 (WEA 02) |       | 07:11                |                      | 06:00 | 05:11 | 05:03 |  |      |  |
|                           | 17:04 | 09:49 (WEA 02) |       | 19:56                |                      | 20:52 | 21:40 | 21:59 |  |      |  |
| 30                        | 08:17 | 09:39 (WEA 02) |       | 07:08                |                      | 05:58 | 05:09 | 05:03 |  |      |  |
|                           | 17:06 | 09:48 (WEA 02) |       | 19:58                |                      | 20:54 | 21:42 | 21:59 |  |      |  |
| 31                        | 08:15 |                |       | 07:06                |                      |       | 05:08 |       |  |      |  |
|                           | 17:08 |                |       | 20:00                |                      |       | 21:43 |       |  |      |  |
| Sonnenscheinstunden       |       | 253            | 274   | 367                  |                      | 419   | 491   | 507   |  |      |  |
| astr.max.mögl.Beschattung |       | 588            | 1501  | 76                   |                      |       |       |       |  |      |  |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: E - Lehmden Str. 121, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | July           | August         | September      | Oktober        |      | November                                     |     | Dezember                                     |                |     |                                  |
|---------------------------|----------------|----------------|----------------|----------------|------|----------------------------------------------|-----|----------------------------------------------|----------------|-----|----------------------------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 | 07:28<br>19:07 |      | 07:25<br>16:58                               | 57  | 07:58 (WEA 03)<br>09:10 (vorh. WEA 09)       | 08:18<br>16:14 | 21  | 09:09 (WEA 02)<br>09:30 (WEA 02) |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 |      | 07:26<br>16:56                               | 38  | 08:19 (WEA 01)<br>09:09 (vorh. WEA 09)       | 08:20<br>16:14 | 20  | 09:10 (WEA 02)<br>09:30 (WEA 02) |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 |      | 07:28<br>16:54                               | 28  | 08:39 (vorh. WEA 09)<br>09:07 (vorh. WEA 09) | 08:21<br>16:13 | 20  | 09:11 (WEA 02)<br>09:31 (WEA 02) |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 |      | 07:30<br>16:52                               | 26  | 08:40 (vorh. WEA 09)<br>09:06 (vorh. WEA 09) | 08:23<br>16:12 | 19  | 09:11 (WEA 02)<br>09:30 (WEA 02) |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 | 07:35<br>18:57 |      | 07:32<br>16:50                               | 22  | 08:42 (vorh. WEA 09)<br>09:04 (vorh. WEA 09) | 08:24<br>16:12 | 17  | 09:13 (WEA 02)<br>09:30 (WEA 02) |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:37<br>18:55 |      | 07:34<br>16:48                               | 17  | 08:45 (vorh. WEA 09)<br>09:02 (vorh. WEA 09) | 08:26<br>16:11 | 17  | 09:13 (WEA 02)<br>09:30 (WEA 02) |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 | 07:38<br>18:52 |      | 07:36<br>16:46                               | 10  | 08:48 (vorh. WEA 09)<br>08:58 (vorh. WEA 09) | 08:27<br>16:11 | 15  | 09:14 (WEA 02)<br>09:29 (WEA 02) |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 |      | 07:38<br>16:44                               |     |                                              | 08:28<br>16:10 | 14  | 09:16 (WEA 02)<br>09:30 (WEA 02) |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 |      | 07:40<br>16:43                               |     |                                              | 08:29<br>16:10 | 13  | 09:16 (WEA 02)<br>09:29 (WEA 02) |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 10   | 09:50 (vorh. WEA 09)<br>10:00 (vorh. WEA 09) |     | 07:42<br>16:41                               | 08:31<br>16:10 | 11  | 09:17 (WEA 02)<br>09:28 (WEA 02) |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 18   | 09:46 (vorh. WEA 09)<br>10:04 (vorh. WEA 09) |     | 07:44<br>16:39                               | 08:32<br>16:10 | 10  | 09:18 (WEA 02)<br>09:28 (WEA 02) |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 33   | 09:20 (WEA 01)<br>10:07 (vorh. WEA 09)       |     | 07:45<br>16:38                               | 08:33<br>16:09 | 7   | 09:21 (WEA 02)<br>09:28 (WEA 02) |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 44   | 09:17 (WEA 01)<br>10:09 (vorh. WEA 09)       | 14  | 07:47<br>16:36                               | 08:34<br>16:09 | 5   | 09:22 (WEA 02)<br>09:27 (WEA 02) |
| 14                        | 05:16<br>21:50 | 06:05<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 51   | 09:14 (WEA 01)<br>10:10 (vorh. WEA 09)       | 17  | 07:49<br>16:35                               | 08:35<br>16:09 | 1   | 09:25 (WEA 02)<br>09:26 (WEA 02) |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 56   | 09:13 (WEA 01)<br>10:11 (vorh. WEA 09)       | 19  | 07:51<br>16:33                               | 08:36<br>16:09 |     |                                  |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 60   | 09:11 (WEA 01)<br>10:11 (vorh. WEA 09)       | 20  | 07:53<br>16:31                               | 08:37<br>16:09 |     |                                  |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 62   | 09:10 (WEA 01)<br>10:12 (vorh. WEA 09)       | 22  | 07:55<br>16:30                               | 08:37<br>16:10 |     |                                  |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 64   | 09:09 (WEA 01)<br>10:13 (vorh. WEA 09)       | 23  | 07:56<br>16:29                               | 08:38<br>16:10 |     |                                  |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 73   | 08:59 (WEA 03)<br>10:13 (vorh. WEA 09)       | 23  | 07:58<br>16:27                               | 08:39<br>16:10 |     |                                  |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:34 | 08:02<br>18:23 | 76   | 08:57 (WEA 03)<br>10:13 (vorh. WEA 09)       | 24  | 08:00<br>16:26                               | 08:40<br>16:10 |     |                                  |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 79   | 08:55 (WEA 03)<br>10:14 (vorh. WEA 09)       | 24  | 08:02<br>16:25                               | 08:40<br>16:11 |     |                                  |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 80   | 08:54 (WEA 03)<br>10:14 (vorh. WEA 09)       | 25  | 08:04<br>16:23                               | 08:41<br>16:11 |     |                                  |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 81   | 08:53 (WEA 03)<br>10:14 (vorh. WEA 09)       | 25  | 08:05<br>16:22                               | 08:41<br>16:12 |     |                                  |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 81   | 08:53 (WEA 03)<br>10:14 (vorh. WEA 09)       | 25  | 08:07<br>16:21                               | 08:42<br>16:12 |     |                                  |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 07:11<br>17:12 | 81   | 07:52 (WEA 03)<br>09:13 (vorh. WEA 09)       | 25  | 08:09<br>16:20                               | 08:42<br>16:13 |     |                                  |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 07:13<br>17:10 | 81   | 07:52 (WEA 03)<br>09:13 (vorh. WEA 09)       | 24  | 08:10<br>16:19                               | 08:42<br>16:14 |     |                                  |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 07:15<br>17:08 | 81   | 07:52 (WEA 03)<br>09:13 (vorh. WEA 09)       | 24  | 08:12<br>16:18                               | 08:43<br>16:14 |     |                                  |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 07:17<br>17:06 | 79   | 07:53 (WEA 03)<br>09:12 (vorh. WEA 09)       | 23  | 08:14<br>16:17                               | 08:43<br>16:15 |     |                                  |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 07:19<br>17:04 | 78   | 07:53 (WEA 03)<br>09:11 (vorh. WEA 09)       | 23  | 08:15<br>16:16                               | 08:43<br>16:16 |     |                                  |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 07:21<br>17:01 | 75   | 07:54 (WEA 03)<br>09:11 (vorh. WEA 09)       | 23  | 08:17<br>16:15                               | 08:43<br>16:17 | 5   | 09:30 (WEA 02)<br>09:35 (WEA 02) |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 07:23<br>16:59 | 67   | 07:55 (WEA 03)<br>09:10 (vorh. WEA 09)       |     |                                              | 08:43<br>16:18 | 7   | 09:30 (WEA 02)<br>09:37 (WEA 02) |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 1410 | 261                                          | 611 |                                              | 236            | 202 |                                  |
| 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 | (WEA mit erstem Schatten) | Zeitpunkt (SS:MM) Schattenende | (WEA mit letztem Schatten) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: F - Lehmden Str. 125, Lehmden

**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Januar                    |       |    | Februar              |       |      | März                 |       |  | April | Mai   | Juni  |
|---------------------------|-------|----|----------------------|-------|------|----------------------|-------|--|-------|-------|-------|
| 1                         | 08:43 |    | 09:47 (WEA 02)       | 08:14 |      | 08:47 (WEA 03)       | 07:17 |  | 07:04 | 05:56 | 05:08 |
|                           | 16:19 | 32 | 10:19 (vorh. WEA 09) | 17:10 | 81   | 10:46 (vorh. WEA 09) | 18:04 |  | 20:01 | 20:55 | 21:44 |
| 2                         | 08:43 |    | 09:48 (WEA 02)       | 08:12 |      | 08:45 (WEA 03)       | 07:15 |  | 07:01 | 05:54 | 05:07 |
|                           | 16:21 | 33 | 10:21 (vorh. WEA 09) | 17:12 | 84   | 10:45 (vorh. WEA 09) | 18:06 |  | 20:03 | 20:57 | 21:45 |
| 3                         | 08:43 |    | 09:49 (WEA 02)       | 08:10 |      | 08:44 (WEA 03)       | 07:13 |  | 06:59 | 05:52 | 05:06 |
|                           | 16:22 | 34 | 10:23 (vorh. WEA 09) | 17:14 | 86   | 10:45 (vorh. WEA 09) | 18:08 |  | 20:05 | 20:59 | 21:46 |
| 4                         | 08:42 |    | 09:49 (WEA 02)       | 08:09 |      | 08:44 (WEA 03)       | 07:11 |  | 06:56 | 05:50 | 05:05 |
|                           | 16:23 | 35 | 10:24 (vorh. WEA 09) | 17:15 | 88   | 10:45 (vorh. WEA 09) | 18:10 |  | 20:07 | 21:01 | 21:48 |
| 5                         | 08:42 |    | 09:50 (WEA 02)       | 08:07 |      | 08:44 (WEA 03)       | 07:08 |  | 06:54 | 05:48 | 05:04 |
|                           | 16:24 | 36 | 10:26 (vorh. WEA 09) | 17:17 | 88   | 10:45 (vorh. WEA 09) | 18:12 |  | 20:09 | 21:02 | 21:49 |
| 6                         | 08:42 |    | 09:50 (WEA 02)       | 08:05 |      | 08:43 (WEA 03)       | 07:06 |  | 06:52 | 05:46 | 05:03 |
|                           | 16:25 | 37 | 10:27 (vorh. WEA 09) | 17:19 | 88   | 10:44 (vorh. WEA 09) | 18:14 |  | 20:10 | 21:04 | 21:50 |
| 7                         | 08:41 |    | 09:50 (WEA 02)       | 08:03 |      | 08:43 (WEA 03)       | 07:04 |  | 06:49 | 05:44 | 05:03 |
|                           | 16:27 | 38 | 10:28 (vorh. WEA 09) | 17:21 | 86   | 10:43 (vorh. WEA 09) | 18:16 |  | 20:12 | 21:06 | 21:51 |
| 8                         | 08:41 |    | 09:51 (WEA 02)       | 08:01 |      | 08:43 (WEA 03)       | 07:01 |  | 06:47 | 05:42 | 05:02 |
|                           | 16:28 | 39 | 10:30 (vorh. WEA 09) | 17:23 | 84   | 10:42 (vorh. WEA 09) | 18:17 |  | 20:14 | 21:08 | 21:52 |
| 9                         | 08:40 |    | 09:51 (WEA 02)       | 08:00 |      | 08:44 (WEA 03)       | 06:59 |  | 06:45 | 05:40 | 05:02 |
|                           | 16:30 | 40 | 10:31 (vorh. WEA 09) | 17:25 | 80   | 10:40 (vorh. WEA 09) | 18:19 |  | 20:16 | 21:09 | 21:52 |
| 10                        | 08:40 |    | 09:52 (WEA 02)       | 07:58 |      | 08:44 (WEA 03)       | 06:57 |  | 06:42 | 05:38 | 05:01 |
|                           | 16:31 | 40 | 10:32 (vorh. WEA 09) | 17:27 | 76   | 10:39 (vorh. WEA 09) | 18:21 |  | 20:18 | 21:11 | 21:53 |
| 11                        | 08:39 |    | 09:52 (WEA 02)       | 07:56 |      | 08:44 (WEA 03)       | 06:54 |  | 06:40 | 05:37 | 05:01 |
|                           | 16:32 | 41 | 10:33 (vorh. WEA 09) | 17:29 | 72   | 10:37 (vorh. WEA 09) | 18:23 |  | 20:19 | 21:13 | 21:54 |
| 12                        | 08:38 |    | 09:53 (WEA 02)       | 07:54 |      | 08:45 (WEA 03)       | 06:52 |  | 06:38 | 05:35 | 05:00 |
|                           | 16:34 | 41 | 10:34 (vorh. WEA 09) | 17:31 | 63   | 10:34 (vorh. WEA 09) | 18:25 |  | 20:21 | 21:15 | 21:55 |
| 13                        | 08:37 |    | 09:54 (WEA 02)       | 07:52 |      | 08:45 (WEA 03)       | 06:49 |  | 06:35 | 05:33 | 05:00 |
|                           | 16:35 | 41 | 10:35 (vorh. WEA 09) | 17:33 | 45   | 09:40 (WEA 01)       | 18:27 |  | 20:23 | 21:16 | 21:56 |
| 14                        | 08:37 |    | 09:55 (WEA 02)       | 07:50 |      | 08:47 (WEA 03)       | 06:47 |  | 06:33 | 05:31 | 05:00 |
|                           | 16:37 | 42 | 10:37 (vorh. WEA 09) | 17:35 | 40   | 09:39 (WEA 01)       | 18:29 |  | 20:25 | 21:18 | 21:56 |
| 15                        | 08:36 |    | 09:56 (WEA 02)       | 07:48 |      | 08:50 (WEA 03)       | 06:45 |  | 06:31 | 05:30 | 05:00 |
|                           | 16:39 | 42 | 10:38 (vorh. WEA 09) | 17:37 | 32   | 09:38 (WEA 01)       | 18:30 |  | 20:27 | 21:20 | 21:57 |
| 16                        | 08:35 |    | 09:57 (WEA 02)       | 07:46 |      | 09:15 (WEA 01)       | 06:42 |  | 06:28 | 05:28 | 04:59 |
|                           | 16:40 | 42 | 10:39 (vorh. WEA 09) | 17:39 | 22   | 09:37 (WEA 01)       | 18:32 |  | 20:28 | 21:21 | 21:57 |
| 17                        | 08:34 |    | 09:59 (WEA 02)       | 07:44 |      | 09:17 (WEA 01)       | 06:40 |  | 06:26 | 05:27 | 04:59 |
|                           | 16:42 | 41 | 10:40 (vorh. WEA 09) | 17:41 | 18   | 09:35 (WEA 01)       | 18:34 |  | 20:30 | 21:23 | 21:58 |
| 18                        | 08:33 |    | 10:00 (WEA 02)       | 07:42 |      | 09:19 (WEA 01)       | 06:37 |  | 06:24 | 05:25 | 04:59 |
|                           | 16:44 | 41 | 10:41 (vorh. WEA 09) | 17:43 | 14   | 09:33 (WEA 01)       | 18:36 |  | 20:32 | 21:24 | 21:58 |
| 19                        | 08:32 |    | 10:03 (WEA 02)       | 07:39 |      | 09:24 (WEA 01)       | 06:35 |  | 06:22 | 05:23 | 04:59 |
|                           | 16:46 | 39 | 10:42 (vorh. WEA 09) | 17:45 | 4    | 09:28 (WEA 01)       | 18:38 |  | 20:34 | 21:26 | 21:59 |
| 20                        | 08:31 |    | 10:03 (vorh. WEA 09) | 07:37 |      | 06:33                | 06:19 |  | 06:19 | 05:22 | 04:59 |
|                           | 16:47 | 39 | 10:42 (vorh. WEA 09) | 17:47 |      | 18:40                | 20:36 |  | 21:28 | 21:59 |       |
| 21                        | 08:29 |    | 10:04 (vorh. WEA 09) | 07:35 |      | 06:30                | 06:17 |  | 06:17 | 05:21 | 05:00 |
|                           | 16:49 | 39 | 10:43 (vorh. WEA 09) | 17:49 |      | 18:41                | 20:37 |  | 21:29 | 21:59 |       |
| 22                        | 08:28 |    | 10:03 (vorh. WEA 09) | 07:33 |      | 06:28                | 06:15 |  | 06:15 | 05:19 | 05:00 |
|                           | 16:51 | 40 | 10:43 (vorh. WEA 09) | 17:51 |      | 18:43                | 20:39 |  | 21:31 | 21:59 |       |
| 23                        | 08:27 |    | 10:03 (vorh. WEA 09) | 07:31 |      | 06:25                | 06:13 |  | 06:13 | 05:18 | 05:00 |
|                           | 16:53 | 41 | 10:44 (vorh. WEA 09) | 17:53 |      | 18:45                | 20:41 |  | 21:32 | 22:00 |       |
| 24                        | 08:26 |    | 10:03 (vorh. WEA 09) | 07:29 |      | 06:23                | 06:10 |  | 06:10 | 05:16 | 05:00 |
|                           | 16:54 | 41 | 10:44 (vorh. WEA 09) | 17:55 |      | 18:47                | 20:43 |  | 21:34 | 22:00 |       |
| 25                        | 08:24 |    | 09:22 (WEA 01)       | 07:26 |      | 06:21                | 06:08 |  | 06:08 | 05:15 | 05:01 |
|                           | 16:56 | 45 | 10:45 (vorh. WEA 09) | 17:57 |      | 18:49                | 20:45 |  | 21:35 | 22:00 |       |
| 26                        | 08:23 |    | 09:18 (WEA 01)       | 07:24 |      | 06:18                | 06:06 |  | 06:06 | 05:14 | 05:01 |
|                           | 16:58 | 54 | 10:45 (vorh. WEA 09) | 17:58 |      | 18:50                | 20:46 |  | 21:36 | 22:00 |       |
| 27                        | 08:21 |    | 09:16 (WEA 01)       | 07:22 |      | 06:16                | 06:04 |  | 06:04 | 05:13 | 05:01 |
|                           | 17:00 | 59 | 10:46 (vorh. WEA 09) | 18:00 |      | 18:52                | 20:48 |  | 21:38 | 22:00 |       |
| 28                        | 08:20 |    | 09:15 (WEA 01)       | 07:20 |      | 06:13                | 06:02 |  | 06:02 | 05:12 | 05:02 |
|                           | 17:02 | 61 | 10:46 (vorh. WEA 09) | 18:02 |      | 18:54                | 20:50 |  | 21:39 | 21:59 |       |
| 29                        | 08:18 |    | 09:13 (WEA 01)       |       |      | 07:11                | 06:00 |  | 06:00 | 05:11 | 05:03 |
|                           | 17:04 | 64 | 10:45 (vorh. WEA 09) |       |      | 19:56                | 20:52 |  | 21:40 | 21:59 |       |
| 30                        | 08:17 |    | 09:13 (WEA 01)       |       |      | 07:08                | 05:58 |  | 05:58 | 05:09 | 05:03 |
|                           | 17:06 | 66 | 10:46 (vorh. WEA 09) |       |      | 19:58                | 20:54 |  | 21:42 | 21:59 |       |
| 31                        | 08:15 |    | 08:49 (WEA 03)       |       |      | 07:06                |       |  | 05:08 |       |       |
|                           | 17:08 | 74 | 10:46 (vorh. WEA 09) |       |      | 20:00                |       |  | 21:43 |       |       |
| Sonnenscheinstunden       |       |    | 252                  |       | 274  |                      | 367   |  | 419   | 491   | 507   |
| astr.max.mögl.Beschattung |       |    | 1357                 |       | 1151 |                      |       |  |       |       |       |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: F - Lehmden Str. 125, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober |                | November             |                         | Dezember                |                         |                   |
|---------------------------|-------|--------|-----------|---------|----------------|----------------------|-------------------------|-------------------------|-------------------------|-------------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |                | 07:25                | 08:13 (WEA 03)          | 08:18                   | 09:35 (WEA 02)          |                   |
|                           | 21:59 | 21:25  | 20:19     | 19:07   |                | 16:58                | 79 10:09 (vorh. WEA 09) | 16:14                   | 41 10:16 (vorh. WEA 09) |                   |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   |                | 07:26                | 08:13 (WEA 03)          | 08:20                   | 09:35 (WEA 02)          |                   |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |                | 16:56                | 81 10:10 (vorh. WEA 09) | 16:14                   | 41 10:16 (vorh. WEA 09) |                   |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |                | 07:28                | 08:13 (WEA 03)          | 08:21                   | 09:36 (WEA 02)          |                   |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |                | 16:54                | 85 10:12 (vorh. WEA 09) | 16:13                   | 40 10:16 (vorh. WEA 09) |                   |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |                | 07:30                | 08:13 (WEA 03)          | 08:23                   | 09:35 (WEA 02)          |                   |
|                           | 21:58 | 21:19  | 20:12     | 19:00   |                | 16:52                | 87 10:13 (vorh. WEA 09) | 16:12                   | 40 10:15 (vorh. WEA 09) |                   |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   |                | 07:32                | 08:13 (WEA 03)          | 08:24                   | 09:36 (WEA 02)          |                   |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |                | 16:50                | 89 10:14 (vorh. WEA 09) | 16:12                   | 39 10:15 (vorh. WEA 09) |                   |
| 6                         | 05:08 | 05:51  | 06:44     | 07:37   |                | 07:34                | 08:14 (WEA 03)          | 08:26                   | 09:36 (WEA 02)          |                   |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |                | 16:48                | 87 10:14 (vorh. WEA 09) | 16:11                   | 38 10:14 (vorh. WEA 09) |                   |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |                | 07:36                | 08:14 (WEA 03)          | 08:27                   | 09:36 (WEA 02)          |                   |
|                           | 21:56 | 21:14  | 20:05     | 18:52   |                | 16:46                | 88 10:15 (vorh. WEA 09) | 16:11                   | 37 10:13 (vorh. WEA 09) |                   |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |                | 07:38                | 08:15 (WEA 03)          | 08:28                   | 09:37 (WEA 02)          |                   |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |                | 16:44                | 86 10:16 (vorh. WEA 09) | 16:10                   | 36 10:13 (vorh. WEA 09) |                   |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |                | 07:40                | 08:16 (WEA 03)          | 08:29                   | 09:37 (WEA 02)          |                   |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |                | 16:43                | 84 10:16 (vorh. WEA 09) | 16:10                   | 35 10:12 (vorh. WEA 09) |                   |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |                | 07:42                | 08:18 (WEA 03)          | 08:31                   | 09:37 (WEA 02)          |                   |
|                           | 21:54 | 21:08  | 19:58     | 18:45   |                | 16:41                | 80 10:17 (vorh. WEA 09) | 16:10                   | 34 10:11 (vorh. WEA 09) |                   |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |                | 07:44                | 08:20 (WEA 03)          | 08:32                   | 09:37 (WEA 02)          |                   |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |                | 16:39                | 74 10:17 (vorh. WEA 09) | 16:10                   | 32 10:09 (vorh. WEA 09) |                   |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |                | 07:45                | 08:44 (WEA 01)          | 08:33                   | 09:39 (WEA 02)          |                   |
|                           | 21:52 | 21:04  | 19:53     | 18:41   |                | 16:38                | 65 10:17 (vorh. WEA 09) | 16:09                   | 27 10:08 (vorh. WEA 09) |                   |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |                | 07:47                | 08:45 (WEA 01)          | 08:34                   | 09:39 (WEA 02)          |                   |
|                           | 21:51 | 21:02  | 19:51     | 18:38   |                | 16:36                | 63 10:17 (vorh. WEA 09) | 16:09                   | 25 10:04 (WEA 02)       |                   |
| 14                        | 05:16 | 06:05  | 06:58     | 07:51   |                | 07:49                | 08:47 (WEA 01)          | 08:35                   | 09:39 (WEA 02)          |                   |
|                           | 21:50 | 20:59  | 19:48     | 18:36   |                | 16:34                | 61 10:18 (vorh. WEA 09) | 16:09                   | 25 10:04 (WEA 02)       |                   |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   |                | 07:51                | 08:48 (WEA 01)          | 08:36                   | 09:40 (WEA 02)          |                   |
|                           | 21:49 | 20:57  | 19:46     | 18:34   |                | 16:33                | 59 10:18 (vorh. WEA 09) | 16:09                   | 25 10:05 (WEA 02)       |                   |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   |                | 07:53                | 08:51 (WEA 01)          | 08:37                   | 09:40 (WEA 02)          |                   |
|                           | 21:48 | 20:55  | 19:43     | 18:32   |                | 16:31                | 54 10:18 (vorh. WEA 09) | 16:09                   | 24 10:04 (WEA 02)       |                   |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   |                | 07:55                | 08:55 (WEA 01)          | 08:37                   | 09:40 (WEA 02)          |                   |
|                           | 21:47 | 20:53  | 19:41     | 18:29   |                | 16:30                | 45 10:18 (vorh. WEA 09) | 16:10                   | 25 10:05 (WEA 02)       |                   |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   |                | 07:56                | 09:37 (vorh. WEA 09)    | 08:38                   | 09:41 (WEA 02)          |                   |
|                           | 21:45 | 20:51  | 19:38     | 18:27   |                | 16:29                | 41 10:18 (vorh. WEA 09) | 16:10                   | 25 10:06 (WEA 02)       |                   |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   |                | 07:58                | 09:37 (vorh. WEA 09)    | 08:39                   | 09:42 (WEA 02)          |                   |
|                           | 21:44 | 20:49  | 19:36     | 18:25   |                | 16:27                | 41 10:18 (vorh. WEA 09) | 16:10                   | 24 10:06 (WEA 02)       |                   |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   |                | 08:00                | 09:38 (vorh. WEA 09)    | 08:40                   | 09:42 (WEA 02)          |                   |
|                           | 21:43 | 20:47  | 19:34     | 18:23   |                | 16:26                | 40 10:18 (vorh. WEA 09) | 16:10                   | 24 10:06 (WEA 02)       |                   |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   |                | 08:02                | 09:39 (vorh. WEA 09)    | 08:40                   | 09:43 (WEA 02)          |                   |
|                           | 21:42 | 20:44  | 19:31     | 18:20   |                | 16:25                | 39 10:18 (vorh. WEA 09) | 16:11                   | 24 10:07 (WEA 02)       |                   |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   |                | 08:04                | 09:39 (vorh. WEA 09)    | 08:41                   | 09:43 (WEA 02)          |                   |
|                           | 21:40 | 20:42  | 19:29     | 18:18   |                | 16:23                | 39 10:18 (vorh. WEA 09) | 16:11                   | 24 10:07 (WEA 02)       |                   |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   | 09:51 (WEA 01) | 08:05                | 09:39 (WEA 02)          | 08:41                   | 09:44 (WEA 02)          |                   |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 9              | 10:00 (WEA 01)       | 16:22                   | 39 10:18 (vorh. WEA 09) | 16:12                   | 24 10:08 (WEA 02) |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 09:48 (WEA 01) | 08:07                | 09:37 (WEA 02)          | 08:42                   | 09:44 (WEA 02)          |                   |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 15             | 10:03 (WEA 01)       | 16:21                   | 41 10:18 (vorh. WEA 09) | 16:12                   | 24 10:08 (WEA 02) |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 08:45 (WEA 01) | 08:09                | 09:37 (WEA 02)          | 08:42                   | 09:44 (WEA 02)          |                   |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 20             | 09:05 (WEA 01)       | 16:20                   | 41 10:18 (vorh. WEA 09) | 16:13                   | 25 10:09 (WEA 02) |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 08:44 (WEA 01) | 08:10                | 09:36 (WEA 02)          | 08:42                   | 09:45 (WEA 02)          |                   |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 23             | 09:07 (WEA 01)       | 16:19                   | 42 10:18 (vorh. WEA 09) | 16:14                   | 25 10:10 (WEA 02) |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   | 08:18 (WEA 03) | 08:12                | 09:35 (WEA 02)          | 08:43                   | 09:45 (WEA 02)          |                   |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 34             | 09:08 (WEA 01)       | 16:18                   | 42 10:17 (vorh. WEA 09) | 16:14                   | 25 10:10 (WEA 02) |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   | 08:16 (WEA 03) | 08:14                | 09:35 (WEA 02)          | 08:43                   | 09:46 (WEA 02)          |                   |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 41             | 09:09 (WEA 01)       | 16:17                   | 42 10:17 (vorh. WEA 09) | 16:15                   | 25 10:11 (WEA 02) |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   | 08:15 (WEA 03) | 08:15                | 09:35 (WEA 02)          | 08:43                   | 09:46 (WEA 02)          |                   |
|                           | 21:30 | 20:26  | 19:12     | 17:04   | 51             | 09:58 (vorh. WEA 09) | 16:16                   | 42 10:17 (vorh. WEA 09) | 16:16                   | 25 10:11 (WEA 02) |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   | 08:14 (WEA 03) | 08:17                | 09:35 (WEA 02)          | 08:43                   | 09:47 (WEA 02)          |                   |
|                           | 21:28 | 20:24  | 19:09     | 17:01   | 64             | 10:03 (vorh. WEA 09) | 16:15                   | 42 10:17 (vorh. WEA 09) | 16:17                   | 25 10:12 (WEA 02) |
| 31                        | 05:41 | 06:34  |           | 07:23   | 08:13 (WEA 03) |                      |                         | 08:43                   | 09:47 (WEA 02)          |                   |
|                           | 21:26 | 20:22  |           | 16:59   | 73             | 10:06 (vorh. WEA 09) |                         | 16:18                   | 25 10:12 (WEA 02)       |                   |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     |                | 261                  |                         | 236                     |                         |                   |
| astr.max.mögl.Beschattung |       |        |           | 330     |                | 1798                 |                         | 908                     |                         |                   |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: G - Lehmden Str. 143, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar |    |                      | Februar |    |                | März  | April | Mal   | Juni  |
|---------------------------|--------|----|----------------------|---------|----|----------------|-------|-------|-------|-------|
| 1                         | 08:43  |    | 09:48 (WEA 01)       | 08:14   |    | 09:09 (WEA 03) | 07:17 | 07:04 | 05:56 | 05:08 |
|                           | 16:19  | 58 | 11:41 (vorh. WEA 09) | 17:10   | 43 | 10:17 (WEA 01) | 18:04 | 20:01 | 20:55 | 21:44 |
| 2                         | 08:43  |    | 09:48 (WEA 01)       | 08:12   |    | 09:10 (WEA 03) | 07:15 | 07:01 | 05:54 | 05:07 |
|                           | 16:21  | 57 | 11:42 (vorh. WEA 09) | 17:12   | 38 | 10:16 (WEA 01) | 18:06 | 20:03 | 20:57 | 21:45 |
| 3                         | 08:43  |    | 09:48 (WEA 01)       | 08:10   |    | 09:11 (WEA 03) | 07:13 | 06:59 | 05:52 | 05:06 |
|                           | 16:22  | 55 | 11:42 (vorh. WEA 09) | 17:14   | 33 | 10:14 (WEA 01) | 18:08 | 20:05 | 20:59 | 21:46 |
| 4                         | 08:42  |    | 09:47 (WEA 01)       | 08:09   |    | 09:13 (WEA 03) | 07:11 | 06:56 | 05:50 | 05:05 |
|                           | 16:23  | 56 | 11:42 (vorh. WEA 09) | 17:15   | 26 | 10:13 (WEA 01) | 18:10 | 20:07 | 21:01 | 21:48 |
| 5                         | 08:42  |    | 09:47 (WEA 01)       | 08:07   |    | 09:16 (WEA 03) | 07:08 | 06:54 | 05:48 | 05:04 |
|                           | 16:24  | 58 | 11:43 (vorh. WEA 09) | 17:17   | 13 | 10:09 (WEA 01) | 18:12 | 20:09 | 21:02 | 21:49 |
| 6                         | 08:42  |    | 09:47 (WEA 01)       | 08:05   |    |                | 07:06 | 06:52 | 05:46 | 05:03 |
|                           | 16:25  | 58 | 11:43 (vorh. WEA 09) | 17:19   |    |                | 18:14 | 20:10 | 21:04 | 21:50 |
| 7                         | 08:41  |    | 09:46 (WEA 01)       | 08:03   |    |                | 07:04 | 06:49 | 05:44 | 05:03 |
|                           | 16:27  | 58 | 11:42 (vorh. WEA 09) | 17:21   |    |                | 18:16 | 20:12 | 21:06 | 21:51 |
| 8                         | 08:41  |    | 09:47 (WEA 01)       | 08:01   |    |                | 07:01 | 06:47 | 05:42 | 05:02 |
|                           | 16:28  | 59 | 11:43 (vorh. WEA 09) | 17:23   |    |                | 18:17 | 20:14 | 21:08 | 21:52 |
| 9                         | 08:40  |    | 09:46 (WEA 01)       | 08:00   |    |                | 06:59 | 06:45 | 05:40 | 05:02 |
|                           | 16:29  | 60 | 11:43 (vorh. WEA 09) | 17:25   |    |                | 18:19 | 20:16 | 21:09 | 21:52 |
| 10                        | 08:40  |    | 09:46 (WEA 01)       | 07:58   |    |                | 06:57 | 06:42 | 05:38 | 05:01 |
|                           | 16:31  | 60 | 11:43 (vorh. WEA 09) | 17:27   |    |                | 18:21 | 20:18 | 21:11 | 21:53 |
| 11                        | 08:39  |    | 09:46 (WEA 01)       | 07:56   |    |                | 06:54 | 06:40 | 05:37 | 05:01 |
|                           | 16:32  | 60 | 11:43 (vorh. WEA 09) | 17:29   |    |                | 18:23 | 20:19 | 21:13 | 21:54 |
| 12                        | 08:38  |    | 09:46 (WEA 01)       | 07:54   |    |                | 06:52 | 06:38 | 05:35 | 05:00 |
|                           | 16:34  | 61 | 11:43 (vorh. WEA 09) | 17:31   |    |                | 18:25 | 20:21 | 21:15 | 21:55 |
| 13                        | 08:37  |    | 09:46 (WEA 01)       | 07:52   |    |                | 06:49 | 06:35 | 05:33 | 05:00 |
|                           | 16:36  | 60 | 11:43 (vorh. WEA 09) | 17:33   |    |                | 18:27 | 20:23 | 21:16 | 21:56 |
| 14                        | 08:37  |    | 09:46 (WEA 01)       | 07:50   |    |                | 06:47 | 06:33 | 05:31 | 05:00 |
|                           | 16:37  | 60 | 11:43 (vorh. WEA 09) | 17:35   |    |                | 18:29 | 20:25 | 21:18 | 21:56 |
| 15                        | 08:36  |    | 09:46 (WEA 01)       | 07:48   |    |                | 06:45 | 06:31 | 05:30 | 05:00 |
|                           | 16:39  | 59 | 11:42 (vorh. WEA 09) | 17:37   |    |                | 18:30 | 20:27 | 21:20 | 21:57 |
| 16                        | 08:35  |    | 09:46 (WEA 01)       | 07:46   |    |                | 06:42 | 06:28 | 05:28 | 04:59 |
|                           | 16:40  | 59 | 11:42 (vorh. WEA 09) | 17:39   |    |                | 18:32 | 20:28 | 21:21 | 21:57 |
| 17                        | 08:34  |    | 09:12 (WEA 03)       | 07:44   |    |                | 06:40 | 06:26 | 05:27 | 04:59 |
|                           | 16:42  | 63 | 11:42 (vorh. WEA 09) | 17:41   |    |                | 18:34 | 20:30 | 21:23 | 21:58 |
| 18                        | 08:33  |    | 09:10 (WEA 03)       | 07:42   |    |                | 06:37 | 06:24 | 05:25 | 04:59 |
|                           | 16:44  | 65 | 11:41 (vorh. WEA 09) | 17:43   |    |                | 18:36 | 20:32 | 21:24 | 21:58 |
| 19                        | 08:32  |    | 09:09 (WEA 03)       | 07:39   |    |                | 06:35 | 06:22 | 05:23 | 04:59 |
|                           | 16:46  | 67 | 11:41 (vorh. WEA 09) | 17:45   |    |                | 18:38 | 20:34 | 21:26 | 21:59 |
| 20                        | 08:31  |    | 09:08 (WEA 03)       | 07:37   |    |                | 06:33 | 06:19 | 05:22 | 04:59 |
|                           | 16:47  | 67 | 11:39 (vorh. WEA 09) | 17:47   |    |                | 18:40 | 20:36 | 21:28 | 21:59 |
| 21                        | 08:29  |    | 09:08 (WEA 03)       | 07:35   |    |                | 06:30 | 06:17 | 05:21 | 05:00 |
|                           | 16:49  | 64 | 11:37 (vorh. WEA 09) | 17:49   |    |                | 18:41 | 20:37 | 21:29 | 21:59 |
| 22                        | 08:28  |    | 09:07 (WEA 03)       | 07:33   |    |                | 06:28 | 06:15 | 05:19 | 05:00 |
|                           | 16:51  | 57 | 11:33 (vorh. WEA 09) | 17:51   |    |                | 18:43 | 20:39 | 21:31 | 21:59 |
| 23                        | 08:27  |    | 09:07 (WEA 03)       | 07:31   |    |                | 06:25 | 06:13 | 05:18 | 05:00 |
|                           | 16:53  | 52 | 10:20 (WEA 01)       | 17:53   |    |                | 18:45 | 20:41 | 21:32 | 22:00 |
| 24                        | 08:26  |    | 09:06 (WEA 03)       | 07:29   |    |                | 06:23 | 06:10 | 05:16 | 05:00 |
|                           | 16:54  | 53 | 10:20 (WEA 01)       | 17:55   |    |                | 18:47 | 20:43 | 21:34 | 22:00 |
| 25                        | 08:24  |    | 09:07 (WEA 03)       | 07:26   |    |                | 06:21 | 06:08 | 05:15 | 05:01 |
|                           | 16:56  | 53 | 10:20 (WEA 01)       | 17:57   |    |                | 18:49 | 20:45 | 21:35 | 22:00 |
| 26                        | 08:23  |    | 09:06 (WEA 03)       | 07:24   |    |                | 06:18 | 06:06 | 05:14 | 05:01 |
|                           | 16:58  | 54 | 10:20 (WEA 01)       | 17:58   |    |                | 18:50 | 20:46 | 21:36 | 22:00 |
| 27                        | 08:21  |    | 09:07 (WEA 03)       | 07:22   |    |                | 06:16 | 06:04 | 05:13 | 05:01 |
|                           | 17:00  | 52 | 10:20 (WEA 01)       | 18:00   |    |                | 18:52 | 20:48 | 21:38 | 22:00 |
| 28                        | 08:20  |    | 09:07 (WEA 03)       | 07:20   |    |                | 06:13 | 06:02 | 05:12 | 05:02 |
|                           | 17:02  | 51 | 10:20 (WEA 01)       | 18:02   |    |                | 18:54 | 20:50 | 21:39 | 21:59 |
| 29                        | 08:18  |    | 09:07 (WEA 03)       |         |    |                | 07:11 | 06:00 | 05:11 | 05:03 |
|                           | 17:04  | 50 | 10:19 (WEA 01)       |         |    |                | 19:56 | 20:52 | 21:40 | 21:59 |
| 30                        | 08:17  |    | 09:08 (WEA 03)       |         |    |                | 07:08 | 05:58 | 05:09 | 05:03 |
|                           | 17:06  | 48 | 10:19 (WEA 01)       |         |    |                | 19:58 | 20:54 | 21:42 | 21:59 |
| 31                        | 08:15  |    | 09:09 (WEA 03)       |         |    |                | 07:06 |       | 05:08 |       |
|                           | 17:08  | 45 | 10:18 (WEA 01)       |         |    |                | 20:00 |       | 21:43 |       |
| Sonnenscheinstunden       |        |    | 274                  |         |    | 367            |       |       | 419   |       |
| astr.max.mögl.Beschattung |        |    | 1779                 |         |    | 153            |       |       | 507   |       |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: G - Lehmden Str. 143, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul            | August         | September      | Oktober        | November       |      | Dezember                               |                                        |
|---------------------------|----------------|----------------|----------------|----------------|----------------|------|----------------------------------------|----------------------------------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:25 | 06:36<br>20:19 | 07:28<br>19:07 | 07:25<br>16:58 |      | 08:18<br>16:14                         | 09:28 (WEA 01)<br>11:25 (vorh. WEA 09) |
| 2                         | 05:05<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:56 |      | 08:20<br>16:14                         | 09:29 (WEA 01)<br>11:26 (vorh. WEA 09) |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 | 07:28<br>16:54 |      | 08:21<br>16:13                         | 09:30 (WEA 01)<br>11:27 (vorh. WEA 09) |
| 4                         | 05:06<br>21:58 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52 |      | 08:23<br>16:12                         | 09:31 (WEA 01)<br>11:27 (vorh. WEA 09) |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:43<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50 |      | 08:24<br>16:12                         | 09:32 (WEA 01)<br>11:29 (vorh. WEA 09) |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 07:34<br>16:48 | 16   | 08:45 (WEA 03)<br>09:40 (WEA 01)       | 08:26<br>11:29 (vorh. WEA 09)          |
| 7                         | 05:09<br>21:56 | 05:53<br>21:14 | 06:46<br>20:05 | 07:38<br>18:52 | 07:36<br>16:46 | 26   | 08:43 (WEA 03)<br>09:43 (WEA 01)       | 08:27<br>11:29 (vorh. WEA 09)          |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 07:38<br>16:44 | 33   | 08:42 (WEA 03)<br>09:45 (WEA 01)       | 08:28<br>11:30 (vorh. WEA 09)          |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 07:40<br>16:43 | 39   | 08:41 (WEA 03)<br>09:47 (WEA 01)       | 08:29<br>11:30 (vorh. WEA 09)          |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 07:42<br>16:41 | 43   | 08:40 (WEA 03)<br>09:48 (WEA 01)       | 08:31<br>11:31 (vorh. WEA 09)          |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 07:44<br>16:39 | 46   | 08:39 (WEA 03)<br>09:49 (WEA 01)       | 08:32<br>11:31 (vorh. WEA 09)          |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 07:45<br>16:38 | 48   | 08:39 (WEA 03)<br>09:50 (WEA 01)       | 08:33<br>11:32 (vorh. WEA 09)          |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 07:47<br>16:36 | 50   | 08:39 (WEA 03)<br>09:51 (WEA 01)       | 08:34<br>11:33 (vorh. WEA 09)          |
| 14                        | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 07:49<br>16:34 | 51   | 08:39 (WEA 03)<br>09:52 (WEA 01)       | 08:35<br>11:33 (vorh. WEA 09)          |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 07:51<br>16:33 | 52   | 08:39 (WEA 03)<br>09:52 (WEA 01)       | 08:36<br>11:34 (vorh. WEA 09)          |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 07:53<br>16:31 | 54   | 08:39 (WEA 03)<br>09:53 (WEA 01)       | 08:37<br>11:33 (vorh. WEA 09)          |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 07:55<br>16:30 | 53   | 08:40 (WEA 03)<br>09:53 (WEA 01)       | 08:37<br>11:34 (vorh. WEA 09)          |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 07:56<br>16:29 | 53   | 08:40 (WEA 03)<br>09:54 (WEA 01)       | 08:38<br>11:35 (vorh. WEA 09)          |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 07:58<br>16:27 | 52   | 08:41 (WEA 03)<br>09:54 (WEA 01)       | 08:39<br>11:36 (vorh. WEA 09)          |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 08:00<br>16:26 | 57   | 08:42 (WEA 03)<br>11:08 (vorh. WEA 09) | 08:40<br>11:35 (vorh. WEA 09)          |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:02<br>16:25 | 64   | 08:43 (WEA 03)<br>11:12 (vorh. WEA 09) | 08:40<br>11:36 (vorh. WEA 09)          |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 08:04<br>16:23 | 67   | 08:44 (WEA 03)<br>11:15 (vorh. WEA 09) | 08:41<br>11:36 (vorh. WEA 09)          |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 08:05<br>16:22 | 67   | 08:45 (WEA 03)<br>11:17 (vorh. WEA 09) | 08:41<br>11:37 (vorh. WEA 09)          |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 08:07<br>16:21 | 66   | 08:47 (WEA 03)<br>11:18 (vorh. WEA 09) | 08:42<br>11:38 (vorh. WEA 09)          |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 07:11<br>17:12 | 08:09<br>16:20 | 65   | 08:49 (WEA 03)<br>11:20 (vorh. WEA 09) | 08:42<br>11:38 (vorh. WEA 09)          |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 07:13<br>17:10 | 08:10<br>16:19 | 59   | 09:25 (WEA 01)<br>11:21 (vorh. WEA 09) | 08:42<br>11:39 (vorh. WEA 09)          |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 07:15<br>17:08 | 08:12<br>16:18 | 59   | 09:25 (WEA 01)<br>11:21 (vorh. WEA 09) | 08:43<br>11:39 (vorh. WEA 09)          |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 07:17<br>17:06 | 08:14<br>16:17 | 60   | 09:26 (WEA 01)<br>11:23 (vorh. WEA 09) | 08:43<br>11:40 (vorh. WEA 09)          |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 07:19<br>17:03 | 08:15<br>16:16 | 60   | 09:27 (WEA 01)<br>11:24 (vorh. WEA 09) | 08:43<br>11:40 (vorh. WEA 09)          |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 07:21<br>17:01 | 08:17<br>16:15 | 61   | 09:28 (WEA 01)<br>11:25 (vorh. WEA 09) | 08:43<br>11:41 (vorh. WEA 09)          |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 07:23<br>16:59 |                |      | 08:43<br>16:18                         | 09:49 (WEA 01)<br>11:41 (vorh. WEA 09) |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 261            | 1301 | 236                                    | 1797                                   |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|--------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: H - Lehmden Str. 145, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Januar               | Februar                          | März                             | April                   | Mai                     | Juni                    |
|---------------------------|----------------------|----------------------------------|----------------------------------|-------------------------|-------------------------|-------------------------|
| 1                         | 08:43<br>16:19<br>58 | 09:53 (WEA 01)<br>17:10<br>10    | 09:21 (WEA 03)<br>18:04<br>2     | 07:04<br>20:01<br>05:56 | 05:07<br>21:44<br>05:07 | 05:07<br>21:44<br>05:07 |
| 2                         | 08:43<br>16:21<br>57 | 09:54 (WEA 01)<br>17:12<br>2     | 09:25 (WEA 03)<br>18:06<br>07:13 | 07:01<br>20:03<br>05:52 | 05:54<br>20:57<br>05:06 | 05:07<br>21:45<br>05:06 |
| 3                         | 08:43<br>16:22<br>58 | 09:54 (WEA 01)<br>17:14<br>08:09 | 07:13<br>18:08<br>07:11          | 06:59<br>20:05<br>05:50 | 05:52<br>20:59<br>05:05 | 05:06<br>21:46<br>05:05 |
| 4                         | 08:42<br>16:23<br>57 | 09:54 (WEA 01)<br>17:15<br>08:07 | 07:11<br>18:10<br>07:08          | 06:56<br>20:07<br>05:48 | 05:50<br>21:01<br>05:04 | 05:05<br>21:48<br>05:04 |
| 5                         | 08:42<br>16:24<br>57 | 09:55 (WEA 01)<br>17:17<br>08:05 | 07:08<br>18:12<br>07:06          | 06:54<br>20:09<br>05:46 | 05:48<br>21:02<br>05:03 | 05:04<br>21:49<br>05:03 |
| 6                         | 08:42<br>16:25<br>58 | 09:54 (WEA 01)<br>17:19<br>08:03 | 07:06<br>18:14<br>07:04          | 06:52<br>20:10<br>05:44 | 05:46<br>21:04<br>05:03 | 05:03<br>21:50<br>05:03 |
| 7                         | 08:41<br>16:27<br>57 | 09:54 (WEA 01)<br>17:21<br>08:01 | 07:04<br>18:16<br>07:01          | 06:49<br>20:12<br>05:42 | 05:44<br>21:06<br>05:02 | 05:03<br>21:51<br>05:02 |
| 8                         | 08:41<br>16:28<br>56 | 09:55 (WEA 01)<br>17:23<br>08:00 | 07:01<br>18:17<br>06:59          | 06:47<br>20:14<br>05:40 | 05:42<br>21:08<br>05:02 | 05:02<br>21:52<br>05:02 |
| 9                         | 08:40<br>16:29<br>55 | 09:55 (WEA 01)<br>17:25<br>07:58 | 06:59<br>18:19<br>06:57          | 06:45<br>20:16<br>05:38 | 05:40<br>21:09<br>05:01 | 05:02<br>21:52<br>05:01 |
| 10                        | 08:40<br>16:31<br>54 | 09:55 (WEA 01)<br>17:27<br>07:56 | 06:57<br>18:21<br>06:54          | 06:42<br>20:18<br>05:37 | 05:38<br>21:11<br>05:01 | 05:01<br>21:53<br>05:01 |
| 11                        | 08:39<br>16:32<br>54 | 09:19 (WEA 03)<br>17:29<br>07:54 | 06:54<br>18:23<br>06:52          | 06:40<br>20:19<br>05:35 | 05:37<br>21:13<br>05:00 | 05:01<br>21:54<br>05:00 |
| 12                        | 08:38<br>16:34<br>59 | 09:16 (WEA 03)<br>17:31<br>07:52 | 06:52<br>18:25<br>06:49          | 06:38<br>20:21<br>05:33 | 05:35<br>21:15<br>05:00 | 05:00<br>21:55<br>05:00 |
| 13                        | 08:37<br>16:36<br>58 | 09:15 (WEA 03)<br>17:33<br>07:50 | 06:49<br>18:27<br>06:47          | 06:35<br>20:23<br>05:31 | 05:33<br>21:16<br>05:00 | 05:00<br>21:56<br>05:00 |
| 14                        | 08:37<br>16:37<br>58 | 09:15 (WEA 03)<br>17:35<br>07:48 | 06:47<br>18:29<br>06:45          | 06:33<br>20:25<br>05:30 | 05:31<br>21:18<br>05:00 | 05:00<br>21:56<br>05:00 |
| 15                        | 08:36<br>16:39<br>54 | 09:14 (WEA 03)<br>17:37<br>07:46 | 06:45<br>18:30<br>06:42          | 06:31<br>20:27<br>05:28 | 05:30<br>21:20<br>04:59 | 05:00<br>21:57<br>04:59 |
| 16                        | 08:35<br>16:40<br>48 | 09:14 (WEA 03)<br>17:39<br>07:44 | 06:42<br>18:32<br>06:40          | 06:28<br>20:28<br>05:27 | 05:28<br>21:21<br>04:59 | 04:59<br>21:57<br>04:59 |
| 17                        | 08:34<br>16:42<br>49 | 09:14 (WEA 03)<br>17:41<br>07:42 | 06:40<br>18:34<br>06:37          | 06:26<br>20:30<br>05:25 | 05:27<br>21:23<br>04:59 | 04:59<br>21:58<br>04:59 |
| 18                        | 08:33<br>16:44<br>50 | 09:14 (WEA 03)<br>17:43<br>07:39 | 06:37<br>18:36<br>06:35          | 06:24<br>20:32<br>05:23 | 05:25<br>21:24<br>04:59 | 04:59<br>21:58<br>04:59 |
| 19                        | 08:32<br>16:45<br>51 | 09:14 (WEA 03)<br>17:45<br>07:37 | 06:35<br>18:38<br>06:33          | 06:22<br>20:34<br>05:22 | 05:23<br>21:26<br>04:59 | 04:59<br>21:59<br>04:59 |
| 20                        | 08:31<br>16:47<br>53 | 09:13 (WEA 03)<br>17:47<br>07:35 | 06:33<br>18:40<br>06:30          | 06:19<br>20:36<br>05:21 | 05:22<br>21:28<br>05:00 | 04:59<br>21:59<br>05:00 |
| 21                        | 08:29<br>16:49<br>51 | 09:14 (WEA 03)<br>17:49<br>07:33 | 06:30<br>18:41<br>06:28          | 06:17<br>20:37<br>05:19 | 05:21<br>21:29<br>05:00 | 05:00<br>21:59<br>05:00 |
| 22                        | 08:28<br>16:51<br>52 | 09:13 (WEA 03)<br>17:51<br>07:31 | 06:28<br>18:43<br>06:25          | 06:15<br>20:39<br>05:18 | 05:19<br>21:31<br>05:00 | 05:00<br>21:59<br>05:00 |
| 23                        | 08:27<br>16:53<br>51 | 09:14 (WEA 03)<br>17:53<br>07:29 | 06:25<br>18:45<br>06:23          | 06:13<br>20:41<br>05:16 | 05:18<br>21:32<br>05:00 | 05:00<br>22:00<br>05:00 |
| 24                        | 08:26<br>16:54<br>49 | 09:14 (WEA 03)<br>17:55<br>07:26 | 06:23<br>18:47<br>06:21          | 06:10<br>20:43<br>05:15 | 05:16<br>21:34<br>05:01 | 05:00<br>22:00<br>05:01 |
| 25                        | 08:24<br>16:56<br>49 | 09:14 (WEA 03)<br>17:57<br>07:24 | 06:21<br>18:49<br>06:18          | 06:08<br>20:45<br>05:14 | 05:15<br>21:35<br>05:01 | 05:01<br>22:00<br>05:01 |
| 26                        | 08:23<br>16:58<br>45 | 09:15 (WEA 03)<br>17:58<br>07:22 | 06:18<br>18:50<br>06:16          | 06:06<br>20:46<br>05:13 | 05:14<br>21:36<br>05:01 | 05:01<br>22:00<br>05:01 |
| 27                        | 08:21<br>17:00<br>44 | 09:16 (WEA 03)<br>18:00<br>07:20 | 06:16<br>18:52<br>06:13          | 06:04<br>20:48<br>05:12 | 05:13<br>21:38<br>05:02 | 05:01<br>22:00<br>05:02 |
| 28                        | 08:20<br>17:02<br>41 | 09:16 (WEA 03)<br>18:02<br>07:18 | 06:13<br>18:54<br>07:11          | 06:02<br>20:50<br>05:11 | 05:12<br>21:39<br>05:03 | 05:02<br>21:59<br>05:03 |
| 29                        | 08:18<br>17:04<br>35 | 09:17 (WEA 03)<br>18:04<br>07:16 | 07:11<br>19:56<br>07:08          | 06:00<br>20:52<br>05:09 | 05:11<br>21:40<br>05:03 | 05:03<br>21:59<br>05:03 |
| 30                        | 08:17<br>17:06<br>31 | 09:18 (WEA 03)<br>18:06<br>07:14 | 07:08<br>19:58<br>07:06          | 05:58<br>20:54<br>05:08 | 05:09<br>21:42<br>05:08 | 05:03<br>21:59<br>05:08 |
| 31                        | 08:15<br>17:08<br>23 | 09:20 (WEA 03)<br>18:08<br>07:12 | 07:06<br>20:00<br>07:04          | 05:08<br>21:43<br>05:06 | 05:08<br>21:43<br>05:06 | 05:08<br>21:59<br>05:06 |
| Sonnenscheinstunden       | 252                  | 274                              | 367                              | 419                     | 491                     | 507                     |
| astr.max.mögl.Beschattung | 1572                 | 12                               |                                  |                         |                         |                         |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: H - Lehmden Str. 145, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonnenfallrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Jul   | August | September | Oktober | November |    | Dezember             |                      |
|---------------------------|-------|--------|-----------|---------|----------|----|----------------------|----------------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   | 07:25    |    | 08:18                | 09:01 (WEA 03)       |
|                           | 21:59 | 21:25  | 20:19     | 19:07   | 16:58    |    | 16:14                | 11:34 (vorh. WEA 09) |
| 2                         | 05:05 | 05:44  | 06:37     | 07:29   | 07:26    |    | 08:20                | 09:38 (WEA 01)       |
|                           | 21:58 | 21:23  | 20:17     | 19:04   | 16:56    |    | 16:14                | 11:36 (vorh. WEA 09) |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   | 07:28    |    | 08:21                | 09:39 (WEA 01)       |
|                           | 21:58 | 21:21  | 20:15     | 19:02   | 16:54    |    | 16:13                | 11:37 (vorh. WEA 09) |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   | 07:30    |    | 08:23                | 09:39 (WEA 01)       |
|                           | 21:58 | 21:19  | 20:12     | 19:00   | 16:52    |    | 16:12                | 11:38 (vorh. WEA 09) |
| 5                         | 05:07 | 05:49  | 06:43     | 07:35   | 07:32    |    | 08:24                | 09:40 (WEA 01)       |
|                           | 21:57 | 21:17  | 20:10     | 18:57   | 16:50    |    | 16:12                | 11:39 (vorh. WEA 09) |
| 6                         | 05:08 | 05:51  | 06:44     | 07:36   | 07:34    |    | 08:26                | 09:41 (WEA 01)       |
|                           | 21:56 | 21:15  | 20:07     | 18:55   | 16:48    |    | 16:11                | 11:40 (vorh. WEA 09) |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   | 07:36    |    | 08:27                | 09:41 (WEA 01)       |
|                           | 21:56 | 21:14  | 20:05     | 18:52   | 16:46    |    | 16:11                | 11:40 (vorh. WEA 09) |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   | 07:38    |    | 08:28                | 09:42 (WEA 01)       |
|                           | 21:55 | 21:12  | 20:03     | 18:50   | 16:44    |    | 16:10                | 11:41 (vorh. WEA 09) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   | 07:40    |    | 08:29                | 09:42 (WEA 01)       |
|                           | 21:54 | 21:10  | 20:00     | 18:48   | 16:43    | 4  | 08:55 (WEA 03)       | 11:42 (vorh. WEA 09) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   | 07:42    |    | 08:52 (WEA 03)       | 09:43 (WEA 01)       |
|                           | 21:54 | 21:08  | 19:58     | 18:45   | 16:41    | 10 | 09:02 (WEA 03)       | 11:42 (vorh. WEA 09) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   | 07:44    |    | 08:50 (WEA 03)       | 09:43 (WEA 01)       |
|                           | 21:53 | 21:06  | 19:55     | 18:43   | 16:39    | 24 | 09:53 (WEA 01)       | 11:43 (vorh. WEA 09) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   | 07:45    |    | 08:49 (WEA 03)       | 09:45 (WEA 01)       |
|                           | 21:52 | 21:04  | 19:53     | 18:41   | 16:38    | 32 | 09:56 (WEA 01)       | 11:44 (vorh. WEA 09) |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   | 07:47    |    | 08:48 (WEA 03)       | 09:46 (WEA 01)       |
|                           | 21:51 | 21:02  | 19:51     | 18:38   | 16:36    | 37 | 09:57 (WEA 01)       | 11:45 (vorh. WEA 09) |
| 14                        | 05:16 | 06:04  | 06:58     | 07:51   | 07:49    |    | 08:48 (WEA 03)       | 09:46 (WEA 01)       |
|                           | 21:50 | 20:59  | 19:48     | 18:36   | 16:34    | 41 | 09:59 (WEA 01)       | 11:46 (vorh. WEA 09) |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   | 07:51    |    | 08:48 (WEA 03)       | 09:47 (WEA 01)       |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 16:33    | 44 | 10:00 (WEA 01)       | 11:46 (vorh. WEA 09) |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   | 07:53    |    | 08:47 (WEA 03)       | 09:47 (WEA 01)       |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 16:31    | 46 | 10:01 (WEA 01)       | 11:46 (vorh. WEA 09) |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   | 07:55    |    | 08:47 (WEA 03)       | 09:47 (WEA 01)       |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 16:30    | 49 | 10:02 (WEA 01)       | 11:47 (vorh. WEA 09) |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   | 07:56    |    | 08:48 (WEA 03)       | 09:48 (WEA 01)       |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 16:29    | 49 | 10:03 (WEA 01)       | 11:47 (vorh. WEA 09) |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   | 07:58    |    | 08:48 (WEA 03)       | 09:49 (WEA 01)       |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 16:27    | 51 | 10:04 (WEA 01)       | 11:48 (vorh. WEA 09) |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   | 08:00    |    | 08:48 (WEA 03)       | 09:49 (WEA 01)       |
|                           | 21:43 | 20:47  | 19:33     | 18:23   | 16:26    | 52 | 10:05 (WEA 01)       | 11:48 (vorh. WEA 09) |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   | 08:02    |    | 08:49 (WEA 03)       | 09:50 (WEA 01)       |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 16:25    | 51 | 10:05 (WEA 01)       | 11:49 (vorh. WEA 09) |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   | 08:04    |    | 08:49 (WEA 03)       | 09:50 (WEA 01)       |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 16:23    | 53 | 10:06 (WEA 01)       | 11:49 (vorh. WEA 09) |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   | 08:05    |    | 08:50 (WEA 03)       | 09:51 (WEA 01)       |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 16:22    | 51 | 10:06 (WEA 01)       | 11:50 (vorh. WEA 09) |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 08:07    |    | 08:51 (WEA 03)       | 09:51 (WEA 01)       |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 16:21    | 51 | 10:07 (WEA 01)       | 11:50 (vorh. WEA 09) |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 08:09    |    | 08:52 (WEA 03)       | 09:51 (WEA 01)       |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 16:20    | 49 | 10:07 (WEA 01)       | 11:50 (vorh. WEA 09) |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 08:10    |    | 08:53 (WEA 03)       | 09:52 (WEA 01)       |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 16:19    | 48 | 10:08 (WEA 01)       | 11:52 (vorh. WEA 09) |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   | 08:12    |    | 08:53 (WEA 03)       | 09:53 (WEA 01)       |
|                           | 21:33 | 20:31  | 19:16     | 17:08   | 16:18    | 53 | 11:25 (vorh. WEA 09) | 11:52 (vorh. WEA 09) |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   | 08:14    |    | 08:55 (WEA 03)       | 09:53 (WEA 01)       |
|                           | 21:31 | 20:29  | 19:14     | 17:06   | 16:17    | 58 | 11:29 (vorh. WEA 09) | 11:52 (vorh. WEA 09) |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   | 08:15    |    | 08:56 (WEA 03)       | 09:53 (WEA 01)       |
|                           | 21:30 | 20:26  | 19:12     | 17:03   | 16:16    | 58 | 11:31 (vorh. WEA 09) | 11:52 (vorh. WEA 09) |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   | 08:17    |    | 08:58 (WEA 03)       | 09:53 (WEA 01)       |
|                           | 21:28 | 20:24  | 19:09     | 17:01   | 16:15    | 60 | 11:33 (vorh. WEA 09) | 11:53 (vorh. WEA 09) |
| 31                        | 05:41 | 06:34  |           | 07:23   |          |    | 08:43                | 09:54 (WEA 01)       |
|                           | 21:26 | 20:22  |           | 16:59   |          |    | 16:18                | 11:53 (vorh. WEA 09) |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     | 261      |    | 236                  |                      |
| astr.max.mögl.Beschattung |       |        |           |         | 971      |    | 1765                 |                      |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: I - Dwoweg 1, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar            | Februar | März  | April | Mai   | Juni  | Juli  | August | September | Oktober | November | Dezember          |
|---------------------------|-------------------|---------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|-------------------|
| 1 06:43                   | 09:31 (WEA 03)    | 08:14   | 07:17 | 07:04 | 05:56 | 05:07 | 05:04 | 05:43  | 05:36     | 07:28   | 07:25    | 08:18             |
| 16:19                     | 50 10:59 (WEA 03) | 17:10   | 18:04 | 20:01 | 20:55 | 21:44 | 21:59 | 21:25  | 20:19     | 19:07   | 16:57    | 16:14             |
| 2 08:43                   | 09:32 (WEA 03)    | 08:12   | 07:15 | 07:01 | 05:54 | 05:07 | 05:05 | 05:44  | 05:37     | 07:29   | 07:26    | 08:20             |
| 16:20                     | 50 11:00 (WEA 03) | 17:12   | 18:06 | 20:03 | 20:57 | 21:45 | 21:58 | 21:23  | 20:17     | 19:04   | 16:56    | 16:14             |
| 3 08:43                   | 09:33 (WEA 03)    | 08:10   | 07:13 | 06:59 | 05:52 | 05:06 | 05:05 | 05:46  | 05:39     | 07:31   | 07:28    | 08:21             |
| 16:22                     | 50 11:01 (WEA 03) | 17:14   | 18:06 | 20:05 | 20:59 | 21:46 | 21:58 | 21:21  | 20:15     | 19:02   | 16:54    | 16:13             |
| 4 08:42                   | 09:32 (WEA 03)    | 08:09   | 07:11 | 06:56 | 05:50 | 05:05 | 05:06 | 05:48  | 05:41     | 07:33   | 07:30    | 08:23             |
| 16:23                     | 50 11:00 (WEA 03) | 17:15   | 18:10 | 20:07 | 21:01 | 21:48 | 21:58 | 21:19  | 20:12     | 19:00   | 16:52    | 16:12             |
| 5 08:42                   | 09:33 (WEA 03)    | 08:07   | 07:08 | 06:54 | 05:48 | 05:04 | 05:07 | 05:49  | 05:43     | 07:35   | 07:32    | 08:24             |
| 16:24                     | 50 11:01 (WEA 03) | 17:17   | 18:12 | 20:09 | 21:02 | 21:49 | 21:57 | 21:17  | 20:10     | 18:57   | 16:50    | 16:12             |
| 6 08:42                   | 09:33 (WEA 03)    | 08:05   | 07:06 | 06:52 | 05:46 | 05:03 | 05:08 | 05:51  | 05:44     | 07:36   | 07:34    | 08:26             |
| 16:25                     | 49 11:01 (WEA 03) | 17:19   | 18:14 | 20:10 | 21:04 | 21:50 | 21:56 | 21:15  | 20:07     | 18:55   | 16:48    | 16:11             |
| 7 08:41                   | 09:33 (WEA 03)    | 08:03   | 07:04 | 06:49 | 05:44 | 05:03 | 05:09 | 05:53  | 05:46     | 07:38   | 07:36    | 08:27             |
| 16:27                     | 50 11:01 (WEA 03) | 17:21   | 18:16 | 20:12 | 21:06 | 21:51 | 21:56 | 21:14  | 20:05     | 18:52   | 16:46    | 16:11             |
| 8 08:41                   | 09:34 (WEA 03)    | 08:01   | 07:01 | 06:47 | 05:42 | 05:02 | 05:10 | 05:54  | 05:48     | 07:40   | 07:38    | 08:28             |
| 16:28                     | 49 11:01 (WEA 03) | 17:23   | 18:17 | 20:14 | 21:06 | 21:52 | 21:55 | 21:12  | 20:03     | 18:50   | 16:44    | 16:10             |
| 9 08:40                   | 09:34 (WEA 03)    | 08:00   | 06:59 | 06:45 | 05:40 | 05:02 | 05:11 | 05:56  | 05:49     | 07:42   | 07:40    | 08:29             |
| 16:29                     | 48 11:01 (WEA 03) | 17:25   | 18:19 | 20:16 | 21:09 | 21:52 | 21:54 | 21:10  | 20:00     | 18:48   | 16:43    | 16:10             |
| 10 08:40                  | 09:35 (WEA 03)    | 07:58   | 06:57 | 06:42 | 05:36 | 05:01 | 05:12 | 05:58  | 05:51     | 07:44   | 07:42    | 08:31             |
| 16:31                     | 47 11:01 (WEA 03) | 17:27   | 18:21 | 20:18 | 21:11 | 21:53 | 21:54 | 21:08  | 19:58     | 18:45   | 16:41    | 16:10             |
| 11 08:39                  | 09:35 (WEA 03)    | 07:56   | 06:54 | 06:40 | 05:37 | 05:01 | 05:13 | 05:59  | 05:53     | 07:45   | 07:44    | 08:32             |
| 16:32                     | 46 11:01 (WEA 03) | 17:29   | 18:23 | 20:19 | 21:13 | 21:54 | 21:53 | 21:06  | 19:55     | 18:43   | 16:39    | 16:10             |
| 12 08:38                  | 09:35 (WEA 03)    | 07:54   | 06:52 | 06:38 | 05:35 | 05:00 | 05:14 | 06:01  | 05:55     | 07:47   | 07:45    | 08:33             |
| 16:34                     | 45 11:00 (WEA 03) | 17:31   | 18:25 | 20:21 | 21:15 | 21:55 | 21:52 | 21:04  | 19:53     | 18:41   | 16:36    | 16:09             |
| 13 08:37                  | 09:36 (WEA 03)    | 07:52   | 06:49 | 06:35 | 05:33 | 05:00 | 05:15 | 06:03  | 05:56     | 07:49   | 07:47    | 08:34             |
| 16:36                     | 43 11:00 (WEA 03) | 17:33   | 18:27 | 20:23 | 21:16 | 21:56 | 21:51 | 21:02  | 19:51     | 18:39   | 16:36    | 16:09             |
| 14 08:37                  | 09:36 (WEA 03)    | 07:50   | 06:47 | 06:33 | 05:31 | 05:00 | 05:16 | 06:04  | 05:58     | 07:51   | 07:49    | 08:35             |
| 16:37                     | 42 11:00 (WEA 03) | 17:35   | 18:29 | 20:25 | 21:18 | 21:56 | 21:50 | 20:59  | 19:48     | 18:36   | 16:34    | 16:09             |
| 15 08:36                  | 09:37 (WEA 03)    | 07:48   | 06:45 | 06:31 | 05:30 | 05:00 | 05:18 | 06:06  | 07:00     | 07:53   | 07:51    | 08:36             |
| 16:39                     | 38 10:59 (WEA 03) | 17:37   | 18:30 | 20:27 | 21:20 | 21:57 | 21:49 | 20:57  | 19:46     | 18:34   | 16:33    | 16:09             |
| 16 08:35                  | 09:38 (WEA 03)    | 07:46   | 06:42 | 06:28 | 05:28 | 04:59 | 05:19 | 06:08  | 07:01     | 07:55   | 07:53    | 08:37             |
| 16:40                     | 34 10:58 (WEA 03) | 17:39   | 18:32 | 20:28 | 21:21 | 21:57 | 21:48 | 20:55  | 19:43     | 18:32   | 16:31    | 16:09             |
| 17 08:34                  | 09:39 (WEA 03)    | 07:44   | 06:40 | 06:26 | 05:27 | 04:59 | 05:20 | 06:10  | 07:03     | 07:56   | 07:55    | 08:37             |
| 16:42                     | 30 10:57 (WEA 03) | 17:41   | 18:34 | 20:30 | 21:23 | 21:58 | 21:47 | 20:53  | 19:41     | 18:29   | 16:30    | 16:10             |
| 18 08:33                  | 09:40 (WEA 03)    | 07:42   | 06:37 | 06:24 | 05:25 | 04:59 | 05:22 | 06:11  | 07:05     | 07:58   | 07:56    | 08:38             |
| 16:44                     | 23 10:54 (WEA 03) | 17:43   | 18:36 | 20:32 | 21:24 | 21:58 | 21:45 | 20:51  | 19:38     | 18:27   | 16:29    | 16:10             |
| 19 08:32                  | 09:41 (WEA 03)    | 07:39   | 06:35 | 06:22 | 05:23 | 04:59 | 05:23 | 06:13  | 07:07     | 08:00   | 07:58    | 08:39             |
| 16:45                     | 16 09:57 (WEA 03) | 17:45   | 18:38 | 20:34 | 21:26 | 21:59 | 21:44 | 20:49  | 19:36     | 18:25   | 16:27    | 16:10             |
| 20 08:31                  | 09:42 (WEA 03)    | 07:37   | 06:33 | 06:19 | 05:22 | 04:59 | 05:24 | 06:15  | 07:08     | 08:02   | 08:00    | 08:40             |
| 16:47                     | 14 09:56 (WEA 03) | 17:47   | 18:40 | 20:36 | 21:28 | 21:59 | 21:43 | 20:47  | 19:33     | 18:23   | 16:26    | 7 09:21 (WEA 03)  |
| 21 08:29                  | 09:44 (WEA 03)    | 07:35   | 06:30 | 06:17 | 05:21 | 05:00 | 05:26 | 06:17  | 07:10     | 08:04   | 08:02    | 09:28 (WEA 03)    |
| 16:49                     | 11 09:55 (WEA 03) | 17:49   | 18:41 | 20:37 | 21:29 | 21:59 | 21:42 | 20:44  | 19:31     | 18:20   | 16:25    | 11 09:30 (WEA 03) |
| 22 08:28                  | 09:46 (WEA 03)    | 07:33   | 06:28 | 06:15 | 05:19 | 05:00 | 05:27 | 06:18  | 07:12     | 08:06   | 08:04    | 09:18 (WEA 03)    |
| 16:51                     | 7 09:53 (WEA 03)  | 17:51   | 18:43 | 20:39 | 21:31 | 21:59 | 21:40 | 20:42  | 19:29     | 18:18   | 16:23    | 14 09:32 (WEA 03) |
| 23 08:27                  |                   | 07:31   | 06:25 | 06:13 | 05:18 | 05:00 | 05:29 | 06:20  | 07:14     | 08:08   | 08:05    | 09:17 (WEA 03)    |
| 16:53                     |                   | 17:53   | 18:45 | 20:41 | 21:32 | 22:00 | 21:39 | 20:40  | 19:26     | 18:16   | 16:22    | 16 09:33 (WEA 03) |
| 24 08:26                  |                   | 07:29   | 06:23 | 06:10 | 05:16 | 05:00 | 05:30 | 06:22  | 07:15     | 08:09   | 08:07    | 09:17 (WEA 03)    |
| 16:54                     |                   | 17:55   | 18:47 | 20:43 | 21:34 | 22:00 | 21:37 | 20:38  | 19:24     | 18:14   | 16:21    | 22 10:31 (WEA 03) |
| 25 08:24                  |                   | 07:26   | 06:21 | 06:08 | 05:15 | 05:01 | 05:32 | 06:23  | 07:17     | 08:11   | 08:09    | 09:17 (WEA 03)    |
| 16:56                     |                   | 17:57   | 18:49 | 20:45 | 21:35 | 22:00 | 21:36 | 20:35  | 19:21     | 18:12   | 16:20    | 30 10:35 (WEA 03) |
| 26 08:23                  |                   | 07:24   | 06:18 | 06:06 | 05:14 | 05:01 | 05:33 | 06:25  | 07:19     | 08:13   | 08:10    | 09:17 (WEA 03)    |
| 16:58                     |                   | 17:58   | 18:50 | 20:46 | 21:36 | 22:00 | 21:34 | 20:33  | 19:19     | 18:10   | 16:19    | 34 10:37 (WEA 03) |
| 27 08:21                  |                   | 07:22   | 06:16 | 06:04 | 05:13 | 05:01 | 05:35 | 06:27  | 07:21     | 08:15   | 08:12    | 09:16 (WEA 03)    |
| 17:00                     |                   | 18:00   | 18:52 | 20:48 | 21:38 | 22:00 | 21:33 | 20:31  | 19:16     | 18:08   | 16:18    | 38 10:38 (WEA 03) |
| 28 08:20                  |                   | 07:20   | 06:13 | 06:02 | 05:12 | 05:02 | 05:36 | 06:29  | 07:22     | 08:17   | 08:14    | 09:16 (WEA 03)    |
| 17:02                     |                   | 18:02   | 18:54 | 20:50 | 21:39 | 21:59 | 21:31 | 20:29  | 19:14     | 18:06   | 16:17    | 41 10:40 (WEA 03) |
| 29 08:18                  |                   |         | 07:11 | 06:00 | 05:11 | 05:03 | 05:38 | 06:30  | 07:24     | 08:19   | 08:15    | 09:17 (WEA 03)    |
| 17:04                     |                   |         | 19:56 | 20:52 | 21:40 | 21:59 | 21:30 | 20:26  | 19:12     | 18:03   | 16:16    | 43 10:41 (WEA 03) |
| 30 08:17                  |                   |         | 07:08 | 05:58 | 05:09 | 05:03 | 05:39 | 06:32  | 07:26     | 08:21   | 08:17    | 09:17 (WEA 03)    |
| 17:06                     |                   |         | 19:58 | 20:54 | 21:42 | 21:59 | 21:28 | 20:24  | 19:09     | 18:01   | 16:15    | 45 10:42 (WEA 03) |
| 31 08:15                  |                   |         | 07:06 |       | 05:08 |       | 05:41 | 06:34  |           | 07:23   |          | 08:43             |
| 17:08                     |                   |         | 20:00 |       | 21:43 |       | 21:26 | 20:22  |           | 16:59   |          | 16:18             |
| Sonnenscheinstunden       | 252               |         |       |       |       |       |       |        |           |         |          |                   |
| astr.max.mögl.Beschattung | 842               | 274     | 367   | 419   | 491   | 507   | 509   | 458    | 382       | 329     | 261      | 301               |
|                           |                   |         |       |       |       |       |       |        |           |         |          | 1525              |

**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)

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: J - Dwoweg 11, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar | Februar        | März  | April | Mai   | Juni  | Juli  | August | September | Oktober | November | Dezember |
|---------------------------|--------|----------------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1                         | 06:43  | 09:51 (WEA 03) | 08:14 | 07:17 | 06:04 | 05:07 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 2                         | 06:43  | 11:30 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 3                         | 06:43  | 09:52 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 4                         | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 5                         | 06:43  | 09:53 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 6                         | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 7                         | 06:43  | 09:54 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 8                         | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 9                         | 06:43  | 09:55 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 10                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 11                        | 06:43  | 09:56 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 12                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 13                        | 06:43  | 09:57 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 14                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 15                        | 06:43  | 09:58 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 16                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 17                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 18                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 19                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 20                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 21                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 22                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 23                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 24                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 25                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 26                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 27                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 28                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 29                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 30                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 31                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 32                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 33                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 34                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 35                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 36                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 37                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 38                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 39                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 40                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 41                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 42                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 43                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 44                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 45                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 46                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 47                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 48                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 49                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 50                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 51                        | 06:43  | 09:59 (WEA 03) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| 52                        | 06:43  | 11:31 (WEA 01) | 08:12 | 07:15 | 06:01 | 05:04 | 04:04 | 03:43  | 03:36     | 07:28   | 07:25    | 06:18    |
| Sonnenscheinstunden       | 252    | 434            | 367   | 419   | 491   | 507   | 509   | 458    | 362       | 329     | 261      | 1358     |
| 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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|------------------------------|---------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: K - Dwoweg 39, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar         | Februar                                      | März           | April          | Mai            | Juni           |
|---------------------------|----------------|----------------------------------------------|----------------|----------------|----------------|----------------|
| 1                         | 08:43<br>16:19 | 13:07 (WEA 01)<br>15:14 (vorh. WEA 09)       | 08:14<br>17:10 | 07:17<br>18:04 | 07:04<br>20:01 | 05:56<br>20:55 |
| 2                         | 08:43<br>16:20 | 14:52 (vorh. WEA 09)<br>15:15 (vorh. WEA 09) | 08:12<br>17:12 | 07:15<br>18:06 | 07:01<br>20:03 | 05:54<br>20:57 |
| 3                         | 08:43<br>16:22 | 14:53 (vorh. WEA 09)<br>15:16 (vorh. WEA 09) | 08:10<br>17:14 | 07:13<br>18:08 | 06:59<br>20:05 | 05:52<br>20:59 |
| 4                         | 08:42<br>16:23 | 14:53 (vorh. WEA 09)<br>15:16 (vorh. WEA 09) | 08:09<br>17:15 | 07:11<br>18:10 | 06:56<br>20:07 | 05:50<br>21:01 |
| 5                         | 08:42<br>16:24 | 14:54 (vorh. WEA 09)<br>15:17 (vorh. WEA 09) | 08:07<br>17:17 | 07:08<br>18:12 | 06:54<br>20:09 | 05:48<br>21:02 |
| 6                         | 08:42<br>16:25 | 14:54 (vorh. WEA 09)<br>15:17 (vorh. WEA 09) | 08:05<br>17:19 | 07:06<br>18:14 | 06:52<br>20:10 | 05:46<br>21:04 |
| 7                         | 08:41<br>16:27 | 14:54 (vorh. WEA 09)<br>15:17 (vorh. WEA 09) | 08:03<br>17:21 | 07:04<br>18:16 | 06:49<br>20:12 | 05:44<br>21:06 |
| 8                         | 08:41<br>16:28 | 14:55 (vorh. WEA 09)<br>15:18 (vorh. WEA 09) | 08:01<br>17:23 | 07:01<br>18:17 | 06:47<br>20:14 | 05:42<br>21:08 |
| 9                         | 08:40<br>16:29 | 14:55 (vorh. WEA 09)<br>15:18 (vorh. WEA 09) | 08:00<br>17:25 | 06:59<br>18:19 | 06:45<br>20:16 | 05:40<br>21:09 |
| 10                        | 08:40<br>16:31 | 14:55 (vorh. WEA 09)<br>15:18 (vorh. WEA 09) | 07:58<br>17:27 | 06:57<br>18:21 | 06:42<br>20:18 | 05:38<br>21:11 |
| 11                        | 08:39<br>16:32 | 14:56 (vorh. WEA 09)<br>15:18 (vorh. WEA 09) | 07:56<br>17:29 | 06:54<br>18:23 | 06:40<br>20:19 | 05:37<br>21:13 |
| 12                        | 08:38<br>16:34 | 14:56 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:54<br>17:31 | 06:52<br>18:25 | 06:38<br>20:21 | 05:35<br>21:15 |
| 13                        | 08:37<br>16:35 | 14:57 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:52<br>17:33 | 06:49<br>18:27 | 06:35<br>20:23 | 05:33<br>21:16 |
| 14                        | 08:37<br>16:37 | 14:58 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:50<br>17:35 | 06:47<br>18:29 | 06:33<br>20:25 | 05:31<br>21:18 |
| 15                        | 08:36<br>16:39 | 14:58 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:48<br>17:37 | 06:45<br>18:30 | 06:31<br>20:27 | 05:30<br>21:20 |
| 16                        | 08:35<br>16:40 | 14:59 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:46<br>17:39 | 06:42<br>18:32 | 06:28<br>20:28 | 05:28<br>21:21 |
| 17                        | 08:34<br>16:42 | 15:00 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:44<br>17:41 | 06:40<br>18:34 | 06:26<br>20:30 | 05:27<br>21:23 |
| 18                        | 08:33<br>16:44 | 15:02 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) | 07:42<br>17:43 | 06:37<br>18:36 | 06:24<br>20:32 | 05:25<br>21:24 |
| 19                        | 08:32<br>16:45 | 15:02 (vorh. WEA 09)<br>15:18 (vorh. WEA 09) | 07:39<br>17:45 | 06:35<br>18:38 | 06:22<br>20:34 | 05:23<br>21:26 |
| 20                        | 08:31<br>16:47 | 15:04 (vorh. WEA 09)<br>15:17 (vorh. WEA 09) | 07:37<br>17:47 | 06:33<br>18:40 | 06:19<br>20:36 | 05:22<br>21:27 |
| 21                        | 08:29<br>16:49 | 15:06 (vorh. WEA 09)<br>15:16 (vorh. WEA 09) | 07:35<br>17:49 | 06:30<br>18:41 | 06:17<br>20:37 | 05:21<br>21:29 |
| 22                        | 08:28<br>16:51 | 15:09 (vorh. WEA 09)<br>15:13 (vorh. WEA 09) | 07:33<br>17:51 | 06:28<br>18:43 | 06:15<br>20:39 | 05:19<br>21:31 |
| 23                        | 08:27<br>16:53 |                                              | 07:31<br>17:53 | 06:25<br>18:45 | 06:13<br>20:41 | 05:18<br>21:32 |
| 24                        | 08:26<br>16:54 |                                              | 07:29<br>17:55 | 06:23<br>18:47 | 06:10<br>20:43 | 05:16<br>21:33 |
| 25                        | 08:24<br>16:56 |                                              | 07:26<br>17:56 | 06:18<br>18:49 | 06:06<br>20:45 | 05:14<br>21:35 |
| 26                        | 08:23<br>16:58 |                                              | 07:24<br>17:58 | 06:16<br>18:50 | 06:04<br>20:46 | 05:13<br>21:36 |
| 27                        | 08:21<br>17:00 |                                              | 07:22<br>18:00 | 06:14<br>18:52 | 06:02<br>20:48 | 05:11<br>21:38 |
| 28                        | 08:20<br>17:02 |                                              | 07:20<br>18:02 | 06:13<br>18:54 | 06:02<br>20:50 | 05:12<br>21:39 |
| 29                        | 08:18<br>17:04 |                                              |                | 07:11<br>19:56 | 06:00<br>20:52 | 05:10<br>21:40 |
| 30                        | 08:17<br>17:06 |                                              |                | 07:08<br>19:58 | 05:58<br>20:54 | 05:09<br>21:42 |
| 31                        | 08:15<br>17:08 |                                              |                | 07:06<br>20:00 |                | 05:08<br>21:43 |
| Sonnenscheinstunden       | 252            |                                              | 274            | 419            | 491            | 507            |
| astr.max.mögl.Beschattung | 442            |                                              |                |                |                |                |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: K - Dwoweg 39, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | Jul            | August         | September      | Oktober        | November       |     | Dezember                                                                                     |
|---------------------------|----------------|----------------|----------------|----------------|----------------|-----|----------------------------------------------------------------------------------------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 07:28<br>19:07 | 07:25<br>16:57 |     | 08:18<br>16:14                                                                               |
| 2                         | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:56 | 22  | 14:38 (vorh. WEA 09)<br>15:00 (vorh. WEA 09)<br>14:39 (vorh. WEA 09)<br>15:01 (vorh. WEA 09) |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 | 07:28<br>16:54 | 22  | 08:21<br>16:13<br>15:02 (vorh. WEA 09)<br>14:39 (vorh. WEA 09)                               |
| 4                         | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52 | 23  | 08:23<br>16:12<br>15:03 (vorh. WEA 09)<br>14:40 (vorh. WEA 09)                               |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50 | 23  | 08:24<br>16:12<br>15:03 (vorh. WEA 09)<br>14:40 (vorh. WEA 09)                               |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 07:34<br>16:48 | 23  | 08:25<br>16:11<br>15:03 (vorh. WEA 09)<br>14:40 (vorh. WEA 09)                               |
| 7                         | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 07:38<br>18:52 | 07:36<br>16:46 | 23  | 08:27<br>16:11<br>15:03 (vorh. WEA 09)<br>14:41 (vorh. WEA 09)                               |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 07:38<br>16:44 | 23  | 08:28<br>16:10<br>15:04 (vorh. WEA 09)<br>14:41 (vorh. WEA 09)                               |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 07:40<br>16:43 | 23  | 08:29<br>16:10<br>15:04 (vorh. WEA 09)<br>14:42 (vorh. WEA 09)                               |
| 10                        | 05:12<br>21:54 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 07:42<br>16:41 | 22  | 08:30<br>16:10<br>15:04 (vorh. WEA 09)<br>12:57 (WEA 01)                                     |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 07:43<br>16:39 | 27  | 08:32<br>16:10<br>15:04 (vorh. WEA 09)<br>12:57 (WEA 01)                                     |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 07:45<br>16:38 | 30  | 08:33<br>16:09<br>15:05 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 13                        | 05:15<br>21:51 | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 07:47<br>16:36 | 32  | 08:34<br>16:09<br>15:06 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 14                        | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 07:49<br>16:34 | 33  | 08:35<br>16:09<br>15:06 (vorh. WEA 09)<br>12:55 (WEA 01)                                     |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 07:51<br>16:33 | 35  | 08:36<br>16:09<br>15:06 (vorh. WEA 09)<br>12:55 (WEA 01)                                     |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 07:53<br>16:31 | 35  | 08:37<br>16:09<br>15:06 (vorh. WEA 09)<br>12:55 (WEA 01)                                     |
| 17                        | 05:20<br>21:47 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 07:55<br>16:30 | 36  | 08:37<br>16:10<br>15:06 (vorh. WEA 09)<br>12:55 (WEA 01)                                     |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 07:56<br>16:29 | 37  | 08:38<br>16:10<br>15:07 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 07:58<br>16:27 | 37  | 08:39<br>16:10<br>15:08 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 08:00<br>16:26 | 3   | 08:40<br>16:10<br>15:08 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 21                        | 05:26<br>21:42 | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:02<br>16:25 | 10  | 08:41<br>16:11<br>15:09 (vorh. WEA 09)<br>12:56 (WEA 01)                                     |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 08:04<br>16:23 | 13  | 08:41<br>16:11<br>15:09 (vorh. WEA 09)<br>12:57 (WEA 01)                                     |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 08:05<br>16:22 | 16  | 08:41<br>16:12<br>15:10 (vorh. WEA 09)<br>12:58 (WEA 01)                                     |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 08:07<br>16:21 | 17  | 08:42<br>16:12<br>15:10 (vorh. WEA 09)<br>12:58 (WEA 01)                                     |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 08:09<br>16:20 | 19  | 08:42<br>16:13<br>15:10 (vorh. WEA 09)<br>13:00 (WEA 01)                                     |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 08:10<br>16:19 | 20  | 08:42<br>16:14<br>15:11 (vorh. WEA 09)<br>13:00 (WEA 01)                                     |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 08:12<br>16:18 | 21  | 08:43<br>16:14<br>15:12 (vorh. WEA 09)<br>13:01 (WEA 01)                                     |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>17:06 | 08:14<br>16:17 | 21  | 08:43<br>16:15<br>15:12 (vorh. WEA 09)<br>13:02 (WEA 01)                                     |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:03 | 08:15<br>16:16 | 22  | 08:43<br>16:16<br>15:13 (vorh. WEA 09)<br>13:03 (WEA 01)                                     |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 08:17<br>16:15 | 23  | 08:43<br>16:17<br>15:13 (vorh. WEA 09)<br>13:04 (WEA 01)                                     |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 07:23<br>16:59 |                |     | 08:43<br>16:18<br>15:13 (vorh. WEA 09)                                                       |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 261            | 185 | 236                                                                                          |
| astr.max.mögl.Beschattung |                |                |                |                |                |     | 960                                                                                          |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: L - Dwoweg 70, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Januar               | Februar                                               | März                    | April                   | Mai                     | Juni                    |
|---------------------------|----------------------|-------------------------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 1                         | 08:43<br>16:19<br>15 | 13:57 (WEA 01)<br>14:12 (WEA 01)<br>17:10             | 08:14<br>07:17<br>18:04 | 07:04<br>20:01<br>20:55 | 05:56<br>20:55<br>21:44 | 05:07<br>21:44<br>21:55 |
| 2                         | 08:43<br>16:20<br>13 | 13:59 (WEA 01)<br>14:12 (WEA 01)<br>17:12             | 08:12<br>07:15<br>18:06 | 07:01<br>20:03<br>20:57 | 05:54<br>20:57<br>21:45 | 05:07<br>21:45<br>21:55 |
| 3                         | 08:43<br>16:22<br>12 | 14:00 (WEA 01)<br>14:12 (WEA 01)<br>17:13             | 08:10<br>07:13<br>18:08 | 07:13<br>20:05<br>20:59 | 05:52<br>20:59<br>21:46 | 05:06<br>21:46<br>21:55 |
| 4                         | 08:42<br>16:23<br>9  | 14:01 (WEA 01)<br>14:10 (WEA 01)<br>17:15             | 08:09<br>07:11<br>18:10 | 06:56<br>20:07<br>21:01 | 05:50<br>21:01<br>21:48 | 05:05<br>21:48<br>21:55 |
| 5                         | 08:42<br>16:24<br>6  | 14:04 (WEA 01)<br>14:10 (WEA 01)<br>17:17             | 08:07<br>07:08<br>18:12 | 06:54<br>20:09<br>21:02 | 05:48<br>21:02<br>21:49 | 05:04<br>21:49<br>21:55 |
| 6                         | 08:42<br>16:25<br>5  | 15:36 (vorh. WEA 09)<br>15:41 (vorh. WEA 09)<br>17:19 | 08:05<br>17:19<br>18:14 | 07:06<br>20:10<br>21:04 | 06:52<br>21:04<br>21:50 | 05:03<br>21:50<br>21:55 |
| 7                         | 08:41<br>16:27<br>8  | 15:35 (vorh. WEA 09)<br>15:43 (vorh. WEA 09)<br>17:21 | 08:03<br>17:21<br>18:15 | 06:49<br>20:12<br>21:06 | 05:44<br>21:06<br>21:51 | 05:03<br>21:51<br>21:55 |
| 8                         | 08:41<br>16:28<br>10 | 15:35 (vorh. WEA 09)<br>15:45 (vorh. WEA 09)<br>17:23 | 08:01<br>17:23<br>18:17 | 06:47<br>20:14<br>21:08 | 05:42<br>21:08<br>21:52 | 05:02<br>21:52<br>21:55 |
| 9                         | 08:40<br>16:29<br>12 | 15:34 (vorh. WEA 09)<br>15:46 (vorh. WEA 09)<br>17:25 | 08:00<br>17:25<br>18:19 | 06:45<br>20:16<br>21:09 | 05:40<br>21:09<br>21:52 | 05:02<br>21:52<br>21:55 |
| 10                        | 08:40<br>16:31<br>13 | 15:34 (vorh. WEA 09)<br>15:47 (vorh. WEA 09)<br>17:27 | 07:58<br>17:27<br>18:21 | 06:42<br>20:18<br>21:11 | 05:38<br>21:11<br>21:53 | 05:01<br>21:53<br>21:55 |
| 11                        | 08:39<br>16:32<br>14 | 15:33 (vorh. WEA 09)<br>15:47 (vorh. WEA 09)<br>17:29 | 07:56<br>17:29<br>18:23 | 06:40<br>20:19<br>21:13 | 05:37<br>21:13<br>21:54 | 05:01<br>21:54<br>21:55 |
| 12                        | 08:38<br>16:34<br>15 | 15:33 (vorh. WEA 09)<br>15:48 (vorh. WEA 09)<br>17:31 | 07:54<br>17:31<br>18:25 | 06:38<br>20:21<br>21:15 | 05:35<br>21:15<br>21:55 | 05:00<br>21:55<br>21:55 |
| 13                        | 08:37<br>16:35<br>16 | 15:33 (vorh. WEA 09)<br>15:49 (vorh. WEA 09)<br>17:33 | 07:52<br>17:33<br>18:27 | 06:35<br>20:23<br>21:16 | 05:33<br>21:16<br>21:56 | 05:00<br>21:56<br>21:55 |
| 14                        | 08:37<br>16:37<br>17 | 15:33 (vorh. WEA 09)<br>15:50 (vorh. WEA 09)<br>17:35 | 07:50<br>17:35<br>18:29 | 06:33<br>20:25<br>21:18 | 05:31<br>21:18<br>21:56 | 05:00<br>21:56<br>21:55 |
| 15                        | 08:36<br>16:39<br>17 | 15:33 (vorh. WEA 09)<br>15:50 (vorh. WEA 09)<br>17:37 | 07:48<br>17:37<br>18:30 | 06:31<br>20:27<br>21:20 | 05:30<br>21:20<br>21:57 | 05:00<br>21:57<br>21:55 |
| 16                        | 08:35<br>16:40<br>18 | 15:33 (vorh. WEA 09)<br>15:51 (vorh. WEA 09)<br>17:39 | 07:46<br>17:39<br>18:32 | 06:28<br>20:28<br>21:21 | 05:28<br>21:21<br>21:57 | 04:59<br>21:57<br>21:55 |
| 17                        | 08:34<br>16:42<br>18 | 15:34 (vorh. WEA 09)<br>15:52 (vorh. WEA 09)<br>17:41 | 07:44<br>17:41<br>18:34 | 06:26<br>20:30<br>21:23 | 05:27<br>21:23<br>21:58 | 04:59<br>21:58<br>21:55 |
| 18                        | 08:33<br>16:44<br>19 | 15:34 (vorh. WEA 09)<br>15:53 (vorh. WEA 09)<br>17:43 | 07:42<br>17:43<br>18:36 | 06:24<br>20:32<br>21:24 | 05:25<br>21:24<br>21:58 | 04:59<br>21:58<br>21:55 |
| 19                        | 08:32<br>16:45<br>18 | 15:34 (vorh. WEA 09)<br>15:52 (vorh. WEA 09)<br>17:45 | 07:39<br>17:45<br>18:38 | 06:21<br>20:34<br>21:26 | 05:23<br>21:26<br>21:59 | 04:59<br>21:59<br>21:55 |
| 20                        | 08:31<br>16:47<br>18 | 15:35 (vorh. WEA 09)<br>15:53 (vorh. WEA 09)<br>17:47 | 07:37<br>17:47<br>18:40 | 06:19<br>20:36<br>21:27 | 05:22<br>21:27<br>21:59 | 04:59<br>21:59<br>21:55 |
| 21                        | 08:29<br>16:49<br>18 | 15:35 (vorh. WEA 09)<br>15:53 (vorh. WEA 09)<br>17:49 | 07:35<br>17:49<br>18:41 | 06:17<br>20:37<br>21:29 | 05:21<br>21:29<br>21:59 | 04:59<br>21:59<br>21:55 |
| 22                        | 08:28<br>16:51<br>17 | 15:36 (vorh. WEA 09)<br>15:53 (vorh. WEA 09)<br>17:51 | 07:33<br>17:51<br>18:43 | 06:15<br>20:39<br>21:31 | 05:19<br>21:31<br>21:59 | 05:00<br>21:59<br>21:55 |
| 23                        | 08:27<br>16:53<br>16 | 15:37 (vorh. WEA 09)<br>15:53 (vorh. WEA 09)<br>17:53 | 07:31<br>17:53<br>18:45 | 06:13<br>20:41<br>21:32 | 05:18<br>21:32<br>22:00 | 05:00<br>22:00<br>22:00 |
| 24                        | 08:26<br>16:54<br>15 | 15:37 (vorh. WEA 09)<br>15:52 (vorh. WEA 09)<br>17:55 | 07:29<br>17:55<br>18:47 | 06:10<br>20:43<br>21:33 | 05:16<br>21:33<br>22:00 | 05:00<br>22:00<br>22:00 |
| 25                        | 08:24<br>16:56<br>13 | 15:39 (vorh. WEA 09)<br>15:52 (vorh. WEA 09)<br>17:56 | 07:26<br>17:56<br>18:49 | 06:08<br>20:45<br>21:35 | 05:15<br>21:35<br>22:00 | 05:01<br>22:00<br>22:00 |
| 26                        | 08:23<br>16:58<br>10 | 15:40 (vorh. WEA 09)<br>15:50 (vorh. WEA 09)<br>17:58 | 07:24<br>17:58<br>18:50 | 06:06<br>20:46<br>21:36 | 05:14<br>21:36<br>22:00 | 05:01<br>22:00<br>22:00 |
| 27                        | 08:21<br>17:00<br>6  | 15:43 (vorh. WEA 09)<br>15:49 (vorh. WEA 09)<br>18:00 | 07:22<br>18:00<br>18:52 | 06:04<br>20:48<br>21:38 | 05:13<br>21:38<br>22:00 | 05:01<br>22:00<br>22:00 |
| 28                        | 08:20<br>17:02       |                                                       | 07:20<br>18:02          | 06:02<br>20:50          | 05:12<br>21:39          | 05:02<br>21:59          |
| 29                        | 08:18<br>17:04       |                                                       |                         | 07:11<br>19:56          | 06:00<br>20:52          | 05:10<br>21:40          |
| 30                        | 08:17<br>17:06       |                                                       |                         | 07:08<br>19:58          | 05:58<br>20:54          | 05:09<br>21:42          |
| 31                        | 08:15<br>17:08       |                                                       |                         | 07:06<br>20:00          | 05:08<br>21:43          | 05:08<br>21:59          |
| Sonnenscheinstunden       | 252                  | 274                                                   | 367                     | 419                     | 491                     | 507                     |
| astr.max.mögl.Beschattung | 368                  |                                                       |                         |                         |                         |                         |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: L - Dwoweg 70, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|    | Jul                       | August         | September      | Oktober        | November       |                      | Dezember                                                       |
|----|---------------------------|----------------|----------------|----------------|----------------|----------------------|----------------------------------------------------------------|
| 1  | 05:04<br>21:59            | 05:43<br>21:24 | 06:36<br>20:19 | 07:28<br>19:07 | 07:25<br>16:57 |                      | 08:18<br>16:14 14 15:15 (vorh. WEA 09)<br>15:29 (vorh. WEA 09) |
| 2  | 05:04<br>21:58            | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:56 |                      | 08:20<br>16:14 13 15:17 (vorh. WEA 09)<br>15:30 (vorh. WEA 09) |
| 3  | 05:05<br>21:58            | 05:46<br>21:21 | 06:39<br>20:15 | 07:31<br>19:02 | 07:28<br>16:54 |                      | 08:21<br>16:13 12 15:29 (vorh. WEA 09)<br>15:19 (vorh. WEA 09) |
| 4  | 05:06<br>21:57            | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52 |                      | 08:23<br>16:12 10 15:29 (vorh. WEA 09)<br>15:22 (vorh. WEA 09) |
| 5  | 05:07<br>21:57            | 05:49<br>21:17 | 06:42<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50 |                      | 08:24<br>16:12 8 15:29 (vorh. WEA 09)<br>15:22 (vorh. WEA 09)  |
| 6  | 05:08<br>21:56            | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 07:34<br>16:48 |                      | 08:25<br>16:11 5 15:27 (vorh. WEA 09)<br>13:50 (WEA 01)        |
| 7  | 05:09<br>21:56            | 05:53<br>21:13 | 06:46<br>20:05 | 07:38<br>18:52 | 07:36<br>16:46 |                      | 08:27<br>16:11 6 13:56 (WEA 01)<br>13:50 (WEA 01)              |
| 8  | 05:10<br>21:55            | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 07:38<br>16:44 |                      | 08:28<br>16:10 8 13:58 (WEA 01)<br>13:48 (WEA 01)              |
| 9  | 05:11<br>21:54            | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 07:40<br>16:43 |                      | 08:29<br>16:10 12 14:00 (WEA 01)<br>13:48 (WEA 01)             |
| 10 | 05:12<br>21:54            | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 07:42<br>16:41 |                      | 08:30<br>16:10 13 14:01 (WEA 01)<br>13:47 (WEA 01)             |
| 11 | 05:13<br>21:53            | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 07:43<br>16:39 |                      | 08:32<br>16:09 15 14:02 (WEA 01)<br>13:48 (WEA 01)             |
| 12 | 05:14<br>21:52            | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 07:45<br>16:38 |                      | 08:33<br>16:09 16 14:04 (WEA 01)<br>13:48 (WEA 01)             |
| 13 | 05:15<br>21:51            | 06:03<br>21:02 | 06:56<br>19:51 | 07:49<br>18:38 | 07:47<br>16:36 |                      | 08:34<br>16:09 16 14:04 (WEA 01)<br>13:48 (WEA 01)             |
| 14 | 05:16<br>21:50            | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 07:49<br>16:34 |                      | 08:35<br>16:09 17 14:05 (WEA 01)<br>13:48 (WEA 01)             |
| 15 | 05:18<br>21:49            | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 07:51<br>16:33 | 15:15 (vorh. WEA 09) | 08:36<br>16:09 18 14:06 (WEA 01)<br>13:48 (WEA 01)             |
| 16 | 05:19<br>21:48            | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:32 | 07:53<br>16:31 | 15:13 (vorh. WEA 09) | 08:37<br>16:09 18 14:06 (WEA 01)<br>13:48 (WEA 01)             |
| 17 | 05:20<br>21:47            | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 07:55<br>16:30 | 15:12 (vorh. WEA 09) | 08:37<br>16:09 19 14:07 (WEA 01)<br>13:49 (WEA 01)             |
| 18 | 05:22<br>21:45            | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 07:56<br>16:29 | 15:11 (vorh. WEA 09) | 08:38<br>16:10 19 14:08 (WEA 01)<br>13:49 (WEA 01)             |
| 19 | 05:23<br>21:44            | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 07:58<br>16:27 | 15:11 (vorh. WEA 09) | 08:39<br>16:10 19 14:08 (WEA 01)<br>13:49 (WEA 01)             |
| 20 | 05:24<br>21:43            | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 08:00<br>16:26 | 15:11 (vorh. WEA 09) | 08:40<br>16:10 19 14:08 (WEA 01)<br>13:50 (WEA 01)             |
| 21 | 05:26<br>21:42            | 06:17<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 08:02<br>16:25 | 15:11 (vorh. WEA 09) | 08:40<br>16:11 19 14:09 (WEA 01)<br>13:51 (WEA 01)             |
| 22 | 05:27<br>21:40            | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 08:04<br>16:23 | 15:11 (vorh. WEA 09) | 08:41<br>16:11 19 14:09 (WEA 01)<br>13:51 (WEA 01)             |
| 23 | 05:29<br>21:39            | 06:20<br>20:40 | 07:14<br>19:26 | 08:08<br>18:16 | 08:05<br>16:22 | 15:11 (vorh. WEA 09) | 08:41<br>16:12 19 14:10 (WEA 01)<br>13:51 (WEA 01)             |
| 24 | 05:30<br>21:37            | 06:22<br>20:36 | 07:15<br>19:24 | 08:09<br>18:14 | 08:07<br>16:21 | 15:11 (vorh. WEA 09) | 08:42<br>16:12 19 14:10 (WEA 01)<br>13:51 (WEA 01)             |
| 25 | 05:32<br>21:36            | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>17:12 | 08:09<br>16:20 | 15:12 (vorh. WEA 09) | 08:42<br>16:13 20 14:11 (WEA 01)<br>13:53 (WEA 01)             |
| 26 | 05:33<br>21:34            | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>17:10 | 08:10<br>16:19 | 15:12 (vorh. WEA 09) | 08:42<br>16:14 19 14:12 (WEA 01)<br>13:54 (WEA 01)             |
| 27 | 05:35<br>21:33            | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>17:08 | 08:12<br>16:18 | 15:12 (vorh. WEA 09) | 08:43<br>16:14 19 14:12 (WEA 01)<br>13:55 (WEA 01)             |
| 28 | 05:36<br>21:31            | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>17:05 | 08:14<br>16:17 | 15:13 (vorh. WEA 09) | 08:43<br>16:15 18 14:12 (WEA 01)<br>13:55 (WEA 01)             |
| 29 | 05:38<br>21:30            | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>17:03 | 08:15<br>16:16 | 15:14 (vorh. WEA 09) | 08:43<br>16:16 17 14:12 (WEA 01)<br>13:56 (WEA 01)             |
| 30 | 05:39<br>21:28            | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>17:01 | 08:17<br>16:15 | 15:15 (vorh. WEA 09) | 08:43<br>16:17 16 14:12 (WEA 01)<br>13:56 (WEA 01)             |
| 31 | 05:41<br>21:26            | 06:34<br>20:22 |                | 07:23<br>16:59 |                |                      | 08:43<br>16:18 15 14:11 (WEA 01)                               |
|    | Sonnenscheinstunden 509   | 458            | 382            | 329            | 261            | 251                  | 236 477                                                        |
|    | 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 | (WEA mit erstem Schatten) | Zeitpunkt (SS:MM) Schattenende | (WEA mit letztem Schatten) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: M - Dwoweg 38, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Januar                   |       | Februar           |       | März                    |       | April | Mai   | Juni  |
|--------------------------|-------|-------------------|-------|-------------------------|-------|-------|-------|-------|
| 1                        | 08:43 | 12:54 (WEA 03)    | 08:14 | 15:14 (WEA 01)          | 07:17 | 07:04 | 05:56 | 05:07 |
|                          | 16:19 | 28 14:35 (WEA 02) | 17:10 | 32 15:46 (WEA 01)       | 18:04 | 20:01 | 20:55 | 21:44 |
| 2                        | 08:43 | 12:56 (WEA 03)    | 08:12 | 15:14 (WEA 01)          | 07:15 | 07:01 | 05:54 | 05:07 |
|                          | 16:20 | 26 14:36 (WEA 02) | 17:12 | 32 15:46 (WEA 01)       | 18:06 | 20:03 | 20:57 | 21:45 |
| 3                        | 08:43 | 12:59 (WEA 03)    | 08:10 | 15:15 (WEA 01)          | 07:13 | 06:59 | 05:52 | 05:06 |
|                          | 16:22 | 20 14:36 (WEA 02) | 17:13 | 31 15:46 (WEA 01)       | 18:08 | 20:05 | 20:59 | 21:46 |
| 4                        | 08:42 | 14:24 (WEA 02)    | 08:09 | 15:15 (WEA 01)          | 07:11 | 06:56 | 05:50 | 05:05 |
|                          | 16:23 | 11 14:35 (WEA 02) | 17:15 | 30 15:45 (WEA 01)       | 18:10 | 20:07 | 21:01 | 21:48 |
| 5                        | 08:42 | 14:26 (WEA 02)    | 08:07 | 15:17 (WEA 01)          | 07:08 | 06:54 | 05:48 | 05:04 |
|                          | 16:24 | 9 14:35 (WEA 02)  | 17:17 | 29 15:46 (WEA 01)       | 18:12 | 20:09 | 21:02 | 21:49 |
| 6                        | 08:42 | 14:27 (WEA 02)    | 08:05 | 15:18 (WEA 01)          | 07:06 | 06:52 | 05:46 | 05:03 |
|                          | 16:25 | 6 14:33 (WEA 02)  | 17:19 | 27 15:45 (WEA 01)       | 18:14 | 20:10 | 21:04 | 21:50 |
| 7                        | 08:41 |                   | 08:03 | 15:19 (WEA 01)          | 07:04 | 06:49 | 05:44 | 05:03 |
|                          | 16:27 |                   | 17:21 | 25 15:44 (WEA 01)       | 18:15 | 20:12 | 21:06 | 21:51 |
| 8                        | 08:41 |                   | 08:01 | 15:20 (WEA 01)          | 07:01 | 06:47 | 05:42 | 05:02 |
|                          | 16:28 |                   | 17:23 | 23 15:43 (WEA 01)       | 18:17 | 20:14 | 21:08 | 21:52 |
| 9                        | 08:40 |                   | 08:00 | 15:22 (WEA 01)          | 06:59 | 06:45 | 05:40 | 05:02 |
|                          | 16:29 |                   | 17:25 | 20 15:42 (WEA 01)       | 18:19 | 20:16 | 21:09 | 21:52 |
| 10                       | 08:40 |                   | 07:58 | 15:24 (WEA 01)          | 06:56 | 06:42 | 05:38 | 05:01 |
|                          | 16:31 |                   | 17:27 | 16 15:40 (WEA 01)       | 18:21 | 20:18 | 21:11 | 21:53 |
| 11                       | 08:39 |                   | 07:56 | 15:26 (WEA 01)          | 06:54 | 06:40 | 05:37 | 05:01 |
|                          | 16:32 |                   | 17:29 | 8 15:36 (WEA 01)        | 18:23 | 20:19 | 21:13 | 21:54 |
| 12                       | 08:38 |                   | 07:54 |                         | 06:52 | 06:38 | 05:35 | 05:00 |
|                          | 16:34 |                   | 17:31 |                         | 18:25 | 20:21 | 21:15 | 21:55 |
| 13                       | 08:37 | 15:21 (WEA 01)    | 07:52 |                         | 06:49 | 06:35 | 05:33 | 05:00 |
|                          | 16:35 | 7 15:28 (WEA 01)  | 17:33 |                         | 18:27 | 20:23 | 21:16 | 21:56 |
| 14                       | 08:37 | 15:19 (WEA 01)    | 07:50 |                         | 06:47 | 06:33 | 05:31 | 05:00 |
|                          | 16:37 | 12 15:31 (WEA 01) | 17:35 |                         | 18:29 | 20:25 | 21:18 | 21:56 |
| 15                       | 08:36 | 15:18 (WEA 01)    | 07:48 | 16:58 (vorh. WEA 09)    | 06:45 | 06:31 | 05:30 | 05:00 |
|                          | 16:39 | 15 15:33 (WEA 01) | 17:37 | 3 17:01 (vorh. WEA 09)  | 18:30 | 20:27 | 21:19 | 21:57 |
| 16                       | 08:35 | 15:17 (WEA 01)    | 07:46 | 16:55 (vorh. WEA 09)    | 06:42 | 06:28 | 05:28 | 04:59 |
|                          | 16:40 | 18 15:35 (WEA 01) | 17:39 | 10 17:05 (vorh. WEA 09) | 18:32 | 20:28 | 21:21 | 21:57 |
| 17                       | 08:34 | 15:16 (WEA 01)    | 07:44 | 16:53 (vorh. WEA 09)    | 06:40 | 06:26 | 05:27 | 04:59 |
|                          | 16:42 | 21 15:37 (WEA 01) | 17:41 | 14 17:07 (vorh. WEA 09) | 18:34 | 20:30 | 21:23 | 21:58 |
| 18                       | 08:33 | 15:16 (WEA 01)    | 07:42 | 16:52 (vorh. WEA 09)    | 06:37 | 06:24 | 05:25 | 04:59 |
|                          | 16:44 | 22 15:38 (WEA 01) | 17:43 | 16 17:08 (vorh. WEA 09) | 18:36 | 20:32 | 21:24 | 21:58 |
| 19                       | 08:32 | 15:14 (WEA 01)    | 07:39 | 16:50 (vorh. WEA 09)    | 06:35 | 06:21 | 05:23 | 04:59 |
|                          | 16:45 | 25 15:39 (WEA 01) | 17:45 | 18 17:08 (vorh. WEA 09) | 18:38 | 20:34 | 21:26 | 21:59 |
| 20                       | 08:31 | 15:14 (WEA 01)    | 07:37 | 16:50 (vorh. WEA 09)    | 06:33 | 06:19 | 05:22 | 04:59 |
|                          | 16:47 | 26 15:40 (WEA 01) | 17:47 | 18 17:08 (vorh. WEA 09) | 18:40 | 20:36 | 21:27 | 21:59 |
| 21                       | 08:29 | 15:14 (WEA 01)    | 07:35 | 16:50 (vorh. WEA 09)    | 06:30 | 06:17 | 05:21 | 04:59 |
|                          | 16:49 | 27 15:41 (WEA 01) | 17:49 | 19 17:09 (vorh. WEA 09) | 18:41 | 20:37 | 21:29 | 21:59 |
| 22                       | 08:28 | 15:13 (WEA 01)    | 07:33 | 16:50 (vorh. WEA 09)    | 06:28 | 06:15 | 05:19 | 05:00 |
|                          | 16:51 | 29 15:42 (WEA 01) | 17:51 | 19 17:09 (vorh. WEA 09) | 18:43 | 20:39 | 21:31 | 21:59 |
| 23                       | 08:27 | 15:14 (WEA 01)    | 07:31 | 16:50 (vorh. WEA 09)    | 06:25 | 06:13 | 05:18 | 05:00 |
|                          | 16:53 | 29 15:43 (WEA 01) | 17:53 | 18 17:08 (vorh. WEA 09) | 18:45 | 20:41 | 21:32 | 22:00 |
| 24                       | 08:26 | 15:13 (WEA 01)    | 07:29 | 16:51 (vorh. WEA 09)    | 06:23 | 06:10 | 05:16 | 05:00 |
|                          | 16:54 | 30 15:43 (WEA 01) | 17:55 | 16 17:07 (vorh. WEA 09) | 18:47 | 20:43 | 21:33 | 22:00 |
| 25                       | 08:24 | 15:13 (WEA 01)    | 07:26 | 16:52 (vorh. WEA 09)    | 06:20 | 06:08 | 05:15 | 05:01 |
|                          | 16:56 | 31 15:44 (WEA 01) | 17:56 | 15 17:07 (vorh. WEA 09) | 18:49 | 20:45 | 21:35 | 22:00 |
| 26                       | 08:23 | 15:13 (WEA 01)    | 07:24 | 16:53 (vorh. WEA 09)    | 06:18 | 06:06 | 05:14 | 05:01 |
|                          | 16:58 | 32 15:45 (WEA 01) | 17:58 | 12 17:05 (vorh. WEA 09) | 18:50 | 20:46 | 21:36 | 22:00 |
| 27                       | 08:21 | 15:14 (WEA 01)    | 07:22 | 16:55 (vorh. WEA 09)    | 06:16 | 06:04 | 05:13 | 05:01 |
|                          | 17:00 | 32 15:46 (WEA 01) | 18:00 | 7 17:02 (vorh. WEA 09)  | 18:52 | 20:48 | 21:38 | 22:00 |
| 28                       | 08:20 | 15:13 (WEA 01)    | 07:20 |                         | 06:13 | 06:02 | 05:12 | 05:02 |
|                          | 17:02 | 33 15:46 (WEA 01) | 18:02 |                         | 18:54 | 20:50 | 21:39 | 21:59 |
| 29                       | 08:18 | 15:13 (WEA 01)    |       |                         | 07:11 | 06:00 | 05:10 | 05:02 |
|                          | 17:04 | 33 15:46 (WEA 01) |       |                         | 19:56 | 20:52 | 21:40 | 21:59 |
| 30                       | 08:17 | 15:14 (WEA 01)    |       |                         | 07:08 | 05:58 | 05:09 | 05:03 |
|                          | 17:06 | 33 15:47 (WEA 01) |       |                         | 19:58 | 20:54 | 21:42 | 21:59 |
| 31                       | 08:15 | 15:14 (WEA 01)    |       |                         | 07:06 |       | 05:08 |       |
|                          | 17:08 | 33 15:47 (WEA 01) |       |                         | 19:59 |       | 21:43 |       |
| Sonnenscheinstunden      |       | 252               | 274   | 458                     | 367   | 419   | 491   | 507   |
| ast.max.mögl.Beschattung |       | 588               |       |                         |       |       |       |       |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: M - Dwoweg 38, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | July  | August | September | Oktober |                         | November |                | Dezember |                   |
|---------------------------|-------|--------|-----------|---------|-------------------------|----------|----------------|----------|-------------------|
| 1                         | 05:04 | 05:43  | 06:36     | 07:28   |                         | 07:25    | 14:52 (WEA 01) | 09:18    |                   |
|                           | 21:59 | 21:24  | 20:19     | 19:07   |                         | 16:57    | 15:09 (WEA 01) | 16:14    |                   |
| 2                         | 05:04 | 05:44  | 06:37     | 07:29   |                         | 07:26    | 14:51 (WEA 01) | 08:20    |                   |
|                           | 21:58 | 21:23  | 20:17     | 19:04   |                         | 16:56    | 15:11 (WEA 01) | 16:14    |                   |
| 3                         | 05:05 | 05:46  | 06:39     | 07:31   |                         | 07:28    | 14:50 (WEA 01) | 08:21    |                   |
|                           | 21:58 | 21:21  | 20:15     | 19:02   |                         | 16:54    | 15:13 (WEA 01) | 16:13    |                   |
| 4                         | 05:06 | 05:48  | 06:41     | 07:33   |                         | 07:30    | 14:48 (WEA 01) | 08:23    |                   |
|                           | 21:57 | 21:19  | 20:12     | 19:00   |                         | 16:52    | 15:14 (WEA 01) | 16:12    |                   |
| 5                         | 05:07 | 05:49  | 06:42     | 07:35   |                         | 07:32    | 14:47 (WEA 01) | 08:24    |                   |
|                           | 21:57 | 21:17  | 20:10     | 18:57   |                         | 16:50    | 15:15 (WEA 01) | 16:12    |                   |
| 6                         | 05:08 | 05:51  | 06:44     | 07:36   |                         | 07:34    | 14:47 (WEA 01) | 08:25    |                   |
|                           | 21:56 | 21:15  | 20:07     | 18:55   |                         | 16:48    | 15:16 (WEA 01) | 16:11    | 6 14:13 (WEA 02)  |
| 7                         | 05:09 | 05:53  | 06:46     | 07:38   |                         | 07:36    | 14:46 (WEA 01) | 08:27    | 14:12 (WEA 02)    |
|                           | 21:56 | 21:13  | 20:05     | 18:52   |                         | 16:46    | 15:16 (WEA 01) | 16:11    | 9 14:21 (WEA 02)  |
| 8                         | 05:10 | 05:54  | 06:48     | 07:40   |                         | 07:38    | 14:46 (WEA 01) | 08:28    | 14:12 (WEA 02)    |
|                           | 21:55 | 21:12  | 20:03     | 18:50   |                         | 16:44    | 15:17 (WEA 01) | 16:10    | 11 14:23 (WEA 02) |
| 9                         | 05:11 | 05:56  | 06:49     | 07:42   |                         | 07:40    | 14:45 (WEA 01) | 08:29    | 12:47 (WEA 03)    |
|                           | 21:54 | 21:10  | 20:00     | 18:48   |                         | 16:43    | 15:17 (WEA 01) | 16:10    | 19 14:24 (WEA 02) |
| 10                        | 05:12 | 05:58  | 06:51     | 07:44   |                         | 07:42    | 14:45 (WEA 01) | 08:30    | 12:46 (WEA 03)    |
|                           | 21:53 | 21:08  | 19:58     | 18:45   |                         | 16:41    | 15:17 (WEA 01) | 16:10    | 23 14:25 (WEA 02) |
| 11                        | 05:13 | 05:59  | 06:53     | 07:45   |                         | 07:43    | 14:45 (WEA 01) | 08:32    | 12:45 (WEA 03)    |
|                           | 21:53 | 21:06  | 19:55     | 18:43   |                         | 16:39    | 15:17 (WEA 01) | 16:09    | 27 14:25 (WEA 02) |
| 12                        | 05:14 | 06:01  | 06:55     | 07:47   |                         | 07:45    | 14:45 (WEA 01) | 08:33    | 12:45 (WEA 03)    |
|                           | 21:52 | 21:04  | 19:53     | 18:41   |                         | 16:38    | 15:18 (WEA 01) | 16:09    | 30 14:27 (WEA 02) |
| 13                        | 05:15 | 06:03  | 06:56     | 07:49   |                         | 07:47    | 14:45 (WEA 01) | 08:34    | 12:45 (WEA 03)    |
|                           | 21:51 | 21:02  | 19:50     | 18:38   |                         | 16:36    | 15:18 (WEA 01) | 16:09    | 32 14:28 (WEA 02) |
| 14                        | 05:16 | 06:04  | 06:58     | 07:51   |                         | 07:49    | 14:45 (WEA 01) | 08:35    | 12:45 (WEA 03)    |
|                           | 21:50 | 20:59  | 19:48     | 18:36   |                         | 16:34    | 15:18 (WEA 01) | 16:09    | 34 14:29 (WEA 02) |
| 15                        | 05:18 | 06:06  | 07:00     | 07:53   | 10 17:27 (vorh. WEA 09) | 07:51    | 14:45 (WEA 01) | 08:36    | 12:45 (WEA 03)    |
|                           | 21:49 | 20:57  | 19:46     | 18:34   | 17:37 (vorh. WEA 09)    | 16:33    | 15:18 (WEA 01) | 16:09    | 35 14:29 (WEA 02) |
| 16                        | 05:19 | 06:08  | 07:01     | 07:55   | 17:24 (vorh. WEA 09)    | 07:53    | 14:46 (WEA 01) | 08:37    | 12:44 (WEA 03)    |
|                           | 21:48 | 20:55  | 19:43     | 18:32   | 17:37 (vorh. WEA 09)    | 16:31    | 15:17 (WEA 01) | 16:09    | 36 14:29 (WEA 02) |
| 17                        | 05:20 | 06:10  | 07:03     | 07:56   | 17:22 (vorh. WEA 09)    | 07:55    | 14:46 (WEA 01) | 08:37    | 12:44 (WEA 03)    |
|                           | 21:47 | 20:53  | 19:41     | 18:29   | 17:38 (vorh. WEA 09)    | 16:30    | 15:17 (WEA 01) | 16:09    | 38 14:30 (WEA 02) |
| 18                        | 05:22 | 06:11  | 07:05     | 07:58   | 17:22 (vorh. WEA 09)    | 07:56    | 14:47 (WEA 01) | 08:38    | 12:45 (WEA 03)    |
|                           | 21:45 | 20:51  | 19:38     | 18:27   | 17:39 (vorh. WEA 09)    | 16:29    | 15:17 (WEA 01) | 16:10    | 38 14:31 (WEA 02) |
| 19                        | 05:23 | 06:13  | 07:07     | 08:00   | 17:21 (vorh. WEA 09)    | 07:58    | 14:48 (WEA 01) | 08:39    | 12:45 (WEA 03)    |
|                           | 21:44 | 20:49  | 19:36     | 18:25   | 17:39 (vorh. WEA 09)    | 16:27    | 15:17 (WEA 01) | 16:10    | 39 14:32 (WEA 02) |
| 20                        | 05:24 | 06:15  | 07:08     | 08:02   | 17:21 (vorh. WEA 09)    | 08:00    | 14:48 (WEA 01) | 08:40    | 12:45 (WEA 03)    |
|                           | 21:43 | 20:47  | 19:33     | 18:23   | 17:39 (vorh. WEA 09)    | 16:26    | 15:17 (WEA 01) | 16:10    | 40 14:32 (WEA 02) |
| 21                        | 05:26 | 06:17  | 07:10     | 08:04   | 17:21 (vorh. WEA 09)    | 08:02    | 14:49 (WEA 01) | 08:40    | 12:46 (WEA 03)    |
|                           | 21:42 | 20:44  | 19:31     | 18:20   | 17:39 (vorh. WEA 09)    | 16:25    | 15:16 (WEA 01) | 16:11    | 40 14:33 (WEA 02) |
| 22                        | 05:27 | 06:18  | 07:12     | 08:06   | 17:21 (vorh. WEA 09)    | 08:04    | 14:50 (WEA 01) | 08:41    | 12:46 (WEA 03)    |
|                           | 21:40 | 20:42  | 19:29     | 18:18   | 17:39 (vorh. WEA 09)    | 16:23    | 15:16 (WEA 01) | 16:11    | 40 14:33 (WEA 02) |
| 23                        | 05:29 | 06:20  | 07:14     | 08:08   | 17:21 (vorh. WEA 09)    | 08:05    | 14:51 (WEA 01) | 08:41    | 12:47 (WEA 03)    |
|                           | 21:39 | 20:40  | 19:26     | 18:16   | 17:38 (vorh. WEA 09)    | 16:22    | 15:16 (WEA 01) | 16:12    | 40 14:34 (WEA 02) |
| 24                        | 05:30 | 06:22  | 07:15     | 08:09   | 17:22 (vorh. WEA 09)    | 08:07    | 14:53 (WEA 01) | 08:42    | 12:47 (WEA 03)    |
|                           | 21:37 | 20:38  | 19:24     | 18:14   | 17:37 (vorh. WEA 09)    | 16:21    | 15:15 (WEA 01) | 16:12    | 40 14:34 (WEA 02) |
| 25                        | 05:32 | 06:23  | 07:17     | 07:11   | 16:23 (vorh. WEA 09)    | 08:09    | 14:54 (WEA 01) | 08:42    | 12:47 (WEA 03)    |
|                           | 21:36 | 20:35  | 19:21     | 17:12   | 16:36 (vorh. WEA 09)    | 16:20    | 15:15 (WEA 01) | 16:13    | 39 14:34 (WEA 02) |
| 26                        | 05:33 | 06:25  | 07:19     | 07:13   | 16:25 (vorh. WEA 09)    | 08:10    | 14:56 (WEA 01) | 08:42    | 12:49 (WEA 03)    |
|                           | 21:34 | 20:33  | 19:19     | 17:10   | 16:34 (vorh. WEA 09)    | 16:19    | 15:14 (WEA 01) | 16:14    | 38 14:35 (WEA 02) |
| 27                        | 05:35 | 06:27  | 07:21     | 07:15   |                         | 08:12    | 14:57 (WEA 01) | 08:43    | 12:50 (WEA 03)    |
|                           | 21:33 | 20:31  | 19:16     | 17:08   |                         | 16:18    | 15:12 (WEA 01) | 16:14    | 36 14:35 (WEA 02) |
| 28                        | 05:36 | 06:29  | 07:22     | 07:17   |                         | 08:14    | 14:59 (WEA 01) | 08:43    | 12:50 (WEA 03)    |
|                           | 21:31 | 20:29  | 19:14     | 17:05   |                         | 16:17    | 15:11 (WEA 01) | 16:15    | 36 14:35 (WEA 02) |
| 29                        | 05:38 | 06:30  | 07:24     | 07:19   |                         | 08:15    | 15:02 (WEA 01) | 08:43    | 12:51 (WEA 03)    |
|                           | 21:30 | 20:26  | 19:12     | 17:03   |                         | 16:16    | 15:10 (WEA 01) | 16:16    | 35 14:36 (WEA 02) |
| 30                        | 05:39 | 06:32  | 07:26     | 07:21   |                         | 08:17    |                | 08:43    | 12:52 (WEA 03)    |
|                           | 21:28 | 20:24  | 19:09     | 17:01   |                         | 16:15    |                | 16:17    | 33 14:36 (WEA 02) |
| 31                        | 05:41 | 06:34  |           | 07:23   | 14:56 (WEA 01)          |          |                | 08:43    | 12:52 (WEA 03)    |
|                           | 21:26 | 20:22  |           | 16:59   | 15:06 (WEA 01)          |          |                | 16:18    | 31 14:35 (WEA 02) |
| Sonnenscheinstunden       | 509   | 458    | 382       | 329     |                         | 261      |                | 236      |                   |
| astr.max.mögl.Beschattung |       |        |           | 192     |                         | 756      |                | 825      |                   |

**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) |
|--------------|-----------------------|-------------------------|----------------------|----------------------------------|---------------------------|--------------------------------|----------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: N - Dwoweg 156, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

| Januar                    |       |                         | Februar |    |                | März  |     |                      | April |  |       | Mai |       |  | Juni |  |  |
|---------------------------|-------|-------------------------|---------|----|----------------|-------|-----|----------------------|-------|--|-------|-----|-------|--|------|--|--|
| 1                         | 08:43 | 15:30 (vorh. WEA 06)    | 08:14   |    | 15:30 (WEA 03) | 07:17 |     | 17:32 (vorh. WEA 09) | 07:04 |  | 05:56 |     | 05:07 |  |      |  |  |
|                           | 16:19 | 8 15:38 (vorh. WEA 06)  | 17:10   | 24 | 16:12 (WEA 02) | 18:04 | 6   | 17:38 (vorh. WEA 09) | 20:01 |  | 20:55 |     | 21:44 |  |      |  |  |
| 2                         | 08:43 | 15:31 (vorh. WEA 06)    | 08:12   |    | 16:00 (WEA 02) | 07:15 |     | 17:30 (vorh. WEA 09) | 07:01 |  | 05:54 |     | 05:07 |  |      |  |  |
|                           | 16:20 | 8 15:39 (vorh. WEA 06)  | 17:12   | 10 | 16:10 (WEA 02) | 18:06 | 9   | 17:39 (vorh. WEA 09) | 20:03 |  | 20:57 |     | 21:45 |  |      |  |  |
| 3                         | 08:43 | 15:32 (vorh. WEA 06)    | 08:10   |    | 16:02 (WEA 02) | 07:13 |     | 17:30 (vorh. WEA 09) | 06:59 |  | 05:52 |     | 05:06 |  |      |  |  |
|                           | 16:22 | 6 15:38 (vorh. WEA 06)  | 17:13   | 6  | 16:08 (WEA 02) | 18:08 | 11  | 17:41 (vorh. WEA 09) | 20:05 |  | 20:59 |     | 21:46 |  |      |  |  |
| 4                         | 08:42 | 15:24 (WEA 03)          | 08:09   |    |                | 07:10 |     | 17:30 (vorh. WEA 09) | 06:56 |  | 05:50 |     | 05:05 |  |      |  |  |
|                           | 16:23 | 9 15:38 (vorh. WEA 06)  | 17:15   |    |                | 18:10 | 12  | 17:42 (vorh. WEA 09) | 20:07 |  | 21:01 |     | 21:48 |  |      |  |  |
| 5                         | 08:42 | 15:23 (WEA 03)          | 08:07   |    |                | 07:08 |     | 17:30 (vorh. WEA 09) | 06:54 |  | 05:48 |     | 05:04 |  |      |  |  |
|                           | 16:24 | 11 15:38 (vorh. WEA 06) | 17:17   |    |                | 18:12 | 11  | 17:41 (vorh. WEA 09) | 20:09 |  | 21:02 |     | 21:49 |  |      |  |  |
| 6                         | 08:42 | 15:22 (WEA 03)          | 08:05   |    |                | 07:06 |     | 17:31 (vorh. WEA 09) | 06:52 |  | 05:46 |     | 05:03 |  |      |  |  |
|                           | 16:25 | 10 15:32 (WEA 03)       | 17:19   |    |                | 18:14 | 9   | 17:40 (vorh. WEA 09) | 20:10 |  | 21:04 |     | 21:50 |  |      |  |  |
| 7                         | 08:41 | 15:20 (WEA 03)          | 08:03   |    |                | 07:04 |     | 17:32 (vorh. WEA 09) | 06:49 |  | 05:44 |     | 05:03 |  |      |  |  |
|                           | 16:27 | 13 15:33 (WEA 03)       | 17:21   |    |                | 18:15 | 6   | 17:38 (vorh. WEA 09) | 20:12 |  | 21:06 |     | 21:51 |  |      |  |  |
| 8                         | 08:41 | 15:21 (WEA 03)          | 08:01   |    |                | 07:01 |     |                      | 06:47 |  | 05:42 |     | 05:02 |  |      |  |  |
|                           | 16:28 | 14 15:35 (WEA 03)       | 17:23   |    |                | 18:17 |     |                      | 20:14 |  | 21:08 |     | 21:52 |  |      |  |  |
| 9                         | 08:40 | 15:20 (WEA 03)          | 07:59   |    |                | 06:59 |     |                      | 06:45 |  | 05:40 |     | 05:02 |  |      |  |  |
|                           | 16:29 | 16 15:36 (WEA 03)       | 17:25   |    |                | 18:19 |     |                      | 20:16 |  | 21:09 |     | 21:52 |  |      |  |  |
| 10                        | 08:40 | 15:20 (WEA 03)          | 07:58   |    |                | 06:56 |     |                      | 06:42 |  | 05:38 |     | 05:01 |  |      |  |  |
|                           | 16:31 | 17 15:37 (WEA 03)       | 17:27   |    |                | 18:21 |     |                      | 20:18 |  | 21:11 |     | 21:53 |  |      |  |  |
| 11                        | 08:39 | 15:19 (WEA 03)          | 07:56   |    |                | 06:54 |     |                      | 06:40 |  | 05:37 |     | 05:01 |  |      |  |  |
|                           | 16:32 | 19 15:38 (WEA 03)       | 17:29   |    |                | 18:23 |     |                      | 20:19 |  | 21:13 |     | 21:54 |  |      |  |  |
| 12                        | 08:38 | 15:19 (WEA 03)          | 07:54   |    |                | 06:52 |     |                      | 06:38 |  | 05:35 |     | 05:00 |  |      |  |  |
|                           | 16:34 | 20 15:39 (WEA 03)       | 17:31   |    |                | 18:25 |     |                      | 20:21 |  | 21:14 |     | 21:55 |  |      |  |  |
| 13                        | 08:37 | 15:19 (WEA 03)          | 07:52   |    | 16:49 (WEA 01) | 06:49 |     |                      | 06:35 |  | 05:33 |     | 05:00 |  |      |  |  |
|                           | 16:35 | 21 15:40 (WEA 03)       | 17:33   | 6  | 16:55 (WEA 01) | 18:27 |     |                      | 20:23 |  | 21:16 |     | 21:55 |  |      |  |  |
| 14                        | 08:37 | 15:19 (WEA 03)          | 07:50   |    | 16:46 (WEA 01) | 06:47 |     |                      | 06:33 |  | 05:31 |     | 05:00 |  |      |  |  |
|                           | 16:37 | 21 15:40 (WEA 03)       | 17:35   | 12 | 16:58 (WEA 01) | 18:28 |     |                      | 20:25 |  | 21:18 |     | 21:56 |  |      |  |  |
| 15                        | 08:36 | 15:19 (WEA 03)          | 07:48   |    | 16:44 (WEA 01) | 06:45 |     |                      | 06:31 |  | 05:30 |     | 05:00 |  |      |  |  |
|                           | 16:39 | 22 15:41 (WEA 03)       | 17:37   | 15 | 16:59 (WEA 01) | 18:30 |     |                      | 20:27 |  | 21:19 |     | 21:57 |  |      |  |  |
| 16                        | 08:35 | 15:19 (WEA 03)          | 07:46   |    | 16:44 (WEA 01) | 06:42 |     |                      | 06:28 |  | 05:28 |     | 04:59 |  |      |  |  |
|                           | 16:40 | 23 15:42 (WEA 03)       | 17:39   | 17 | 17:01 (WEA 01) | 18:32 |     |                      | 20:28 |  | 21:21 |     | 21:57 |  |      |  |  |
| 17                        | 08:34 | 15:19 (WEA 03)          | 07:44   |    | 16:43 (WEA 01) | 06:40 |     |                      | 06:26 |  | 05:26 |     | 04:59 |  |      |  |  |
|                           | 16:42 | 24 15:43 (WEA 03)       | 17:41   | 18 | 17:01 (WEA 01) | 18:34 |     |                      | 20:30 |  | 21:23 |     | 21:58 |  |      |  |  |
| 18                        | 08:33 | 15:19 (WEA 03)          | 07:41   |    | 16:43 (WEA 01) | 06:37 |     |                      | 06:24 |  | 05:25 |     | 04:59 |  |      |  |  |
|                           | 16:44 | 33 16:10 (vorh. WEA 05) | 17:43   | 19 | 17:02 (WEA 01) | 18:36 |     |                      | 20:32 |  | 21:24 |     | 21:58 |  |      |  |  |
| 19                        | 08:32 | 15:19 (WEA 03)          | 07:39   |    | 16:41 (WEA 01) | 06:35 |     |                      | 06:21 |  | 05:23 |     | 04:59 |  |      |  |  |
|                           | 16:45 | 37 16:11 (vorh. WEA 05) | 17:45   | 21 | 17:02 (WEA 01) | 18:38 |     |                      | 20:34 |  | 21:26 |     | 21:59 |  |      |  |  |
| 20                        | 08:31 | 15:19 (WEA 03)          | 07:37   |    | 16:42 (WEA 01) | 06:33 |     |                      | 06:19 |  | 05:22 |     | 04:59 |  |      |  |  |
|                           | 16:47 | 41 16:13 (vorh. WEA 05) | 17:47   | 20 | 17:02 (WEA 01) | 18:40 |     |                      | 20:36 |  | 21:27 |     | 21:59 |  |      |  |  |
| 21                        | 08:29 | 15:20 (WEA 03)          | 07:35   |    | 16:42 (WEA 01) | 06:30 |     |                      | 06:17 |  | 05:20 |     | 04:59 |  |      |  |  |
|                           | 16:49 | 46 16:16 (vorh. WEA 05) | 17:49   | 20 | 17:02 (WEA 01) | 18:41 |     |                      | 20:37 |  | 21:29 |     | 21:59 |  |      |  |  |
| 22                        | 08:28 | 15:20 (WEA 03)          | 07:33   |    | 16:43 (WEA 01) | 06:28 |     |                      | 06:15 |  | 05:19 |     | 05:00 |  |      |  |  |
|                           | 16:51 | 48 16:17 (vorh. WEA 05) | 17:51   | 19 | 17:02 (WEA 01) | 18:43 |     |                      | 20:39 |  | 21:30 |     | 21:59 |  |      |  |  |
| 23                        | 08:27 | 15:20 (WEA 03)          | 07:31   |    | 16:42 (WEA 01) | 06:25 |     |                      | 06:13 |  | 05:18 |     | 05:00 |  |      |  |  |
|                           | 16:53 | 49 16:18 (vorh. WEA 05) | 17:53   | 18 | 17:00 (WEA 01) | 18:45 |     |                      | 20:41 |  | 21:32 |     | 21:59 |  |      |  |  |
| 24                        | 08:26 | 15:20 (WEA 03)          | 07:29   |    | 16:44 (WEA 01) | 06:23 |     |                      | 06:10 |  | 05:16 |     | 05:00 |  |      |  |  |
|                           | 16:54 | 48 16:17 (vorh. WEA 05) | 17:55   | 15 | 16:59 (WEA 01) | 18:47 |     |                      | 20:43 |  | 21:33 |     | 22:00 |  |      |  |  |
| 25                        | 08:24 | 15:21 (WEA 03)          | 07:26   |    | 16:45 (WEA 01) | 06:20 |     |                      | 06:08 |  | 05:15 |     | 05:01 |  |      |  |  |
|                           | 16:56 | 43 16:13 (WEA 02)       | 17:56   | 13 | 16:58 (WEA 01) | 18:49 |     |                      | 20:45 |  | 21:35 |     | 22:00 |  |      |  |  |
| 26                        | 08:23 | 15:22 (WEA 03)          | 07:24   |    | 16:48 (WEA 01) | 06:18 |     |                      | 06:06 |  | 05:14 |     | 05:01 |  |      |  |  |
|                           | 16:58 | 42 16:13 (WEA 02)       | 17:58   | 7  | 16:55 (WEA 01) | 18:50 |     |                      | 20:46 |  | 21:36 |     | 22:00 |  |      |  |  |
| 27                        | 08:21 | 15:23 (WEA 03)          | 07:22   |    |                | 06:16 |     |                      | 06:04 |  | 05:13 |     | 05:01 |  |      |  |  |
|                           | 17:00 | 41 16:13 (WEA 02)       | 18:00   |    |                | 18:52 |     |                      | 20:48 |  | 21:38 |     | 22:00 |  |      |  |  |
| 28                        | 08:20 | 15:23 (WEA 03)          | 07:20   |    |                | 06:13 |     |                      | 06:02 |  | 05:12 |     | 05:02 |  |      |  |  |
|                           | 17:02 | 40 16:13 (WEA 02)       | 18:02   |    |                | 18:54 |     |                      | 20:50 |  | 21:39 |     | 21:59 |  |      |  |  |
| 29                        | 08:18 | 15:24 (WEA 03)          |         |    |                | 07:11 |     |                      | 06:00 |  | 05:10 |     | 05:02 |  |      |  |  |
|                           | 17:04 | 38 16:13 (WEA 02)       |         |    |                | 19:56 |     |                      | 20:52 |  | 21:40 |     | 21:59 |  |      |  |  |
| 30                        | 08:17 | 15:26 (WEA 03)          |         |    |                | 07:08 |     |                      | 05:58 |  | 05:09 |     | 05:03 |  |      |  |  |
|                           | 17:06 | 34 16:13 (WEA 02)       |         |    |                | 19:58 |     |                      | 20:54 |  | 21:42 |     | 21:59 |  |      |  |  |
| 31                        | 08:15 | 15:28 (WEA 03)          |         |    |                | 07:06 |     |                      |       |  | 05:08 |     |       |  |      |  |  |
|                           | 17:08 | 30 16:13 (WEA 02)       |         |    |                | 19:59 |     |                      |       |  | 21:43 |     |       |  |      |  |  |
| Sonnenscheinstunden       |       |                         | 252     |    |                |       | 367 |                      |       |  | 419   |     |       |  | 507  |  |  |
| astr.max.mögl.Beschattung |       |                         | 832     |    |                |       | 64  |                      |       |  |       |     |       |  |      |  |  |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: N - Dwoweg 156, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                           | July           | August         | September      | Oktober        | November                      | Dezember                      |
|---------------------------|----------------|----------------|----------------|----------------|-------------------------------|-------------------------------|
| 1                         | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 07:28<br>19:07 | 07:24<br>16:57                | 08:18<br>16:14                |
| 2                         | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 07:29<br>19:04 | 07:26<br>16:55                | 08:20<br>16:14                |
| 3                         | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 | 07:31<br>19:02 | 07:28<br>16:54                | 08:21<br>16:13                |
| 4                         | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 07:33<br>19:00 | 07:30<br>16:52                | 08:23<br>16:12                |
| 5                         | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 07:35<br>18:57 | 07:32<br>16:50                | 08:24<br>16:12                |
| 6                         | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 07:36<br>18:55 | 18:11 (vorh. WEA 09)<br>07:34 | 08:25<br>16:11                |
| 7                         | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 07:38<br>18:52 | 18:06 (vorh. WEA 09)<br>07:36 | 08:27<br>16:11                |
| 8                         | 05:10<br>21:55 | 05:54<br>21:12 | 06:48<br>20:03 | 07:40<br>18:50 | 18:05 (vorh. WEA 09)<br>07:38 | 15:32 (WEA 02)<br>08:28       |
| 9                         | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 07:42<br>18:48 | 18:04 (vorh. WEA 09)<br>07:40 | 15:39 (WEA 02)<br>08:29       |
| 10                        | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 07:44<br>18:45 | 18:16 (vorh. WEA 09)<br>07:42 | 15:41 (WEA 02)<br>08:29       |
| 11                        | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 07:45<br>18:43 | 18:04 (vorh. WEA 09)<br>07:43 | 15:43 (WEA 02)<br>08:30       |
| 12                        | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 07:47<br>18:41 | 18:05 (vorh. WEA 09)<br>07:45 | 15:45 (WEA 02)<br>08:33       |
| 13                        | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 07:49<br>18:38 | 18:12 (vorh. WEA 09)<br>07:47 | 15:46 (WEA 02)<br>08:34       |
| 14                        | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 07:51<br>18:36 | 18:06 (vorh. WEA 09)<br>07:49 | 15:48 (WEA 02)<br>08:35       |
| 15                        | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 07:53<br>18:34 | 18:10 (vorh. WEA 09)<br>07:51 | 15:50 (WEA 02)<br>08:36       |
| 16                        | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 07:55<br>18:31 | 17:18 (WEA 01)<br>07:53       | 15:52 (WEA 02)<br>08:37       |
| 17                        | 05:20<br>21:46 | 06:10<br>20:53 | 07:03<br>19:41 | 07:56<br>18:29 | 17:28 (WEA 01)<br>07:55       | 15:54 (WEA 02)<br>08:37       |
| 18                        | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 07:58<br>18:27 | 17:16 (WEA 01)<br>07:55       | 15:56 (WEA 02)<br>08:38       |
| 19                        | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 08:00<br>18:25 | 17:31 (WEA 01)<br>07:58       | 15:58 (WEA 02)<br>08:39       |
| 20                        | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 08:02<br>18:23 | 17:30 (WEA 01)<br>08:00       | 15:59 (vorh. WEA 05)<br>08:40 |
| 21                        | 05:26<br>21:41 | 06:16<br>20:44 | 07:10<br>19:31 | 08:04<br>18:20 | 17:32 (WEA 01)<br>08:02       | 15:52 (vorh. WEA 05)<br>08:40 |
| 22                        | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 08:06<br>18:18 | 17:12 (WEA 01)<br>08:04       | 14:55 (WEA 03)<br>08:41       |
| 23                        | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 08:07<br>18:16 | 17:32 (WEA 01)<br>08:05       | 15:49 (vorh. WEA 05)<br>08:41 |
| 24                        | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 08:09<br>18:14 | 17:32 (WEA 01)<br>08:07       | 14:56 (WEA 03)<br>08:42       |
| 25                        | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 08:11<br>18:12 | 17:31 (WEA 01)<br>08:09       | 15:47 (vorh. WEA 05)<br>08:42 |
| 26                        | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 08:13<br>18:10 | 16:13 (WEA 01)<br>08:10       | 14:57 (WEA 03)<br>08:42       |
| 27                        | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 08:15<br>18:08 | 16:30 (WEA 01)<br>08:12       | 15:21 (WEA 03)<br>08:43       |
| 28                        | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 08:17<br>18:05 | 17:12 (WEA 01)<br>08:14       | 14:58 (WEA 03)<br>08:43       |
| 29                        | 05:38<br>21:30 | 06:30<br>20:26 | 07:24<br>19:12 | 08:19<br>18:03 | 16:27 (WEA 01)<br>08:15       | 15:20 (WEA 03)<br>08:43       |
| 30                        | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 08:21<br>18:01 | 16:19 (WEA 01)<br>08:16       | 15:00 (WEA 03)<br>08:43       |
| 31                        | 05:41<br>21:26 | 06:34<br>20:22 |                | 08:23<br>17:59 | 16:15<br>08:17                | 15:21 (WEA 03)<br>08:43       |
| Sonnenscheinstunden       | 509            | 458            | 382            | 329            | 261                           | 236                           |
| astr.max.mögl.Beschattung |                |                |                | 290            | 748                           | 325                           |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: O - Droweg 190, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Januar                    |       | Februar                 |       | März                    |       | April                |       | Mai                     |       | Juni  |     |
|---------------------------|-------|-------------------------|-------|-------------------------|-------|----------------------|-------|-------------------------|-------|-------|-----|
| 1                         | 08:43 |                         | 08:14 | 16:30 (vorh. WEA 07)    | 07:17 | 17:13 (WEA 02)       | 07:04 | 18:56 (WEA 01)          | 05:56 | 05:07 |     |
|                           | 16:19 |                         | 17:10 | 8 16:38 (vorh. WEA 07)  | 18:04 | 17:30 (WEA 02)       | 20:01 | 24 19:35 (vorh. WEA 09) | 20:55 | 21:44 |     |
| 2                         | 08:43 |                         | 08:12 | 16:31 (vorh. WEA 07)    | 07:15 | 17:12 (WEA 02)       | 07:01 | 18:57 (WEA 01)          | 05:54 | 05:07 |     |
|                           | 16:20 |                         | 17:12 | 9 16:40 (vorh. WEA 08)  | 18:06 | 17:30 (WEA 02)       | 20:03 | 23 19:36 (vorh. WEA 09) | 20:57 | 21:45 |     |
| 3                         | 08:43 | 15:44 (vorh. WEA 04)    | 08:10 | 16:32 (vorh. WEA 07)    | 07:13 | 17:11 (WEA 02)       | 06:59 | 18:59 (WEA 01)          | 05:52 | 05:06 |     |
|                           | 16:22 | 1 15:45 (vorh. WEA 04)  | 17:13 | 7 16:39 (vorh. WEA 08)  | 18:08 | 17:30 (WEA 02)       | 20:05 | 19 19:36 (vorh. WEA 09) | 20:59 | 21:46 |     |
| 4                         | 08:42 | 15:45 (vorh. WEA 04)    | 08:09 |                         | 07:10 | 17:12 (WEA 02)       | 06:56 | 19:27 (vorh. WEA 09)    | 05:50 | 05:05 |     |
|                           | 16:23 | 1 15:46 (vorh. WEA 04)  | 17:15 |                         | 18:10 | 17:31 (WEA 02)       | 20:07 | 9 19:36 (vorh. WEA 09)  | 21:01 | 21:47 |     |
| 5                         | 08:42 | 15:46 (vorh. WEA 04)    | 08:07 |                         | 07:08 | 17:11 (WEA 02)       | 06:54 | 19:27 (vorh. WEA 09)    | 05:48 | 05:04 |     |
|                           | 16:24 | 2 15:48 (vorh. WEA 04)  | 17:17 |                         | 18:12 | 17:30 (WEA 02)       | 20:09 | 6 19:33 (vorh. WEA 09)  | 21:02 | 21:49 |     |
| 6                         | 08:42 | 15:46 (vorh. WEA 04)    | 08:05 |                         | 07:06 | 17:11 (WEA 02)       | 06:52 |                         | 05:46 | 05:03 |     |
|                           | 16:25 | 3 15:49 (vorh. WEA 04)  | 17:19 |                         | 18:14 | 17:29 (WEA 02)       | 20:10 |                         | 21:04 | 21:50 |     |
| 7                         | 08:41 | 15:45 (vorh. WEA 04)    | 08:03 | 16:47 (vorh. WEA 06)    | 07:03 | 17:11 (WEA 02)       | 06:49 |                         | 05:44 | 05:03 |     |
|                           | 16:27 | 5 15:50 (vorh. WEA 04)  | 17:21 | 4 16:51 (vorh. WEA 06)  | 18:15 | 17:31 (WEA 03)       | 20:12 |                         | 21:06 | 21:51 |     |
| 8                         | 08:41 | 15:46 (vorh. WEA 04)    | 08:01 | 16:47 (vorh. WEA 06)    | 07:01 | 17:11 (WEA 03)       | 06:47 |                         | 05:42 | 05:02 |     |
|                           | 16:28 | 6 15:52 (vorh. WEA 04)  | 17:23 | 7 16:54 (vorh. WEA 06)  | 18:17 | 17:32 (WEA 03)       | 20:14 |                         | 21:08 | 21:51 |     |
| 9                         | 08:40 | 15:47 (vorh. WEA 04)    | 07:59 | 16:46 (vorh. WEA 06)    | 06:59 | 17:10 (WEA 03)       | 06:45 |                         | 05:40 | 05:02 |     |
|                           | 16:29 | 7 15:54 (vorh. WEA 04)  | 17:25 | 10 16:56 (vorh. WEA 06) | 18:19 | 17:34 (WEA 03)       | 20:16 |                         | 21:09 | 21:52 |     |
| 10                        | 08:40 | 15:47 (vorh. WEA 04)    | 07:58 | 16:47 (vorh. WEA 06)    | 06:56 | 17:08 (WEA 03)       | 06:42 |                         | 05:38 | 05:01 |     |
|                           | 16:31 | 8 15:55 (vorh. WEA 04)  | 17:27 | 10 16:57 (vorh. WEA 06) | 18:21 | 17:33 (WEA 03)       | 20:18 |                         | 21:11 | 21:53 |     |
| 11                        | 08:39 | 15:47 (vorh. WEA 04)    | 07:56 | 16:47 (vorh. WEA 06)    | 06:54 | 17:08 (WEA 03)       | 06:40 |                         | 05:37 | 05:01 |     |
|                           | 16:32 | 10 15:57 (vorh. WEA 04) | 17:29 | 10 16:57 (vorh. WEA 06) | 18:23 | 17:34 (WEA 03)       | 20:19 |                         | 21:13 | 21:54 |     |
| 12                        | 08:38 | 15:48 (vorh. WEA 04)    | 07:54 | 16:47 (vorh. WEA 06)    | 06:52 | 17:06 (WEA 03)       | 06:38 |                         | 05:35 | 05:00 |     |
|                           | 16:34 | 9 15:57 (vorh. WEA 04)  | 17:31 | 8 16:55 (vorh. WEA 06)  | 18:25 | 17:34 (WEA 03)       | 20:21 |                         | 21:14 | 21:55 |     |
| 13                        | 08:37 | 15:49 (vorh. WEA 04)    | 07:52 | 16:49 (vorh. WEA 06)    | 06:49 | 17:06 (WEA 03)       | 06:35 |                         | 05:33 | 05:00 |     |
|                           | 16:35 | 8 15:57 (vorh. WEA 04)  | 17:33 | 5 16:54 (vorh. WEA 06)  | 18:27 | 17:34 (WEA 03)       | 20:23 |                         | 21:16 | 21:55 |     |
| 14                        | 08:37 | 15:50 (vorh. WEA 04)    | 07:50 |                         | 06:47 | 17:06 (WEA 03)       | 06:33 |                         | 05:31 | 05:00 |     |
|                           | 16:37 | 8 16:02 (vorh. WEA 03)  | 17:35 |                         | 18:28 | 17:33 (WEA 03)       | 20:25 |                         | 21:18 | 21:56 |     |
| 15                        | 08:36 | 15:51 (vorh. WEA 04)    | 07:48 |                         | 06:45 | 17:06 (WEA 03)       | 06:31 |                         | 05:30 | 05:00 |     |
|                           | 16:39 | 8 16:04 (vorh. WEA 03)  | 17:37 |                         | 18:30 | 17:33 (WEA 03)       | 20:27 |                         | 21:19 | 21:57 |     |
| 16                        | 08:35 | 16:02 (vorh. WEA 03)    | 07:46 |                         | 06:42 | 17:07 (WEA 03)       | 06:28 |                         | 05:28 | 04:59 |     |
|                           | 16:40 | 4 16:06 (vorh. WEA 03)  | 17:39 |                         | 18:32 | 17:33 (WEA 03)       | 20:28 |                         | 21:21 | 21:57 |     |
| 17                        | 08:34 | 16:03 (vorh. WEA 03)    | 07:44 |                         | 06:40 | 17:06 (WEA 03)       | 06:26 |                         | 05:27 | 04:59 |     |
|                           | 16:42 | 5 16:08 (vorh. WEA 03)  | 17:41 |                         | 18:34 | 17:32 (WEA 03)       | 20:30 |                         | 21:23 | 21:58 |     |
| 18                        | 08:33 | 16:05 (vorh. WEA 03)    | 07:41 | 17:12 (vorh. WEA 05)    | 06:37 | 17:07 (WEA 03)       | 06:24 |                         | 05:25 | 04:59 |     |
|                           | 16:44 | 2 16:07 (vorh. WEA 03)  | 17:43 | 3 17:15 (vorh. WEA 05)  | 18:36 | 17:31 (WEA 03)       | 20:32 |                         | 21:24 | 21:58 |     |
| 19                        | 08:32 |                         | 07:39 | 17:11 (vorh. WEA 05)    | 06:35 | 17:08 (WEA 03)       | 06:21 |                         | 05:23 | 04:59 |     |
|                           | 16:45 |                         | 17:45 | 5 17:16 (vorh. WEA 05)  | 18:38 | 17:29 (WEA 03)       | 20:34 |                         | 21:26 | 21:59 |     |
| 20                        | 08:31 |                         | 07:37 | 17:11 (vorh. WEA 05)    | 06:33 | 17:09 (WEA 03)       | 06:19 |                         | 05:22 | 04:59 |     |
|                           | 16:47 |                         | 17:47 | 8 17:19 (vorh. WEA 05)  | 18:39 | 17:28 (WEA 03)       | 20:36 |                         | 21:27 | 21:59 |     |
| 21                        | 08:29 |                         | 07:35 | 17:12 (vorh. WEA 05)    | 06:30 | 17:11 (WEA 03)       | 06:17 |                         | 05:21 | 04:59 |     |
|                           | 16:49 |                         | 17:49 | 7 17:19 (vorh. WEA 05)  | 18:41 | 17:25 (WEA 03)       | 20:37 |                         | 21:29 | 21:59 |     |
| 22                        | 08:28 |                         | 07:33 | 17:13 (vorh. WEA 05)    | 06:28 | 17:15 (WEA 03)       | 06:15 |                         | 05:19 | 05:00 |     |
|                           | 16:51 |                         | 17:51 | 5 17:18 (vorh. WEA 05)  | 18:43 | 17:21 (WEA 03)       | 20:39 |                         | 21:30 | 21:59 |     |
| 23                        | 08:27 |                         | 07:31 |                         | 06:25 | 18:03 (WEA 01)       | 06:13 |                         | 05:18 | 05:00 |     |
|                           | 16:53 |                         | 17:53 |                         | 18:45 | 18:12 (WEA 01)       | 20:41 |                         | 21:32 | 21:59 |     |
| 24                        | 08:26 |                         | 07:29 |                         | 06:23 | 18:00 (WEA 01)       | 06:10 |                         | 05:16 | 05:00 |     |
|                           | 16:54 |                         | 17:55 |                         | 18:47 | 18:13 (WEA 01)       | 20:43 |                         | 21:33 | 22:00 |     |
| 25                        | 08:24 |                         | 07:26 |                         | 06:20 | 17:59 (WEA 01)       | 06:08 |                         | 05:15 | 05:01 |     |
|                           | 16:56 |                         | 17:56 |                         | 18:49 | 18:15 (WEA 01)       | 20:45 |                         | 21:35 | 22:00 |     |
| 26                        | 08:23 |                         | 07:24 |                         | 06:18 | 17:57 (WEA 01)       | 06:05 |                         | 05:14 | 05:01 |     |
|                           | 16:58 |                         | 17:58 | 6 17:19 (WEA 02)        | 18:50 | 18:15 (WEA 01)       | 20:46 |                         | 21:36 | 22:00 |     |
| 27                        | 08:21 |                         | 07:22 | 17:16 (WEA 02)          | 06:16 | 17:56 (WEA 01)       | 06:04 |                         | 05:13 | 05:01 |     |
|                           | 17:00 |                         | 18:00 | 11 17:27 (WEA 02)       | 18:52 | 18:15 (WEA 01)       | 20:48 |                         | 21:38 | 22:00 |     |
| 28                        | 08:20 |                         | 07:20 | 17:14 (WEA 02)          | 06:13 | 17:55 (WEA 01)       | 06:02 |                         | 05:12 | 05:02 |     |
|                           | 17:02 |                         | 18:02 | 15 17:29 (WEA 02)       | 18:54 | 18:15 (WEA 01)       | 20:50 |                         | 21:39 | 21:59 |     |
| 29                        | 08:18 | 16:29 (vorh. WEA 07)    |       |                         | 07:11 | 18:55 (WEA 01)       | 06:00 |                         | 05:10 | 05:02 |     |
|                           | 17:04 | 3 16:32 (vorh. WEA 07)  |       |                         | 19:56 | 19:15 (WEA 01)       | 20:52 |                         | 21:40 | 21:59 |     |
| 30                        | 08:17 | 16:30 (vorh. WEA 07)    |       |                         | 07:08 | 18:56 (WEA 01)       | 05:58 |                         | 05:09 | 05:03 |     |
|                           | 17:06 | 4 16:34 (vorh. WEA 07)  |       |                         | 19:58 | 19:32 (vorh. WEA 09) | 20:54 |                         | 21:42 | 21:59 |     |
| 31                        | 08:15 | 16:30 (vorh. WEA 07)    |       |                         | 07:06 | 18:55 (WEA 01)       |       |                         | 05:08 |       |     |
|                           | 17:08 | 6 16:36 (vorh. WEA 07)  |       |                         | 19:59 | 19:33 (vorh. WEA 09) |       |                         | 21:43 |       |     |
| Sonnenscheinstunden       |       | 253                     |       |                         | 367   |                      | 419   |                         | 491   |       | 507 |
| astr.max.mögl.Beschattung |       | 100                     | 138   | 631                     |       | 81                   |       |                         |       |       |     |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: O - Dweg 190, Lehmden  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                              | Jul            | August         | September      |    | Oktober                                      |                | November                                     |                | Dezember                                     |                |                                              |
|------------------------------|----------------|----------------|----------------|----|----------------------------------------------|----------------|----------------------------------------------|----------------|----------------------------------------------|----------------|----------------------------------------------|
| 1                            | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 |    | 07:28<br>19:07                               | 28             | 17:46 (WEA 03)<br>18:14 (WEA 03)             | 07:24<br>16:57 | 16:15 (vorh. WEA 06)<br>16:26 (vorh. WEA 06) | 08:18<br>16:14 | 15:29 (vorh. WEA 04)<br>15:39 (vorh. WEA 04) |
| 2                            | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 |    | 07:29<br>19:04                               | 27             | 17:45 (WEA 03)<br>18:12 (WEA 03)             | 07:26<br>16:55 | 16:16 (vorh. WEA 06)<br>16:25 (vorh. WEA 06) | 08:20<br>16:14 | 15:30 (vorh. WEA 04)<br>15:38 (vorh. WEA 04) |
| 3                            | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 |    | 07:31<br>19:02                               | 26             | 17:46 (WEA 03)<br>18:12 (WEA 03)             | 07:28<br>16:54 | 16:16 (vorh. WEA 06)<br>16:23 (vorh. WEA 06) | 08:21<br>16:13 | 15:30 (vorh. WEA 04)<br>15:37 (vorh. WEA 04) |
| 4                            | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 |    | 07:33<br>19:00                               | 25             | 17:46 (WEA 03)<br>18:11 (WEA 03)             | 07:30<br>16:52 | 16:17 (vorh. WEA 06)<br>16:21 (vorh. WEA 06) | 08:23<br>16:12 | 15:31 (vorh. WEA 04)<br>15:37 (vorh. WEA 04) |
| 5                            | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 |    | 07:35<br>18:57                               | 23             | 17:47 (WEA 03)<br>18:10 (WEA 03)             | 07:32<br>16:50 |                                              | 08:24<br>16:12 | 15:31 (vorh. WEA 04)<br>15:35 (vorh. WEA 04) |
| 6                            | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 |    | 07:36<br>18:55                               | 20             | 17:48 (WEA 03)<br>18:08 (WEA 03)             | 07:34<br>16:48 |                                              | 08:25<br>16:11 | 15:32 (vorh. WEA 04)<br>15:35 (vorh. WEA 04) |
| 7                            | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 |    | 07:38<br>18:52                               | 19             | 17:47 (WEA 02)<br>18:06 (WEA 03)             | 07:36<br>16:46 |                                              | 08:27<br>16:11 | 15:32 (vorh. WEA 04)<br>15:34 (vorh. WEA 04) |
| 8                            | 05:10<br>21:55 | 05:54<br>21:11 | 06:48<br>20:03 | 6  | 19:21 (vorh. WEA 09)<br>19:30 (vorh. WEA 09) | 18:50          | 17:46 (WEA 02)<br>18:05 (WEA 02)             | 07:38<br>16:44 | 16:03 (vorh. WEA 07)<br>16:11 (vorh. WEA 08) | 08:28<br>16:10 | 15:33 (vorh. WEA 04)<br>15:34 (vorh. WEA 04) |
| 9                            | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 9  | 18:53 (WEA 01)<br>19:31 (vorh. WEA 09)       | 18:48          | 17:46 (WEA 02)<br>18:05 (WEA 02)             | 07:40<br>16:43 | 16:01 (vorh. WEA 07)<br>16:11 (vorh. WEA 08) | 08:29<br>16:10 | 15:30 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 10                           | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 20 | 18:50 (WEA 01)<br>19:29 (vorh. WEA 09)       | 18:45          | 17:46 (WEA 02)<br>18:05 (WEA 02)             | 07:42<br>16:41 | 16:01 (vorh. WEA 07)<br>16:09 (vorh. WEA 07) | 08:30<br>16:10 | 15:29 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 11                           | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 23 | 18:49 (WEA 01)<br>19:27 (vorh. WEA 09)       | 18:43          | 17:46 (WEA 02)<br>18:04 (WEA 02)             | 07:43<br>16:39 | 16:01 (vorh. WEA 07)<br>16:07 (vorh. WEA 07) | 08:32<br>16:09 | 15:30 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 12                           | 05:14<br>21:52 | 06:01<br>21:04 | 06:55<br>19:53 | 24 | 18:48 (WEA 01)<br>19:25 (vorh. WEA 09)       | 18:41          | 17:46 (WEA 02)<br>18:04 (WEA 02)             | 07:45<br>16:38 | 16:01 (vorh. WEA 07)<br>16:05 (vorh. WEA 07) | 08:33<br>16:09 | 15:31 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 13                           | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 22 | 18:46 (WEA 01)<br>19:22 (vorh. WEA 09)       | 18:38          | 17:47 (WEA 02)<br>18:03 (WEA 02)             | 07:47<br>16:36 | 16:01 (vorh. WEA 07)<br>16:03 (vorh. WEA 07) | 08:34<br>16:09 | 15:31 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 14                           | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 21 | 18:45 (WEA 01)<br>19:05 (WEA 01)             | 18:36          | 17:48 (WEA 02)<br>18:01 (WEA 02)             | 07:49<br>16:34 |                                              | 08:35<br>16:09 | 15:32 (vorh. WEA 04)<br>15:29 (vorh. WEA 04) |
| 15                           | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 20 | 18:46 (WEA 01)<br>19:05 (WEA 01)             | 18:34          | 17:49 (WEA 02)<br>17:58 (WEA 02)             | 07:51<br>16:33 |                                              | 08:36<br>16:09 | 15:33 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 16                           | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 19 | 18:46 (WEA 01)<br>19:05 (WEA 01)             | 18:31          |                                              | 07:53<br>16:31 |                                              | 08:36<br>16:09 | 15:34 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 17                           | 05:20<br>21:46 | 06:10<br>20:53 | 07:03<br>19:41 | 18 | 18:45 (WEA 01)<br>19:03 (WEA 01)             | 18:29          |                                              | 07:55<br>16:30 |                                              | 08:37<br>16:09 | 15:35 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 18                           | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 17 | 18:46 (WEA 01)<br>19:02 (WEA 01)             | 18:27          |                                              | 07:56<br>16:29 |                                              | 08:38<br>16:10 | 15:36 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 19                           | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 16 | 18:47 (WEA 01)<br>19:01 (WEA 01)             | 18:00<br>18:25 |                                              | 07:58<br>16:27 |                                              | 08:39<br>16:10 | 15:37 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 20                           | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 15 | 18:48 (WEA 01)<br>18:58 (WEA 01)             | 18:02<br>18:23 | 17:43 (vorh. WEA 05)<br>17:49 (vorh. WEA 05) | 08:00<br>16:26 |                                              | 08:39<br>16:10 | 15:38 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 21                           | 05:26<br>21:41 | 06:16<br>20:44 | 07:10<br>19:31 | 14 | 18:52 (WEA 01)<br>18:53 (WEA 01)             | 18:04<br>18:20 | 17:42 (vorh. WEA 05)<br>17:50 (vorh. WEA 05) | 08:02<br>16:25 |                                              | 08:40<br>16:11 | 15:39 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 22                           | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 13 | 17:57 (WEA 03)<br>18:10 (WEA 03)             | 18:06<br>18:18 | 17:41 (vorh. WEA 05)<br>17:48 (vorh. WEA 05) | 08:03<br>16:23 |                                              | 08:41<br>16:11 | 15:40 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 23                           | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 12 | 17:53 (WEA 03)<br>18:11 (WEA 03)             | 18:07<br>18:16 | 17:41 (vorh. WEA 05)<br>17:46 (vorh. WEA 05) | 08:05<br>16:22 |                                              | 08:41<br>16:12 | 15:41 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 24                           | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 11 | 17:52 (WEA 03)<br>18:12 (WEA 03)             | 18:09<br>18:14 | 17:42 (vorh. WEA 05)<br>17:44 (vorh. WEA 05) | 08:07<br>16:21 | 15:43 (vorh. WEA 03)<br>15:44 (vorh. WEA 03) | 08:42<br>16:12 | 15:42 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 25                           | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 10 | 17:50 (WEA 03)<br>18:13 (WEA 03)             | 17:11<br>17:12 |                                              | 08:09<br>16:20 | 15:41 (vorh. WEA 03)<br>15:46 (vorh. WEA 03) | 08:42<br>16:13 | 15:43 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 26                           | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 9  | 17:49 (WEA 03)<br>18:14 (WEA 03)             | 17:13<br>17:10 |                                              | 08:10<br>16:19 | 15:41 (vorh. WEA 03)<br>15:45 (vorh. WEA 03) | 08:42<br>16:14 | 15:44 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 27                           | 05:35<br>21:33 | 06:27<br>20:31 | 07:21<br>19:16 | 8  | 17:47 (WEA 03)<br>18:14 (WEA 03)             | 17:15<br>17:08 |                                              | 08:12<br>16:18 | 15:30 (vorh. WEA 04)<br>15:43 (vorh. WEA 04) | 08:42<br>16:14 | 15:45 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 28                           | 05:36<br>21:31 | 06:29<br>20:29 | 07:22<br>19:14 | 7  | 17:47 (WEA 03)<br>18:14 (WEA 03)             | 17:17<br>17:05 |                                              | 08:14<br>16:17 | 15:30 (vorh. WEA 04)<br>15:42 (vorh. WEA 04) | 08:43<br>16:15 | 15:46 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 29                           | 05:38<br>21:29 | 06:30<br>20:26 | 07:24<br>19:12 | 6  | 17:46 (WEA 03)<br>18:14 (WEA 03)             | 17:19<br>17:03 | 16:18 (vorh. WEA 06)<br>16:24 (vorh. WEA 06) | 08:15<br>16:16 | 15:30 (vorh. WEA 04)<br>15:38 (vorh. WEA 04) | 08:43<br>16:16 | 15:47 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 30                           | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 5  | 17:46 (WEA 03)<br>18:14 (WEA 03)             | 17:21<br>17:01 | 16:16 (vorh. WEA 06)<br>16:25 (vorh. WEA 06) | 08:17<br>16:15 | 15:30 (vorh. WEA 04)<br>15:39 (vorh. WEA 04) | 08:43<br>16:17 | 15:48 (vorh. WEA 04)<br>15:30 (vorh. WEA 04) |
| 31                           | 05:41<br>21:26 | 06:34<br>20:22 |                | 4  |                                              | 07:23<br>16:59 | 16:16 (vorh. WEA 06)<br>16:26 (vorh. WEA 06) |                |                                              | 08:43<br>16:18 |                                              |
| Sonnenscheinstunden          | 509            | 458            | 382            |    | 329                                          | 352            |                                              | 261            | 111                                          |                | 41                                           |
| astr. max. mögl. Beschattung |                |                | 450            |    |                                              |                |                                              |                |                                              |                |                                              |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: P - Weidenstr. 73, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

| Januar                                           | Februar        | März           | April                                        | Mai                              | Juni           |
|--------------------------------------------------|----------------|----------------|----------------------------------------------|----------------------------------|----------------|
| 1 08:43<br>16:19                                 | 08:14<br>17:10 | 07:17<br>18:04 | 07:04<br>20:01                               | 19:09 (WEA 03)<br>19:27 (WEA 03) | 05:56<br>20:55 |
| 2 08:43<br>16:20                                 | 08:12<br>17:12 | 07:15<br>18:06 | 07:01<br>20:03                               | 19:07 (WEA 03)<br>19:26 (WEA 03) | 05:54<br>20:57 |
| 3 08:42<br>16:22                                 | 08:10<br>17:13 | 07:13<br>18:08 | 17:36 (vorh. WEA 06)<br>17:39 (vorh. WEA 06) | 19:07 (WEA 03)<br>19:27 (WEA 03) | 05:52<br>20:59 |
| 4 08:42<br>16:23                                 | 08:09<br>17:15 | 07:10<br>18:10 | 17:41 (vorh. WEA 06)<br>17:36 (vorh. WEA 06) | 19:07 (WEA 03)<br>19:27 (WEA 03) | 05:50<br>21:01 |
| 5 08:42<br>16:24                                 | 08:07<br>17:17 | 07:08<br>18:12 | 17:43 (vorh. WEA 06)<br>17:37 (vorh. WEA 06) | 19:07 (WEA 03)<br>19:41 (WEA 01) | 05:48<br>21:02 |
| 6 08:42<br>16:25                                 | 08:05<br>17:19 | 07:06<br>18:14 | 17:43 (vorh. WEA 06)<br>17:37 (vorh. WEA 06) | 19:07 (WEA 03)<br>19:44 (WEA 01) | 05:46<br>21:04 |
| 7 08:41<br>16:27                                 | 08:03<br>17:21 | 07:03<br>18:15 | 17:43 (vorh. WEA 06)<br>17:37 (vorh. WEA 06) | 19:07 (WEA 03)<br>19:44 (WEA 01) | 05:44<br>21:06 |
| 8 08:41<br>16:28                                 | 08:01<br>17:23 | 07:01<br>18:17 | 17:49 (vorh. WEA 05)<br>17:51 (vorh. WEA 05) | 19:09 (WEA 03)<br>19:45 (WEA 01) | 05:42<br>21:08 |
| 9 08:40<br>16:29                                 | 07:59<br>17:25 | 06:59<br>18:19 | 17:50 (vorh. WEA 05)<br>17:53 (vorh. WEA 05) | 19:09 (WEA 03)<br>19:45 (WEA 01) | 05:40<br>21:09 |
| 10 08:39<br>16:31                                | 07:58<br>17:27 | 06:58<br>18:21 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:31 (WEA 01)<br>19:45 (WEA 01) | 05:38<br>21:11 |
| 11 08:39<br>16:32                                | 07:56<br>17:29 | 06:56<br>18:23 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:30 (WEA 01)<br>19:44 (WEA 01) | 05:37<br>21:13 |
| 12 08:38<br>16:34                                | 07:54<br>17:31 | 06:52<br>18:25 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:31 (WEA 01)<br>19:44 (WEA 01) | 05:35<br>21:14 |
| 13 08:37<br>16:35                                | 07:52<br>17:33 | 06:49<br>18:27 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:32 (WEA 01)<br>19:43 (WEA 01) | 05:33<br>21:16 |
| 14 08:37<br>16:37                                | 07:50<br>17:35 | 06:47<br>18:28 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:31<br>21:18 |
| 15 08:36<br>16:39                                | 07:48<br>17:37 | 06:45<br>18:30 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:30<br>21:19 |
| 16 08:35<br>16:40                                | 07:46<br>17:39 | 06:42<br>18:32 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:28<br>21:21 |
| 17 08:34<br>16:42                                | 07:44<br>17:41 | 06:40<br>18:34 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:26<br>21:23 |
| 18 08:33<br>16:44                                | 07:41<br>17:43 | 06:37<br>18:36 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:25<br>21:24 |
| 19 08:32<br>16:45                                | 07:39<br>17:45 | 06:35<br>18:38 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:23<br>21:26 |
| 20 08:30<br>16:47                                | 07:37<br>17:47 | 06:33<br>18:39 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:22<br>21:27 |
| 21 08:29<br>16:49                                | 07:35<br>17:49 | 06:30<br>18:41 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:20<br>21:29 |
| 22 08:28<br>16:51                                | 07:33<br>17:51 | 06:28<br>18:43 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:19<br>21:30 |
| 23 08:27<br>16:53                                | 07:31<br>17:53 | 06:25<br>18:45 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:18<br>21:32 |
| 24 08:26<br>16:54                                | 07:29<br>17:55 | 06:23<br>18:47 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:16<br>21:33 |
| 25 08:24<br>16:56                                | 07:26<br>17:58 | 06:20<br>18:49 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:15<br>21:35 |
| 26 08:23<br>16:58                                | 07:24<br>17:58 | 06:18<br>18:50 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:14<br>21:36 |
| 27 08:21<br>17:00                                | 07:22<br>18:00 | 06:16<br>18:52 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:13<br>21:38 |
| 28 08:20<br>17:02                                | 07:20<br>18:02 | 06:13<br>18:54 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:12<br>21:39 |
| 29 08:18<br>17:04                                | 07:18<br>18:04 | 06:11<br>18:56 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:10<br>21:40 |
| 30 08:17<br>17:06                                | 07:16<br>18:06 | 06:09<br>18:58 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:09<br>21:42 |
| 31 08:15<br>17:08                                | 07:14<br>18:08 | 06:07<br>19:00 | 17:50 (vorh. WEA 05)<br>17:54 (vorh. WEA 05) | 19:33 (WEA 01)<br>19:41 (WEA 01) | 05:08<br>21:43 |
| Sonnenscheinstunden<br>astr.max.mögl.Beschattung | 253<br>35      | 274<br>34      | 367<br>183                                   | 419<br>265                       | 491<br>507     |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA Schattenrezeptor: P - Weidenstr. 73, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

|                              | Jul            | August         | September      | Oktober                          | November       | Dezember                                     |
|------------------------------|----------------|----------------|----------------|----------------------------------|----------------|----------------------------------------------|
| 1                            | 05:04<br>21:59 | 05:43<br>21:24 | 06:36<br>20:19 | 19:30 (WEA 01)<br>19:44 (WEA 01) | 07:28<br>16:57 | 15:20 (vorh. WEA 04)<br>16:14 (vorh. WEA 04) |
| 2                            | 05:04<br>21:58 | 05:44<br>21:23 | 06:37<br>20:17 | 19:29 (WEA 01)<br>19:43 (WEA 01) | 07:29<br>16:55 | 16:19 (vorh. WEA 04)<br>16:24 (vorh. WEA 04) |
| 3                            | 05:05<br>21:58 | 05:46<br>21:21 | 06:39<br>20:14 | 19:09 (WEA 03)<br>19:43 (WEA 01) | 07:31<br>16:54 | 16:20 (vorh. WEA 04)<br>16:23 (vorh. WEA 03) |
| 4                            | 05:06<br>21:57 | 05:48<br>21:19 | 06:41<br>20:12 | 19:06 (WEA 03)<br>19:42 (WEA 01) | 07:33<br>16:52 | 16:20 (vorh. WEA 04)<br>16:21 (vorh. WEA 04) |
| 5                            | 05:07<br>21:57 | 05:49<br>21:17 | 06:42<br>20:10 | 19:04 (WEA 03)<br>19:41 (WEA 01) | 07:35<br>16:50 | 16:12<br>16:11                               |
| 6                            | 05:08<br>21:56 | 05:51<br>21:15 | 06:44<br>20:07 | 19:03 (WEA 03)<br>19:40 (WEA 01) | 07:36<br>16:48 | 16:11<br>16:10                               |
| 7                            | 05:09<br>21:56 | 05:53<br>21:13 | 06:46<br>20:05 | 19:02 (WEA 03)<br>19:36 (WEA 01) | 07:38<br>16:46 | 16:09<br>16:08                               |
| 8                            | 05:10<br>21:55 | 05:54<br>21:11 | 06:48<br>20:03 | 19:01 (WEA 03)<br>19:21 (WEA 03) | 07:40<br>16:44 | 16:08<br>16:07                               |
| 9                            | 05:11<br>21:54 | 05:56<br>21:10 | 06:49<br>20:00 | 19:01 (WEA 03)<br>19:21 (WEA 03) | 07:42<br>16:43 | 16:07<br>16:06                               |
| 10                           | 05:12<br>21:53 | 05:58<br>21:08 | 06:51<br>19:58 | 19:00 (WEA 03)<br>19:20 (WEA 03) | 07:44<br>16:41 | 16:06<br>16:05                               |
| 11                           | 05:13<br>21:53 | 05:59<br>21:06 | 06:53<br>19:55 | 19:01 (WEA 03)<br>19:19 (WEA 03) | 07:45<br>16:39 | 16:05<br>16:04                               |
| 12                           | 05:14<br>21:52 | 06:01<br>21:04 | 06:54<br>19:53 | 19:01 (WEA 03)<br>19:18 (WEA 03) | 07:47<br>16:38 | 16:04<br>16:03                               |
| 13                           | 05:15<br>21:51 | 06:03<br>21:01 | 06:56<br>19:50 | 19:01 (WEA 03)<br>19:16 (WEA 03) | 07:49<br>16:36 | 16:03<br>16:02                               |
| 14                           | 05:16<br>21:50 | 06:04<br>20:59 | 06:58<br>19:48 | 19:03 (WEA 03)<br>19:15 (WEA 03) | 07:51<br>16:34 | 16:02<br>16:01                               |
| 15                           | 05:18<br>21:49 | 06:06<br>20:57 | 07:00<br>19:46 | 19:06 (WEA 03)<br>19:11 (WEA 03) | 07:53<br>16:33 | 16:01<br>16:00                               |
| 16                           | 05:19<br>21:48 | 06:08<br>20:55 | 07:01<br>19:43 | 19:07 (WEA 03)<br>18:49 (WEA 02) | 07:54<br>16:31 | 16:00<br>15:59                               |
| 17                           | 05:20<br>21:46 | 06:10<br>20:53 | 07:03<br>19:41 | 18:49 (WEA 02)<br>18:53 (WEA 02) | 07:56<br>16:30 | 15:58<br>15:57                               |
| 18                           | 05:22<br>21:45 | 06:11<br>20:51 | 07:05<br>19:38 | 18:46 (WEA 02)<br>18:56 (WEA 02) | 07:58<br>16:29 | 15:56<br>15:55                               |
| 19                           | 05:23<br>21:44 | 06:13<br>20:49 | 07:07<br>19:36 | 18:44 (WEA 02)<br>18:57 (WEA 02) | 07:58<br>16:27 | 15:54<br>15:53                               |
| 20                           | 05:24<br>21:43 | 06:15<br>20:47 | 07:08<br>19:33 | 18:43 (WEA 02)<br>18:57 (WEA 02) | 08:00<br>16:26 | 15:52<br>15:51                               |
| 21                           | 05:26<br>21:41 | 06:16<br>20:44 | 07:10<br>19:31 | 18:42 (WEA 02)<br>18:57 (WEA 02) | 08:04<br>16:25 | 15:49<br>15:48                               |
| 22                           | 05:27<br>21:40 | 06:18<br>20:42 | 07:12<br>19:29 | 18:42 (WEA 02)<br>18:57 (WEA 02) | 08:06<br>16:23 | 15:47<br>15:46                               |
| 23                           | 05:29<br>21:39 | 06:20<br>20:40 | 07:14<br>19:26 | 18:41 (WEA 02)<br>18:55 (WEA 02) | 08:07<br>16:22 | 15:45<br>15:44                               |
| 24                           | 05:30<br>21:37 | 06:22<br>20:38 | 07:15<br>19:24 | 18:42 (WEA 02)<br>18:55 (WEA 02) | 08:09<br>16:21 | 15:43<br>15:42                               |
| 25                           | 05:32<br>21:36 | 06:23<br>20:35 | 07:17<br>19:21 | 18:43 (WEA 02)<br>18:53 (WEA 02) | 08:11<br>16:20 | 15:41<br>15:40                               |
| 26                           | 05:33<br>21:34 | 06:25<br>20:33 | 07:19<br>19:19 | 18:45 (WEA 02)<br>18:51 (WEA 02) | 08:13<br>16:19 | 15:39<br>15:38                               |
| 27                           | 05:35<br>21:33 | 06:27<br>20:31 | 07:20<br>19:16 | 18:45 (WEA 02)<br>18:51 (WEA 02) | 08:15<br>16:18 | 15:37<br>15:36                               |
| 28                           | 05:36<br>21:31 | 06:29<br>20:28 | 07:22<br>19:14 | 18:46 (WEA 02)<br>18:51 (WEA 02) | 08:17<br>16:17 | 15:35<br>15:34                               |
| 29                           | 05:38<br>21:29 | 06:30<br>20:26 | 07:24<br>19:12 | 19:34 (WEA 01)<br>19:42 (WEA 01) | 08:19<br>16:16 | 15:33<br>15:32                               |
| 30                           | 05:39<br>21:28 | 06:32<br>20:24 | 07:26<br>19:09 | 19:31 (WEA 01)<br>19:43 (WEA 01) | 08:21<br>16:15 | 15:31<br>15:30                               |
| 31                           | 05:41<br>21:26 | 06:34<br>20:22 | 07:28<br>19:07 | 19:30 (WEA 01)<br>19:44 (WEA 01) | 08:23<br>16:14 | 15:29<br>15:28                               |
| Sonnenscheinstunden          | 509            | 458            | 382            | 329                              | 261            | 236                                          |
| astr. max. mögl. Beschattung |                | 34             | 396            | 47                               | 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 (WEA mit erstem Schatten) | Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten) |
|--------------|-----------------------|-------------------------|----------------------|------------------------------------------------------------|-----------------------------------------------------------|
|--------------|-----------------------|-------------------------|----------------------|------------------------------------------------------------|-----------------------------------------------------------|

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA **Schattenrezeptor:** Q - Strothweg 20, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

[illegible]

**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) |
|--------------|-----------------------|-------------------------|----------------------|------------------------------------------------------------|-----------------------------------------------------------|
| 1            |                       |                         |                      |                                                            |                                                           |
| 2            |                       |                         |                      |                                                            |                                                           |
| 3            |                       |                         |                      |                                                            |                                                           |
| 4            |                       |                         |                      |                                                            |                                                           |
| 5            |                       |                         |                      |                                                            |                                                           |
| 6            |                       |                         |                      |                                                            |                                                           |
| 7            |                       |                         |                      |                                                            |                                                           |
| 8            |                       |                         |                      |                                                            |                                                           |
| 9            |                       |                         |                      |                                                            |                                                           |
| 10           |                       |                         |                      |                                                            |                                                           |
| 11           |                       |                         |                      |                                                            |                                                           |
| 12           |                       |                         |                      |                                                            |                                                           |
| 13           |                       |                         |                      |                                                            |                                                           |
| 14           |                       |                         |                      |                                                            |                                                           |
| 15           |                       |                         |                      |                                                            |                                                           |
| 16           |                       |                         |                      |                                                            |                                                           |
| 17           |                       |                         |                      |                                                            |                                                           |
| 18           |                       |                         |                      |                                                            |                                                           |
| 19           |                       |                         |                      |                                                            |                                                           |
| 20           |                       |                         |                      |                                                            |                                                           |
| 21           |                       |                         |                      |                                                            |                                                           |
| 22           |                       |                         |                      |                                                            |                                                           |
| 23           |                       |                         |                      |                                                            |                                                           |
| 24           |                       |                         |                      |                                                            |                                                           |
| 25           |                       |                         |                      |                                                            |                                                           |
| 26           |                       |                         |                      |                                                            |                                                           |
| 27           |                       |                         |                      |                                                            |                                                           |
| 28           |                       |                         |                      |                                                            |                                                           |
| 29           |                       |                         |                      |                                                            |                                                           |
| 30           |                       |                         |                      |                                                            |                                                           |
| 31           |                       |                         |                      |                                                            |                                                           |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: Q - Strothweg 20, Kleibrok  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Juli                      |       | August               |                      | September |                      | Oktober              |       | November |       | Dezember |  |
|---------------------------|-------|----------------------|----------------------|-----------|----------------------|----------------------|-------|----------|-------|----------|--|
| 1                         | 05:04 | 21:11 (vorh. WEA 06) | 05:43                |           | 06:36                | 19:26 (vorh. WEA 01) | 07:28 | 07:24    | 08:18 |          |  |
|                           | 21:59 | 11                   | 21:22 (vorh. WEA 06) | 21:24     | 20:19                | 19:41 (vorh. WEA 01) | 19:07 | 16:57    | 16:14 |          |  |
| 2                         | 05:05 |                      | 21:12 (vorh. WEA 06) | 05:44     | 20:37 (vorh. WEA 07) | 19:25 (vorh. WEA 01) | 07:29 | 07:26    | 08:20 |          |  |
|                           | 21:58 | 11                   | 21:23 (vorh. WEA 06) | 21:23     | 20:43 (vorh. WEA 07) | 19:40 (vorh. WEA 01) | 19:04 | 16:56    | 16:14 |          |  |
| 3                         | 05:05 |                      | 21:12 (vorh. WEA 06) | 05:46     | 20:36 (vorh. WEA 07) | 19:25 (vorh. WEA 01) | 07:31 | 07:28    | 08:21 |          |  |
|                           | 21:58 | 11                   | 21:23 (vorh. WEA 06) | 21:21     | 20:45 (vorh. WEA 07) | 19:40 (vorh. WEA 01) | 19:02 | 16:54    | 16:13 |          |  |
| 4                         | 05:06 |                      | 21:12 (vorh. WEA 06) | 05:48     | 20:35 (vorh. WEA 07) | 19:25 (vorh. WEA 01) | 07:33 | 07:30    | 08:23 |          |  |
|                           | 21:57 | 10                   | 21:22 (vorh. WEA 06) | 21:19     | 20:45 (vorh. WEA 07) | 19:41 (vorh. WEA 03) | 19:00 | 16:52    | 16:12 |          |  |
| 5                         | 05:07 |                      | 21:12 (vorh. WEA 06) | 05:49     | 20:35 (vorh. WEA 07) | 19:25 (vorh. WEA 01) | 07:35 | 07:32    | 08:24 |          |  |
|                           | 21:57 | 10                   | 21:22 (vorh. WEA 06) | 21:17     | 20:46 (vorh. WEA 07) | 19:40 (vorh. WEA 03) | 18:57 | 16:50    | 16:12 |          |  |
| 6                         | 05:08 |                      | 21:12 (vorh. WEA 06) | 05:51     | 20:34 (vorh. WEA 07) | 19:27 (vorh. WEA 01) | 07:36 | 07:34    | 08:25 |          |  |
|                           | 21:56 | 10                   | 21:22 (vorh. WEA 06) | 21:15     | 20:44 (vorh. WEA 07) | 19:40 (vorh. WEA 03) | 18:55 | 16:48    | 16:11 |          |  |
| 7                         | 05:09 |                      | 21:13 (vorh. WEA 06) | 05:53     | 20:35 (vorh. WEA 07) | 19:30 (vorh. WEA 01) | 07:38 | 07:36    | 08:27 |          |  |
|                           | 21:56 | 8                    | 21:21 (vorh. WEA 06) | 21:13     | 20:43 (vorh. WEA 07) | 19:37 (vorh. WEA 03) | 18:52 | 16:46    | 16:11 |          |  |
| 8                         | 05:10 |                      | 21:13 (vorh. WEA 06) | 05:54     | 20:36 (vorh. WEA 07) | 19:15 (vorh. WEA 02) | 07:40 | 07:38    | 08:28 |          |  |
|                           | 21:55 | 8                    | 21:21 (vorh. WEA 06) | 21:11     | 20:42 (vorh. WEA 07) | 19:35 (vorh. WEA 03) | 18:50 | 16:44    | 16:10 |          |  |
| 9                         | 05:11 |                      | 21:13 (vorh. WEA 06) | 05:56     | 20:18 (vorh. WEA 04) | 19:13 (vorh. WEA 02) | 07:42 | 07:40    | 08:29 |          |  |
|                           | 21:54 | 7                    | 21:20 (vorh. WEA 06) | 21:10     | 20:39 (vorh. WEA 07) | 19:33 (vorh. WEA 03) | 18:48 | 16:43    | 16:10 |          |  |
| 10                        | 05:12 |                      | 21:14 (vorh. WEA 06) | 05:58     | 20:17 (vorh. WEA 04) | 19:12 (vorh. WEA 02) | 07:44 | 07:42    | 08:30 |          |  |
|                           | 21:53 | 5                    | 21:19 (vorh. WEA 06) | 21:08     | 20:38 (vorh. WEA 07) | 19:23 (vorh. WEA 02) | 18:45 | 16:41    | 16:10 |          |  |
| 11                        | 05:13 |                      | 21:14 (vorh. WEA 06) | 05:59     | 20:15 (vorh. WEA 04) | 19:11 (vorh. WEA 02) | 07:45 | 07:43    | 08:31 |          |  |
|                           | 21:53 | 4                    | 21:18 (vorh. WEA 06) | 21:06     | 20:26 (vorh. WEA 04) | 19:23 (vorh. WEA 02) | 18:43 | 16:39    | 16:10 |          |  |
| 12                        | 05:14 |                      | 21:15 (vorh. WEA 06) | 06:01     | 20:15 (vorh. WEA 04) | 19:11 (vorh. WEA 02) | 07:47 | 07:45    | 08:33 |          |  |
|                           | 21:52 | 3                    | 21:18 (vorh. WEA 06) | 21:03     | 20:27 (vorh. WEA 04) | 19:23 (vorh. WEA 02) | 18:41 | 16:38    | 16:09 |          |  |
| 13                        | 05:15 |                      | 21:15 (vorh. WEA 06) | 06:03     | 20:15 (vorh. WEA 04) | 19:11 (vorh. WEA 02) | 07:49 | 07:47    | 08:34 |          |  |
|                           | 21:51 | 2                    | 21:17 (vorh. WEA 06) | 21:01     | 20:27 (vorh. WEA 04) | 19:22 (vorh. WEA 02) | 18:38 | 16:36    | 16:09 |          |  |
| 14                        | 05:16 |                      |                      | 06:04     | 20:14 (vorh. WEA 04) | 19:12 (vorh. WEA 02) | 07:51 | 07:49    | 08:35 |          |  |
|                           | 21:50 |                      |                      | 20:59     | 20:27 (vorh. WEA 04) | 19:20 (vorh. WEA 02) | 18:36 | 16:34    | 16:09 |          |  |
| 15                        | 05:18 |                      |                      | 06:06     | 20:14 (vorh. WEA 04) | 19:14 (vorh. WEA 02) | 07:53 | 07:51    | 08:36 |          |  |
|                           | 21:49 |                      |                      | 20:57     | 20:27 (vorh. WEA 04) | 19:18 (vorh. WEA 02) | 18:34 | 16:33    | 16:09 |          |  |
| 16                        | 05:19 |                      |                      | 06:08     | 20:14 (vorh. WEA 04) | 19:11 (vorh. WEA 02) | 07:54 | 07:53    | 08:36 |          |  |
|                           | 21:48 |                      |                      | 20:55     | 20:25 (vorh. WEA 04) | 19:13                | 18:32 | 16:31    | 16:09 |          |  |
| 17                        | 05:20 |                      | 21:04 (vorh. WEA 05) | 06:10     | 20:15 (vorh. WEA 04) | 19:13                | 07:56 | 07:54    | 08:37 |          |  |
|                           | 21:46 | 4                    | 21:08 (vorh. WEA 05) | 20:53     | 20:39 (vorh. WEA 04) | 19:41                | 18:29 | 16:30    | 16:10 |          |  |
| 18                        | 05:22 |                      | 21:03 (vorh. WEA 05) | 06:11     | 20:17 (vorh. WEA 04) | 19:11                | 07:58 | 07:56    | 08:38 |          |  |
|                           | 21:45 | 6                    | 21:09 (vorh. WEA 05) | 20:51     | 20:22 (vorh. WEA 04) | 19:38                | 18:27 | 16:29    | 16:10 |          |  |
| 19                        | 05:23 |                      | 21:02 (vorh. WEA 05) | 06:13     |                      | 07:07                | 08:00 | 07:58    | 08:39 |          |  |
|                           | 21:44 | 7                    | 21:09 (vorh. WEA 05) | 20:49     |                      | 19:36                | 18:25 | 16:27    | 16:10 |          |  |
| 20                        | 05:24 |                      | 21:02 (vorh. WEA 05) | 06:15     | 20:08 (vorh. WEA 08) | 07:08                | 08:02 | 08:00    | 08:39 |          |  |
|                           | 21:43 | 8                    | 21:10 (vorh. WEA 05) | 20:47     | 20:14 (vorh. WEA 08) | 19:33                | 18:23 | 16:26    | 16:10 |          |  |
| 21                        | 05:26 |                      | 21:02 (vorh. WEA 05) | 06:17     | 20:06 (vorh. WEA 08) | 07:10                | 08:04 | 08:02    | 08:40 |          |  |
|                           | 21:41 | 7                    | 21:09 (vorh. WEA 05) | 20:44     | 20:14 (vorh. WEA 08) | 19:31                | 18:20 | 16:25    | 16:11 |          |  |
| 22                        | 05:27 |                      | 21:01 (vorh. WEA 05) | 06:18     | 20:05 (vorh. WEA 08) | 07:12                | 08:06 | 08:03    | 08:41 |          |  |
|                           | 21:40 | 6                    | 21:07 (vorh. WEA 05) | 20:42     | 20:13 (vorh. WEA 08) | 19:29                | 18:18 | 16:23    | 16:11 |          |  |
| 23                        | 05:29 |                      | 21:02 (vorh. WEA 05) | 06:20     | 20:06 (vorh. WEA 08) | 07:14                | 08:07 | 08:05    | 08:41 |          |  |
|                           | 21:39 | 5                    | 21:07 (vorh. WEA 05) | 20:40     | 20:12 (vorh. WEA 08) | 19:26                | 18:16 | 16:22    | 16:12 |          |  |
| 24                        | 05:30 |                      | 21:02 (vorh. WEA 05) | 06:22     | 20:05 (vorh. WEA 08) | 07:15                | 08:09 | 08:07    | 08:41 |          |  |
|                           | 21:37 | 3                    | 21:05 (vorh. WEA 05) | 20:38     | 20:09 (vorh. WEA 08) | 19:24                | 18:14 | 16:21    | 16:12 |          |  |
| 25                        | 05:32 |                      | 21:02 (vorh. WEA 05) | 06:23     | 20:06 (vorh. WEA 08) | 07:17                | 07:11 | 08:09    | 08:43 |          |  |
|                           | 21:36 | 1                    | 21:03 (vorh. WEA 05) | 20:35     | 20:07 (vorh. WEA 08) | 19:21                | 17:12 | 16:20    | 16:13 |          |  |
| 26                        | 05:33 |                      |                      | 06:25     |                      | 07:19                | 07:13 | 08:10    | 08:42 |          |  |
|                           | 21:34 |                      |                      | 20:33     |                      | 19:19                | 17:10 | 16:19    | 16:14 |          |  |
| 27                        | 05:35 |                      |                      | 06:27     |                      | 07:21                | 07:15 | 08:12    | 08:42 |          |  |
|                           | 21:33 |                      |                      | 20:31     |                      | 19:16                | 17:08 | 16:18    | 16:14 |          |  |
| 28                        | 05:36 |                      |                      | 06:29     | 19:31 (vorh. WEA 01) | 07:22                | 07:17 | 08:14    | 08:43 |          |  |
|                           | 21:31 |                      |                      | 20:28     | 19:38 (vorh. WEA 01) | 19:14                | 17:05 | 16:17    | 16:15 |          |  |
| 29                        | 05:38 |                      |                      | 06:30     | 19:29 (vorh. WEA 01) | 07:24                | 07:19 | 08:15    | 08:43 |          |  |
|                           | 21:29 |                      |                      | 20:26     | 19:40 (vorh. WEA 01) | 19:12                | 17:03 | 16:16    | 16:16 |          |  |
| 30                        | 05:39 |                      |                      | 06:32     | 19:27 (vorh. WEA 01) | 07:26                | 07:21 | 08:17    | 08:43 |          |  |
|                           | 21:28 |                      |                      | 20:24     | 19:40 (vorh. WEA 01) | 19:09                | 17:01 | 16:15    | 16:17 |          |  |
| 31                        | 05:41 |                      |                      | 06:34     | 19:26 (vorh. WEA 01) |                      | 07:23 |          | 08:43 |          |  |
|                           | 21:26 |                      |                      | 20:22     | 19:41 (vorh. WEA 01) |                      | 16:59 |          | 16:18 |          |  |
| Sonnenscheinstunden       |       |                      |                      | 458       |                      | 382                  |       | 261      | 236   |          |  |
| astr.max.mögl.Beschattung |       | 147                  |                      | 244       |                      | 176                  |       |          |       |          |  |

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

|              |                         |                                  |                            |
|--------------|-------------------------|----------------------------------|----------------------------|
| Tag Im Monat | Sonnenaufgang (SS:MM)   | Zeitpunkt (SS:MM) Schattenanfang | (WEA mit erstem Schatten)  |
|              | Sonnenuntergang (SS:MM) | Zeitpunkt (SS:MM) Schattende     | (WEA mit letztem Schatten) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: R - Hohe Looe 2-8 (BÜFA GmbH)  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

| Januar                       |       |       | Februar |       |       | März  |       |       | April |       |                      | Mai   |                      |       | Juni                 |       |       |
|------------------------------|-------|-------|---------|-------|-------|-------|-------|-------|-------|-------|----------------------|-------|----------------------|-------|----------------------|-------|-------|
| 1                            | 08:43 | 16:20 | 08:14   | 17:10 | 18:04 | 07:17 | 18:10 | 18:04 | 07:04 | 20:01 | 07:27 (vorh. WEA 08) | 05:56 | 07:38 (vorh. WEA 08) | 20:55 | 06:15 (vorh. WEA 05) | 05:05 | 05:08 |
| 2                            | 08:43 | 16:21 | 08:12   | 17:12 | 18:06 | 07:15 | 18:12 | 18:06 | 20:01 | 07:01 | 07:25 (vorh. WEA 08) | 05:54 | 07:38 (vorh. WEA 08) | 20:55 | 06:14 (vorh. WEA 05) | 05:04 | 21:44 |
| 3                            | 08:43 | 16:22 | 08:10   | 17:14 | 18:08 | 07:13 | 18:14 | 18:08 | 20:03 | 07:03 | 07:39 (vorh. WEA 08) | 20:57 | 07:23 (vorh. WEA 08) | 05:52 | 06:12 (vorh. WEA 05) | 05:04 | 21:45 |
| 4                            | 08:42 | 16:23 | 08:09   | 17:16 | 18:10 | 07:11 | 18:16 | 18:10 | 20:05 | 07:05 | 07:36 (vorh. WEA 08) | 20:59 | 07:38 (vorh. WEA 08) | 20:59 | 06:10 (vorh. WEA 05) | 05:03 | 21:46 |
| 5                            | 08:42 | 16:24 | 08:07   | 17:18 | 18:12 | 07:09 | 18:18 | 18:12 | 20:07 | 07:07 | 07:35 (vorh. WEA 08) | 21:01 | 07:38 (vorh. WEA 08) | 21:01 | 06:08 (vorh. WEA 05) | 05:02 | 21:48 |
| 6                            | 08:42 | 16:25 | 08:05   | 17:20 | 18:14 | 07:07 | 18:20 | 18:14 | 20:09 | 07:05 | 07:34 (vorh. WEA 08) | 21:02 | 07:37 (vorh. WEA 08) | 21:02 | 06:07 (vorh. WEA 05) | 05:02 | 21:49 |
| 7                            | 08:41 | 16:27 | 08:03   | 17:22 | 18:16 | 07:04 | 18:22 | 18:16 | 20:10 | 07:04 | 07:33 (vorh. WEA 08) | 21:04 | 07:36 (vorh. WEA 08) | 21:04 | 06:06 (vorh. WEA 05) | 05:02 | 21:50 |
| 8                            | 08:41 | 16:28 | 08:01   | 17:23 | 18:17 | 07:02 | 18:23 | 18:17 | 20:12 | 07:02 | 07:32 (vorh. WEA 08) | 21:06 | 07:35 (vorh. WEA 08) | 21:06 | 06:05 (vorh. WEA 05) | 05:01 | 21:51 |
| 9                            | 08:40 | 16:30 | 08:00   | 17:25 | 18:19 | 07:00 | 18:24 | 18:19 | 20:14 | 07:00 | 07:31 (vorh. WEA 08) | 21:08 | 07:34 (vorh. WEA 08) | 21:08 | 06:04 (vorh. WEA 05) | 05:01 | 21:52 |
| 10                           | 08:40 | 16:31 | 07:58   | 17:27 | 18:21 | 06:57 | 18:25 | 18:21 | 20:16 | 06:57 | 07:30 (vorh. WEA 08) | 21:10 | 07:33 (vorh. WEA 08) | 21:10 | 06:03 (vorh. WEA 05) | 05:01 | 21:53 |
| 11                           | 08:39 | 16:33 | 07:56   | 17:29 | 18:23 | 06:54 | 18:26 | 18:23 | 20:18 | 06:54 | 07:29 (vorh. WEA 08) | 21:12 | 07:32 (vorh. WEA 08) | 21:12 | 06:02 (vorh. WEA 05) | 05:01 | 21:54 |
| 12                           | 08:38 | 16:34 | 07:54   | 17:31 | 18:25 | 06:52 | 18:27 | 18:25 | 20:19 | 06:52 | 07:28 (vorh. WEA 08) | 21:13 | 07:31 (vorh. WEA 08) | 21:13 | 06:01 (vorh. WEA 05) | 05:01 | 21:55 |
| 13                           | 08:37 | 16:36 | 07:52   | 17:33 | 18:27 | 06:49 | 18:29 | 18:27 | 20:21 | 06:49 | 07:27 (vorh. WEA 08) | 21:15 | 07:30 (vorh. WEA 08) | 21:15 | 06:00 (vorh. WEA 05) | 05:01 | 21:56 |
| 14                           | 08:37 | 16:37 | 07:50   | 17:35 | 18:29 | 06:47 | 18:31 | 18:29 | 20:23 | 06:47 | 07:26 (vorh. WEA 08) | 21:16 | 07:29 (vorh. WEA 08) | 21:16 | 05:59 (vorh. WEA 05) | 05:01 | 21:57 |
| 15                           | 08:36 | 16:39 | 07:48   | 17:37 | 18:30 | 06:45 | 18:33 | 18:30 | 20:25 | 06:45 | 07:25 (vorh. WEA 08) | 21:18 | 07:28 (vorh. WEA 08) | 21:18 | 05:58 (vorh. WEA 05) | 05:01 | 21:58 |
| 16                           | 08:35 | 16:40 | 07:46   | 17:39 | 18:32 | 06:42 | 18:35 | 18:32 | 20:27 | 06:42 | 07:24 (vorh. WEA 08) | 21:20 | 07:27 (vorh. WEA 08) | 21:20 | 05:57 (vorh. WEA 05) | 05:01 | 21:59 |
| 17                           | 08:34 | 16:42 | 07:44   | 17:41 | 18:34 | 06:40 | 18:37 | 18:34 | 20:28 | 06:40 | 07:23 (vorh. WEA 08) | 21:21 | 07:26 (vorh. WEA 08) | 21:21 | 05:56 (vorh. WEA 05) | 05:01 | 22:00 |
| 18                           | 08:33 | 16:44 | 07:42   | 17:43 | 18:36 | 06:37 | 18:39 | 18:36 | 20:30 | 06:37 | 07:22 (vorh. WEA 08) | 21:23 | 07:25 (vorh. WEA 08) | 21:23 | 05:55 (vorh. WEA 05) | 05:01 | 22:01 |
| 19                           | 08:32 | 16:46 | 07:39   | 17:45 | 18:38 | 06:35 | 18:41 | 18:38 | 20:32 | 06:35 | 07:21 (vorh. WEA 08) | 21:24 | 07:24 (vorh. WEA 08) | 21:24 | 05:54 (vorh. WEA 05) | 05:01 | 22:02 |
| 20                           | 08:31 | 16:47 | 07:37   | 17:47 | 18:40 | 06:33 | 18:43 | 18:40 | 20:34 | 06:33 | 07:20 (vorh. WEA 08) | 21:26 | 07:23 (vorh. WEA 08) | 21:26 | 05:53 (vorh. WEA 05) | 05:01 | 22:03 |
| 21                           | 08:29 | 16:49 | 07:35   | 17:49 | 18:41 | 06:30 | 18:45 | 18:41 | 20:36 | 06:30 | 07:19 (vorh. WEA 08) | 21:28 | 07:22 (vorh. WEA 08) | 21:28 | 05:52 (vorh. WEA 05) | 05:01 | 22:04 |
| 22                           | 08:28 | 16:51 | 07:33   | 17:51 | 18:43 | 06:28 | 18:47 | 18:43 | 20:38 | 06:28 | 07:18 (vorh. WEA 08) | 21:29 | 07:21 (vorh. WEA 08) | 21:29 | 05:51 (vorh. WEA 05) | 05:01 | 22:05 |
| 23                           | 08:27 | 16:53 | 07:31   | 17:53 | 18:45 | 06:25 | 18:49 | 18:45 | 20:40 | 06:25 | 07:17 (vorh. WEA 08) | 21:31 | 07:20 (vorh. WEA 08) | 21:31 | 05:50 (vorh. WEA 05) | 05:01 | 22:06 |
| 24                           | 08:26 | 16:55 | 07:29   | 17:55 | 18:47 | 06:23 | 18:51 | 18:47 | 20:42 | 06:23 | 07:16 (vorh. WEA 08) | 21:33 | 07:19 (vorh. WEA 08) | 21:33 | 05:49 (vorh. WEA 05) | 05:01 | 22:07 |
| 25                           | 08:24 | 16:56 | 07:26   | 17:57 | 18:49 | 06:21 | 18:53 | 18:49 | 20:44 | 06:21 | 07:15 (vorh. WEA 08) | 21:35 | 07:18 (vorh. WEA 08) | 21:35 | 05:48 (vorh. WEA 05) | 05:01 | 22:08 |
| 26                           | 08:23 | 16:58 | 07:24   | 17:59 | 18:51 | 06:18 | 18:55 | 18:51 | 20:46 | 06:18 | 07:14 (vorh. WEA 08) | 21:37 | 07:17 (vorh. WEA 08) | 21:37 | 05:47 (vorh. WEA 05) | 05:01 | 22:09 |
| 27                           | 08:21 | 17:00 | 07:22   | 18:00 | 18:52 | 06:16 | 18:57 | 18:52 | 20:48 | 06:16 | 07:13 (vorh. WEA 08) | 21:39 | 07:16 (vorh. WEA 08) | 21:39 | 05:46 (vorh. WEA 05) | 05:01 | 22:10 |
| 28                           | 08:20 | 17:02 | 07:20   | 18:02 | 18:54 | 06:13 | 19:00 | 18:54 | 20:50 | 06:13 | 07:12 (vorh. WEA 08) | 21:41 | 07:15 (vorh. WEA 08) | 21:41 | 05:45 (vorh. WEA 05) | 05:01 | 22:11 |
| 29                           | 08:18 | 17:04 | 07:18   | 18:04 | 18:56 | 06:11 | 19:02 | 18:56 | 20:52 | 06:11 | 07:11 (vorh. WEA 08) | 21:43 | 07:14 (vorh. WEA 08) | 21:43 | 05:44 (vorh. WEA 05) | 05:01 | 22:12 |
| 30                           | 08:17 | 17:06 | 07:16   | 18:06 | 18:58 | 06:09 | 19:04 | 18:58 | 20:54 | 06:09 | 07:10 (vorh. WEA 08) | 21:45 | 07:13 (vorh. WEA 08) | 21:45 | 05:43 (vorh. WEA 05) | 05:01 | 22:13 |
| 31                           | 08:15 | 17:08 | 07:14   | 18:08 | 19:00 | 06:06 | 19:06 | 19:00 | 20:56 | 06:06 | 07:09 (vorh. WEA 08) | 21:47 | 07:12 (vorh. WEA 08) | 21:47 | 05:42 (vorh. WEA 05) | 05:01 | 22:14 |
| Sonnenscheinstunden          |       |       | 253     | 274   | 367   |       |       |       | 419   |       |                      | 491   |                      |       |                      |       |       |
| astr. max. mögl. Beschattung |       |       |         |       |       | 140   |       |       | 156   |       |                      | 233   |                      |       | 507                  |       | 77    |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: R - Hohe Looge 2-8 (BÜFA GmbH)  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlungsrichtung

Die Windenergieanlage/n ist/sind immer in Betrieb

|                           | Juli  |                      | August |                      | September |                      | Oktober |                      | November |       | Dezember |  |
|---------------------------|-------|----------------------|--------|----------------------|-----------|----------------------|---------|----------------------|----------|-------|----------|--|
| 1                         | 05:04 | 05:36 (WEA 01)       | 05:43  | 06:13 (WEA 02)       | 06:36     | 07:03 (vorh. WEA 07) | 07:28   | 07:54 (vorh. WEA 01) | 07:25    | 08:18 |          |  |
|                           | 21:59 | 05:37 (WEA 01)       | 21:25  | 06:28 (vorh. WEA 05) | 20:19     | 07:12 (vorh. WEA 07) | 19:07   | 08:07 (vorh. WEA 03) | 16:58    | 16:14 |          |  |
| 2                         | 05:05 |                      | 05:44  | 06:14 (WEA 02)       | 06:37     | 07:04 (vorh. WEA 07) | 07:29   | 07:55 (vorh. WEA 01) | 07:26    | 08:20 |          |  |
|                           | 21:58 |                      | 21:23  | 06:28 (vorh. WEA 05) | 20:17     | 07:11 (vorh. WEA 07) | 19:04   | 08:06 (vorh. WEA 03) | 16:56    | 16:14 |          |  |
| 3                         | 05:05 |                      | 05:46  | 06:16 (WEA 02)       | 06:39     | 07:06 (vorh. WEA 07) | 07:31   | 07:57 (vorh. WEA 03) | 07:28    | 08:21 |          |  |
|                           | 21:58 |                      | 21:21  | 06:28 (vorh. WEA 05) | 20:15     | 07:10 (vorh. WEA 07) | 19:02   | 08:05 (vorh. WEA 03) | 16:54    | 16:13 |          |  |
| 4                         | 05:06 |                      | 05:48  | 06:17 (vorh. WEA 05) | 06:41     | 07:08 (vorh. WEA 07) | 07:33   | 07:59 (vorh. WEA 03) | 07:30    | 08:23 |          |  |
|                           | 21:57 |                      | 21:19  | 06:28 (vorh. WEA 05) | 20:12     | 07:10 (vorh. WEA 07) | 19:00   | 08:08 (vorh. WEA 02) | 16:52    | 16:12 |          |  |
| 5                         | 05:07 |                      | 05:49  | 06:19 (vorh. WEA 05) | 06:43     | 07:22 (vorh. WEA 08) | 07:35   | 08:01 (vorh. WEA 03) | 07:32    | 08:24 |          |  |
|                           | 21:57 |                      | 21:17  | 06:28 (vorh. WEA 05) | 20:10     | 07:30 (vorh. WEA 08) | 18:57   | 08:11 (vorh. WEA 02) | 16:50    | 16:12 |          |  |
| 6                         | 05:08 |                      | 05:51  | 06:20 (vorh. WEA 05) | 06:44     | 07:20 (vorh. WEA 08) | 07:37   | 08:03 (vorh. WEA 02) | 07:34    | 08:26 |          |  |
|                           | 21:56 |                      | 21:15  | 06:28 (vorh. WEA 05) | 20:07     | 07:32 (vorh. WEA 08) | 18:55   | 08:12 (vorh. WEA 02) | 16:48    | 16:11 |          |  |
| 7                         | 05:09 |                      | 05:53  | 06:22 (vorh. WEA 05) | 06:46     | 07:19 (vorh. WEA 08) | 07:38   | 08:05 (vorh. WEA 02) | 07:36    | 08:27 |          |  |
|                           | 21:56 |                      | 21:14  | 06:27 (vorh. WEA 05) | 20:05     | 07:33 (vorh. WEA 08) | 18:53   | 08:12 (vorh. WEA 02) | 16:46    | 16:11 |          |  |
| 8                         | 05:10 |                      | 05:54  | 06:24 (vorh. WEA 05) | 06:48     | 07:18 (vorh. WEA 08) | 07:40   | 08:06 (vorh. WEA 02) | 07:38    | 08:28 |          |  |
|                           | 21:55 |                      | 21:12  | 06:27 (vorh. WEA 05) | 20:03     | 07:32 (vorh. WEA 08) | 18:50   | 08:11 (vorh. WEA 02) | 16:45    | 16:10 |          |  |
| 9                         | 05:11 |                      | 05:56  |                      | 06:49     | 07:16 (vorh. WEA 08) | 07:42   | 08:08 (vorh. WEA 02) | 07:40    | 08:29 |          |  |
|                           | 21:54 |                      | 21:10  |                      | 20:00     | 07:32 (vorh. WEA 08) | 18:48   | 08:11 (vorh. WEA 02) | 16:43    | 16:10 |          |  |
| 10                        | 05:12 |                      | 05:58  |                      | 06:51     | 07:18 (vorh. WEA 08) | 07:44   |                      | 07:42    | 08:30 |          |  |
|                           | 21:54 |                      | 21:08  |                      | 19:58     | 07:32 (vorh. WEA 08) | 18:45   |                      | 16:41    | 16:10 |          |  |
| 11                        | 05:13 |                      | 05:59  |                      | 06:53     | 07:19 (vorh. WEA 08) | 07:46   |                      | 07:44    | 08:32 |          |  |
|                           | 21:53 |                      | 21:06  |                      | 19:55     | 07:31 (vorh. WEA 08) | 18:43   |                      | 16:39    | 16:10 |          |  |
| 12                        | 05:14 |                      | 06:01  |                      | 06:55     | 07:21 (vorh. WEA 08) | 07:47   |                      | 07:45    | 08:33 |          |  |
|                           | 21:52 |                      | 21:04  |                      | 19:53     | 07:30 (vorh. WEA 08) | 18:41   |                      | 16:38    | 16:09 |          |  |
| 13                        | 05:15 |                      | 06:03  |                      | 06:56     | 07:23 (vorh. WEA 08) | 07:49   |                      | 07:47    | 08:34 |          |  |
|                           | 21:51 |                      | 21:02  |                      | 19:51     | 07:28 (vorh. WEA 08) | 18:38   |                      | 16:36    | 16:09 |          |  |
| 14                        | 05:17 |                      | 06:05  |                      | 06:58     | 07:25 (vorh. WEA 04) | 07:51   |                      | 07:49    | 08:35 |          |  |
|                           | 21:50 |                      | 21:00  |                      | 19:48     | 07:32 (vorh. WEA 04) | 18:36   |                      | 16:35    | 16:09 |          |  |
| 15                        | 05:18 |                      | 06:06  |                      | 07:00     | 07:26 (vorh. WEA 04) | 07:53   |                      | 07:51    | 08:36 |          |  |
|                           | 21:49 |                      | 20:57  |                      | 19:46     | 07:33 (vorh. WEA 04) | 18:34   |                      | 16:33    | 16:09 |          |  |
| 16                        | 05:19 |                      | 06:08  | 06:37 (vorh. WEA 06) | 07:02     | 07:28 (vorh. WEA 04) | 07:55   |                      | 07:53    | 08:37 |          |  |
|                           | 21:48 |                      | 20:55  | 06:43 (vorh. WEA 06) | 19:43     | 07:33 (vorh. WEA 04) | 18:32   |                      | 16:32    | 16:09 |          |  |
| 17                        | 05:20 |                      | 06:10  | 06:38 (vorh. WEA 06) | 07:03     | 07:29 (vorh. WEA 04) | 07:56   |                      | 07:55    | 08:37 |          |  |
|                           | 21:47 |                      | 20:53  | 06:45 (vorh. WEA 06) | 19:41     | 07:32 (vorh. WEA 04) | 18:29   |                      | 16:30    | 16:10 |          |  |
| 18                        | 05:22 |                      | 06:11  | 06:40 (vorh. WEA 06) | 07:05     | 07:31 (vorh. WEA 04) | 07:58   |                      | 07:56    | 08:38 |          |  |
|                           | 21:45 |                      | 20:51  | 06:46 (vorh. WEA 06) | 19:38     | 07:32 (vorh. WEA 04) | 18:27   |                      | 16:29    | 16:10 |          |  |
| 19                        | 05:23 | 06:11 (WEA 02)       | 06:13  | 06:41 (vorh. WEA 06) | 07:07     |                      | 18:20   |                      | 07:58    | 08:39 |          |  |
|                           | 21:44 | 06:14 (WEA 02)       | 20:49  | 06:45 (vorh. WEA 06) | 19:36     |                      | 18:25   |                      | 16:27    | 16:10 |          |  |
| 20                        | 05:24 | 06:10 (WEA 02)       | 06:15  | 06:43 (vorh. WEA 06) | 07:08     |                      | 08:02   |                      | 08:00    | 08:40 |          |  |
|                           | 21:43 | 06:17 (WEA 02)       | 20:47  | 06:45 (vorh. WEA 06) | 19:34     |                      | 18:23   |                      | 16:26    | 16:10 |          |  |
| 21                        | 05:26 | 06:08 (WEA 02)       | 06:17  |                      | 07:10     |                      | 08:04   |                      | 08:02    | 08:40 |          |  |
|                           | 21:42 | 06:18 (WEA 02)       | 20:44  |                      | 19:31     |                      | 18:20   |                      | 16:25    | 16:11 |          |  |
| 22                        | 05:27 | 06:07 (WEA 02)       | 06:18  |                      | 07:12     |                      | 08:06   |                      | 08:04    | 08:41 |          |  |
|                           | 21:40 | 06:19 (WEA 02)       | 20:42  |                      | 19:29     |                      | 18:18   |                      | 16:23    | 16:11 |          |  |
| 23                        | 05:29 | 06:07 (WEA 02)       | 06:20  |                      | 07:14     |                      | 08:08   |                      | 08:05    | 08:41 |          |  |
|                           | 21:39 | 06:20 (WEA 02)       | 20:40  |                      | 19:26     |                      | 18:16   |                      | 16:22    | 16:12 |          |  |
| 24                        | 05:30 | 06:07 (WEA 02)       | 06:22  |                      | 07:15     |                      | 08:09   |                      | 08:07    | 08:42 |          |  |
|                           | 21:37 | 06:20 (WEA 02)       | 20:38  |                      | 19:24     |                      | 18:14   |                      | 16:21    | 16:12 |          |  |
| 25                        | 05:32 | 06:07 (WEA 02)       | 06:24  |                      | 07:17     |                      | 07:11   |                      | 08:09    | 08:42 |          |  |
|                           | 21:36 | 06:21 (WEA 02)       | 20:35  |                      | 19:21     |                      | 17:12   |                      | 16:20    | 16:13 |          |  |
| 26                        | 05:33 | 06:06 (WEA 02)       | 06:25  |                      | 07:19     |                      | 07:13   |                      | 08:10    | 08:42 |          |  |
|                           | 21:34 | 06:21 (WEA 02)       | 20:33  |                      | 19:19     |                      | 17:10   |                      | 16:19    | 16:14 |          |  |
| 27                        | 05:35 | 06:06 (WEA 02)       | 06:27  |                      | 07:21     |                      | 07:15   |                      | 08:12    | 08:43 |          |  |
|                           | 21:33 | 06:21 (WEA 02)       | 20:31  |                      | 19:17     |                      | 17:08   |                      | 16:18    | 16:15 |          |  |
| 28                        | 05:36 | 06:07 (WEA 02)       | 06:29  |                      | 07:22     |                      | 07:17   |                      | 08:14    | 08:43 |          |  |
|                           | 21:31 | 06:21 (WEA 02)       | 20:29  |                      | 19:14     | 07:57 (vorh. WEA 03) | 17:17   |                      | 16:17    | 16:15 |          |  |
| 29                        | 05:38 | 06:08 (WEA 02)       | 06:30  | 07:04 (vorh. WEA 07) | 07:24     | 08:05 (vorh. WEA 03) | 17:06   |                      | 08:15    | 08:43 |          |  |
|                           | 21:30 | 06:21 (WEA 02)       | 20:26  | 07:10 (vorh. WEA 07) | 19:12     | 07:51 (vorh. WEA 01) | 17:19   |                      | 16:16    | 16:16 |          |  |
| 30                        | 05:40 | 06:10 (WEA 02)       | 06:32  | 07:01 (vorh. WEA 07) | 07:26     | 08:06 (vorh. WEA 03) | 17:04   |                      | 08:17    | 08:43 |          |  |
|                           | 21:28 | 06:25 (vorh. WEA 05) | 20:24  | 07:10 (vorh. WEA 07) | 19:09     | 07:52 (vorh. WEA 01) | 17:21   |                      | 16:15    | 16:17 |          |  |
| 31                        | 05:41 | 06:11 (WEA 02)       | 06:34  | 07:01 (vorh. WEA 07) |           | 08:07 (vorh. WEA 03) | 17:02   |                      |          | 08:43 |          |  |
|                           | 21:26 | 06:26 (vorh. WEA 05) | 20:22  | 07:11 (vorh. WEA 07) |           |                      | 17:23   |                      |          | 16:18 |          |  |
| Sonnenscheinstunden       |       | 509                  | 458    |                      | 382       |                      | 329     |                      | 261      | 236   |          |  |
| astr.max.mögl.Beschattung |       | 160                  | 127    |                      | 183       |                      | 72      |                      |          |       |          |  |

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

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

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: S - Wilhelmshavener Str. 88, Liethe  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

Die Sonne scheint täglich von Sonnenauf- bis -untergang

Die Rotorfläche steht immer senkrecht zur Sonneneinstrahlung

Die Windenergieanlage/n ist/sind immer in Betrieb

| Januar                       | Februar | März                   | April                  | Mal               | Juni  |
|------------------------------|---------|------------------------|------------------------|-------------------|-------|
| 1 08:43                      | 08:14   | 07:17                  | 07:04                  | 05:56             | 05:08 |
| 16:20                        | 17:10   | 18:04                  | 20:01                  | 20:55             | 21:44 |
| 2 08:43                      | 08:12   | 07:15                  | 07:01                  | 07:25 (WEA 02)    | 05:07 |
| 16:21                        | 17:12   | 18:06                  | 20:03                  | 2 07:27 (WEA 02)  | 21:45 |
| 3 08:43                      | 08:10   | 07:13                  | 06:59                  | 07:22 (WEA 02)    | 05:06 |
| 16:22                        | 17:14   | 18:08                  | 20:05                  | 5 07:27 (WEA 02)  | 21:47 |
| 4 08:42                      | 08:09   | 07:11                  | 06:57                  | 07:20 (WEA 02)    | 05:05 |
| 16:23                        | 17:16   | 18:10                  | 20:07                  | 6 07:28 (WEA 02)  | 21:48 |
| 5 08:42                      | 08:07   | 07:08                  | 07:32 (vorh. WEA 07)   | 06:54             | 05:04 |
| 16:24                        | 17:18   | 18:12                  | 1 07:33 (vorh. WEA 07) | 20:09             | 21:49 |
| 6 08:42                      | 08:05   | 07:06                  | 07:30 (vorh. WEA 07)   | 06:52             | 05:04 |
| 16:25                        | 17:19   | 18:14                  | 3 07:33 (vorh. WEA 07) | 20:10             | 21:50 |
| 7 08:41                      | 08:03   | 07:04                  | 07:27 (vorh. WEA 07)   | 06:49             | 05:03 |
| 16:27                        | 17:21   | 18:16                  | 5 07:32 (vorh. WEA 07) | 20:12             | 21:51 |
| 8 08:41                      | 08:01   | 07:01                  | 07:27 (vorh. WEA 07)   | 06:47             | 05:02 |
| 16:28                        | 17:23   | 18:17                  | 3 07:30 (vorh. WEA 07) | 20:14             | 21:52 |
| 9 08:40                      | 08:00   | 06:59                  | 06:45                  | 10 07:25 (WEA 02) | 05:02 |
| 16:30                        | 17:25   | 18:19                  | 20:16                  | 8 07:24 (WEA 02)  | 21:53 |
| 10 08:40                     | 07:58   | 06:57                  | 06:42                  | 05:39             | 05:01 |
| 16:31                        | 17:27   | 18:21                  | 20:18                  | 21:11             | 21:53 |
| 11 08:39                     | 07:56   | 06:54                  | 06:40                  | 05:37             | 05:01 |
| 16:33                        | 17:29   | 18:23                  | 20:19                  | 21:13             | 21:54 |
| 12 08:38                     | 07:54   | 06:52                  | 06:38                  | 05:35             | 05:01 |
| 16:34                        | 17:31   | 18:25                  | 20:21                  | 21:15             | 21:55 |
| 13 08:37                     | 07:52   | 06:49                  | 06:35                  | 05:33             | 05:00 |
| 16:36                        | 17:33   | 18:27                  | 20:23                  | 21:16             | 21:56 |
| 14 08:37                     | 07:50   | 06:47                  | 06:33                  | 05:32             | 05:00 |
| 16:37                        | 17:35   | 18:29                  | 20:25                  | 21:18             | 21:56 |
| 15 08:36                     | 07:48   | 06:45                  | 06:31                  | 05:30             | 05:00 |
| 16:39                        | 17:37   | 18:30                  | 20:27                  | 21:20             | 21:57 |
| 16 08:35                     | 07:46   | 06:42                  | 06:28                  | 05:28             | 05:00 |
| 16:40                        | 17:39   | 18:32                  | 20:29                  | 21:21             | 21:57 |
| 17 08:34                     | 07:44   | 06:40                  | 06:26                  | 05:27             | 04:59 |
| 16:42                        | 17:41   | 18:34                  | 20:30                  | 21:23             | 21:58 |
| 18 08:33                     | 07:42   | 06:37                  | 06:24                  | 05:25             | 04:59 |
| 16:44                        | 17:43   | 18:36                  | 20:32                  | 21:24             | 21:58 |
| 19 08:32                     | 07:40   | 06:35                  | 06:22                  | 05:24             | 04:59 |
| 16:46                        | 17:45   | 18:38                  | 1 06:58 (vorh. WEA 06) | 21:26             | 21:59 |
| 20 08:31                     | 07:37   | 06:33                  | 06:56 (vorh. WEA 05)   | 06:44 (WEA 01)    | 05:00 |
| 16:47                        | 17:47   | 18:40                  | 3 06:59 (vorh. WEA 06) | 21:28             | 21:59 |
| 21 08:29                     | 07:35   | 06:30                  | 06:54 (vorh. WEA 05)   | 06:41 (WEA 01)    | 05:00 |
| 16:49                        | 17:49   | 18:41                  | 4 06:58 (vorh. WEA 05) | 21:29             | 21:59 |
| 22 08:28                     | 07:33   | 06:28                  | 06:51 (vorh. WEA 05)   | 06:39 (WEA 01)    | 05:00 |
| 16:51                        | 17:51   | 18:43                  | 7 06:58 (vorh. WEA 05) | 21:31             | 21:59 |
| 23 08:27                     | 07:31   | 06:25                  | 06:49 (vorh. WEA 05)   | 06:37 (WEA 01)    | 05:00 |
| 16:53                        | 17:53   | 18:45                  | 8 06:57 (vorh. WEA 05) | 21:32             | 22:00 |
| 24 08:26                     | 07:29   | 06:23                  | 06:48 (vorh. WEA 05)   | 06:35 (WEA 01)    | 05:00 |
| 16:55                        | 17:55   | 18:47                  | 7 06:55 (vorh. WEA 05) | 21:34             | 22:00 |
| 25 08:24                     | 07:26   | 06:21                  | 06:46                  | 06:34 (WEA 01)    | 05:01 |
| 16:56                        | 17:57   | 18:49                  | 20:45                  | 13 06:47 (WEA 01) | 22:00 |
| 26 08:23                     | 07:24   | 06:18                  | 06:46                  | 06:35 (WEA 01)    | 05:01 |
| 16:58                        | 17:59   | 18:51                  | 20:47                  | 11 06:46 (WEA 01) | 22:00 |
| 27 08:21                     | 07:22   | 06:16                  | 06:44                  | 06:36 (WEA 01)    | 05:02 |
| 17:00                        | 18:00   | 1 07:47 (vorh. WEA 04) | 20:48                  | 9 06:45 (WEA 01)  | 22:00 |
| 28 08:20                     | 07:20   | 06:13                  | 06:42                  | 06:38 (WEA 01)    | 05:02 |
| 17:02                        | 18:02   | 2 07:46 (vorh. WEA 04) | 20:50                  | 5 06:43 (WEA 01)  | 21:59 |
| 29 08:19                     |         | 07:11                  | 06:40                  | 05:11             | 05:03 |
| 17:04                        |         | 19:56                  | 20:52                  | 21:40             | 21:59 |
| 30 08:17                     |         | 07:09                  | 05:58                  | 05:10             | 05:03 |
| 17:06                        |         | 19:58                  | 20:54                  | 21:42             | 21:59 |
| 31 08:15                     |         | 07:06                  |                        | 05:09             |       |
| 17:08                        |         | 20:00                  |                        | 21:43             |       |
| Sonneneinstrahlung           | 253     |                        |                        | 491               |       |
| astr. max. mögl. Beschattung | 274     | 50                     | 42                     | 145               | 43    |
|                              |         |                        |                        |                   | 507   |

**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) |

## SHADOW - Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEASchattenrezeptor: S - Wilhelmshavener Str. 88, Liethe  
**Voraussetzungen für Berechnung des Schattenwurfs**

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

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

| Jul                       | August               | September            | Oktober | November       | Dzember |
|---------------------------|----------------------|----------------------|---------|----------------|---------|
| 1 05:04                   | 05:43                | 06:14 (vorh. WEA 09) | 06:36   | 07:28          | 07:25   |
| 2 21:59                   | 21:25                | 06:22 (vorh. WEA 09) | 20:19   | 19:07          | 16:58   |
| 3 05:05                   | 05:44                | 06:14 (vorh. WEA 09) | 06:37   | 07:29          | 07:27   |
| 4 21:58                   | 21:23                | 06:22 (vorh. WEA 09) | 20:17   | 19:04          | 16:56   |
| 5 05:05                   | 05:46                | 06:16 (vorh. WEA 09) | 06:39   | 07:14 (WEA 02) | 07:31   |
| 6 21:58                   | 21:21                | 06:23 (vorh. WEA 09) | 20:15   | 07:22 (WEA 02) | 19:02   |
| 7 05:06                   | 05:46                | 06:17 (vorh. WEA 09) | 06:41   | 07:13 (WEA 02) | 07:33   |
| 8 21:58                   | 21:19                | 06:23 (vorh. WEA 09) | 20:12   | 07:23 (WEA 02) | 19:00   |
| 9 05:07                   | 05:49                | 06:19 (vorh. WEA 09) | 06:43   | 07:11 (WEA 02) | 07:35   |
| 10 21:57                  | 21:17                | 06:23 (vorh. WEA 09) | 20:10   | 07:23 (WEA 02) | 18:57   |
| 11 05:08                  | 05:51                | 06:21 (vorh. WEA 09) | 06:44   | 07:11 (WEA 02) | 07:37   |
| 12 21:56                  | 21:15                | 06:23 (vorh. WEA 09) | 20:07   | 07:24 (WEA 02) | 18:55   |
| 13 05:09                  | 05:53                |                      | 06:46   | 07:13 (WEA 02) | 07:38   |
| 14 21:56                  | 21:14                |                      | 20:05   | 07:24 (WEA 02) | 18:53   |
| 15 05:10                  | 05:54                |                      | 06:48   | 07:14 (WEA 02) | 07:40   |
| 16 21:55                  | 21:12                |                      | 20:03   | 07:22 (WEA 02) | 18:50   |
| 17 05:11                  | 05:56                |                      | 06:49   | 07:16 (WEA 02) | 07:42   |
| 18 21:54                  | 21:10                |                      | 20:00   | 07:22 (WEA 02) | 18:48   |
| 19 05:12                  | 05:58                |                      | 06:51   | 07:18 (WEA 02) | 07:44   |
| 20 21:54                  | 21:08                |                      | 19:58   | 07:20 (WEA 02) | 18:45   |
| 21 05:13                  | 05:59                |                      | 06:53   |                | 07:46   |
| 22 21:53                  | 21:06                |                      | 19:55   |                | 18:43   |
| 23 05:14                  | 06:01                |                      | 06:55   |                | 07:47   |
| 24 21:52                  | 21:04                |                      | 19:53   |                | 18:41   |
| 25 05:15                  | 06:03                |                      | 06:56   |                | 07:49   |
| 26 21:51                  | 21:02                |                      | 19:51   |                | 18:39   |
| 27 05:17                  | 06:05                |                      | 06:58   |                | 07:51   |
| 28 21:50                  | 21:00                |                      | 19:48   |                | 18:36   |
| 29 05:18                  | 06:06                | 06:45 (WEA 01)       | 07:00   |                | 07:53   |
| 30 21:49                  | 20:57                | 06:51 (WEA 01)       | 19:46   |                | 18:34   |
| 31 05:19                  | 06:08                | 06:42 (WEA 01)       | 07:02   |                | 07:55   |
| 1 21:48                   | 20:55                | 06:52 (WEA 01)       | 19:43   |                | 18:32   |
| 2 05:20                   | 06:10                | 06:41 (WEA 01)       | 07:03   |                | 07:56   |
| 3 21:47                   | 20:53                | 06:53 (WEA 01)       | 19:41   |                | 18:29   |
| 4 05:22                   | 06:11                | 06:41 (WEA 01)       | 07:05   |                | 07:58   |
| 5 21:45                   | 20:51                | 06:54 (WEA 01)       | 19:38   |                | 18:27   |
| 6 05:23                   | 06:13                | 06:41 (WEA 01)       | 07:07   |                | 07:58   |
| 7 21:44                   | 20:49                | 06:53 (WEA 01)       | 19:36   |                | 18:25   |
| 8 05:24                   | 06:15                | 06:43 (WEA 01)       | 07:08   |                | 07:54   |
| 9 21:43                   | 20:47                | 06:53 (WEA 01)       | 19:34   |                | 18:23   |
| 10 05:26                  | 06:17                | 06:45 (WEA 01)       | 07:10   |                | 07:56   |
| 11 21:42                  | 20:44                | 06:53 (WEA 01)       | 19:31   |                | 18:20   |
| 12 05:27                  | 06:18                | 06:46 (WEA 01)       | 07:12   |                | 07:56   |
| 13 21:40                  | 20:42                | 06:51 (WEA 01)       | 19:29   |                | 18:18   |
| 14 05:29                  | 06:20                | 06:48 (WEA 01)       | 07:14   |                | 07:50   |
| 15 21:39                  | 20:40                | 06:50 (WEA 01)       | 19:26   |                | 18:16   |
| 16 05:30                  | 06:22                |                      | 07:15   |                | 07:41   |
| 17 21:37                  | 20:38                |                      | 19:24   |                | 18:14   |
| 18 05:32                  | 06:24                |                      | 07:17   |                | 07:11   |
| 19 21:36                  | 20:36                |                      | 19:21   |                | 17:12   |
| 20 05:33                  | 06:25                |                      | 07:19   |                | 07:13   |
| 21 21:34                  | 20:33                |                      | 19:19   |                | 17:10   |
| 22 05:35                  | 06:27                |                      | 07:21   |                | 07:15   |
| 23 21:33                  | 20:31                |                      | 19:17   |                | 17:08   |
| 24 05:36                  | 06:29                |                      | 07:22   |                | 07:17   |
| 25 21:31                  | 20:29                |                      | 19:14   |                | 17:06   |
| 26 05:38                  | 06:30                |                      | 07:24   |                | 07:19   |
| 27 21:30                  | 20:26                |                      | 19:12   |                | 17:04   |
| 28 05:40                  | 06:32                |                      | 07:26   |                | 07:21   |
| 29 21:28                  | 20:24                |                      | 19:09   |                | 17:02   |
| 30 05:41                  | 06:15 (vorh. WEA 09) |                      |         |                | 07:23   |
| 31 21:26                  | 06:21 (vorh. WEA 09) |                      |         |                | 17:00   |
| Sonnenscheinstunden       | 509                  |                      |         |                | 329     |
| astr.max.mögl.Beschattung | 6                    | 113                  | 101     | 55             | 9       |

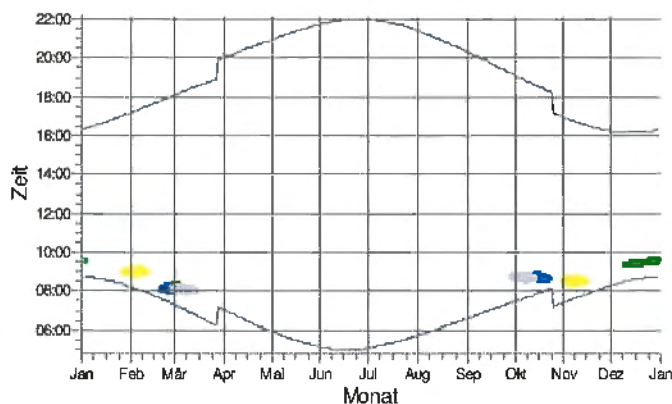
**Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):**

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

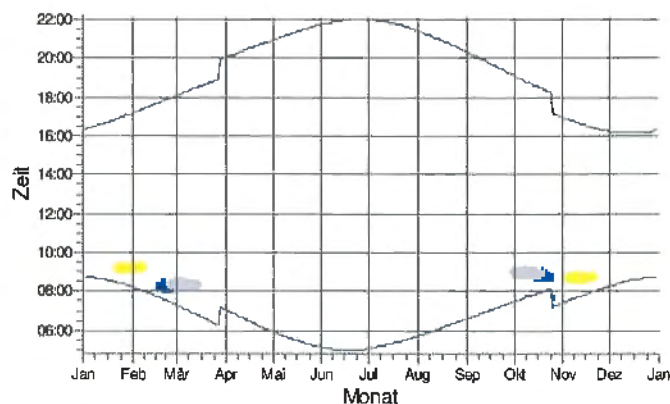
## SHADOW - Grafischer Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

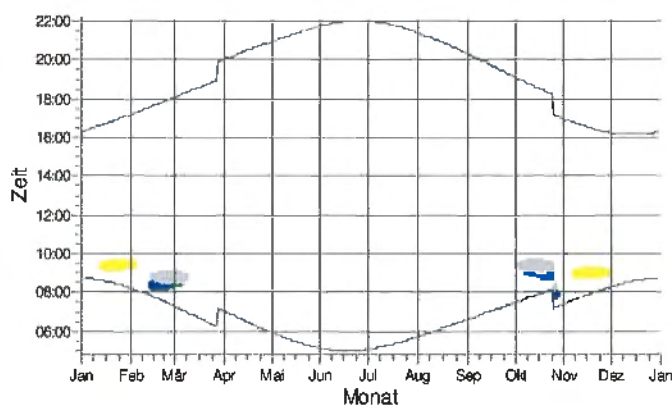
A: Lehmder Str. 99, Lehmden



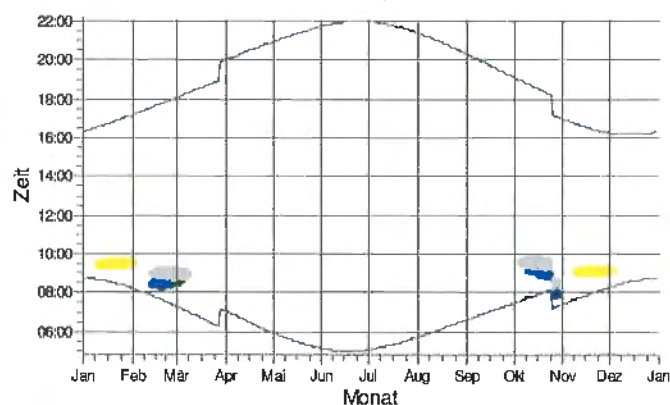
B: Lehmder Str. 103, Lehmden



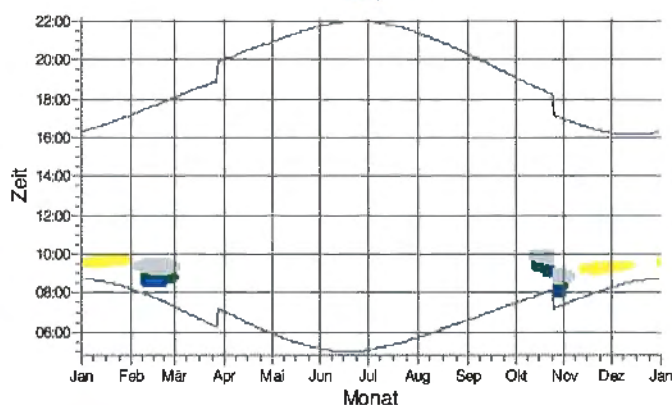
C: Lemder Str. 109, Lehmden



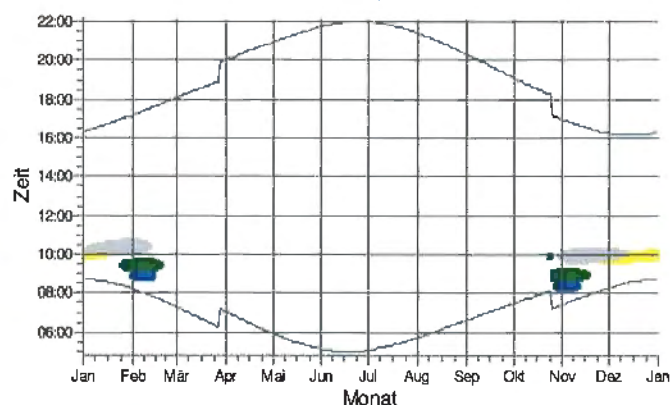
D: Lehmder Str. 109a, Lehmden



E: Lehmder Str. 121, Lehmden



F: Lehmder Str. 125, Lehmden



WEA

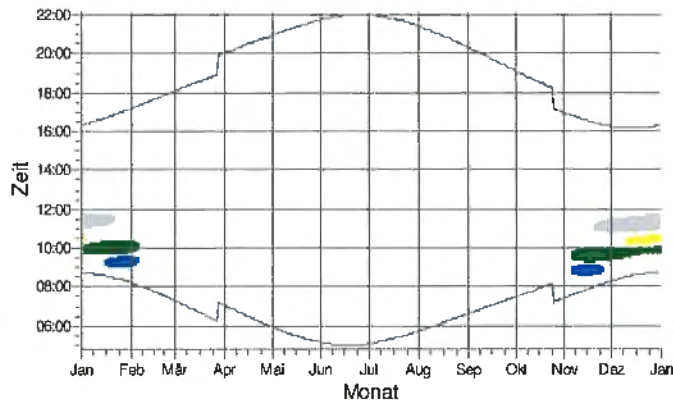
- WEA 01: Enercon E-82 E2 TES (2,3 MW)
- WEA 02: Enercon E-82 E2 TES (2,3 MW)
- WEA 03: Enercon E-82 E2 TES (2,3 MW)

- vorh. WEA 06: NEG Micon NM52
- vorh. WEA 09: Enercon E-58/10.58

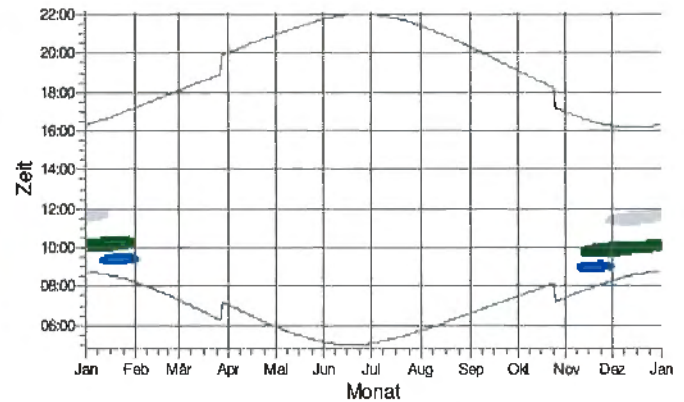
## SHADOW - Grafischer Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

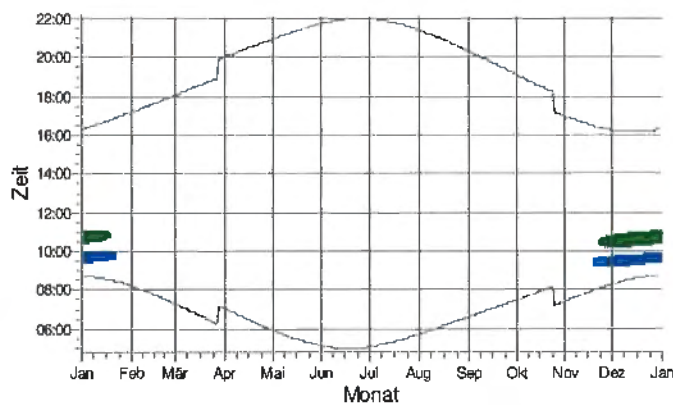
G: Lehmden Str. 143, Lehmden



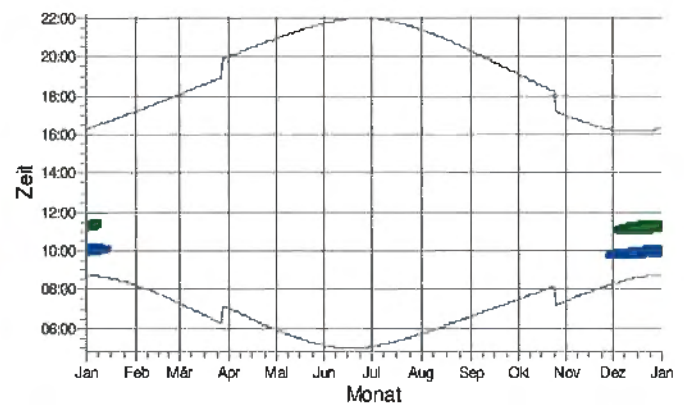
H: Lehmden Str. 145, Lehmden



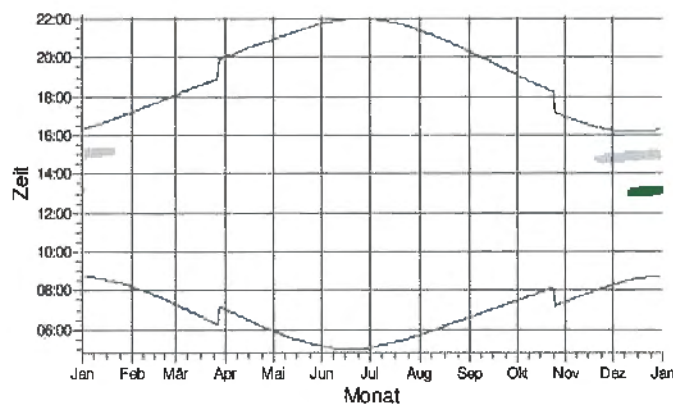
I: Dwoweg 1, Lehmden



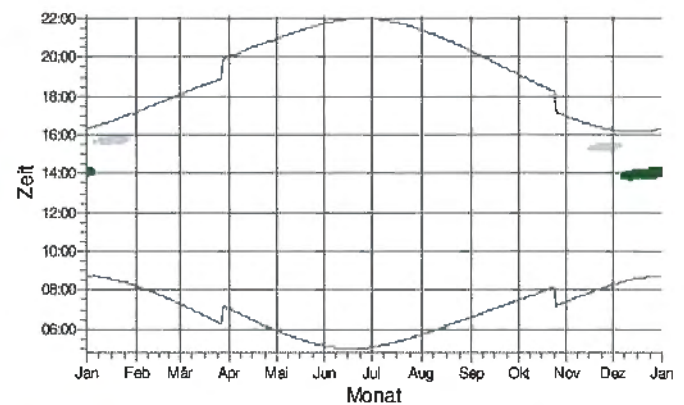
J: Dwoweg 11, Lehmden



K: Dwoweg 39, Lehmden



L: Dwoweg 70, Lehmden



WEA

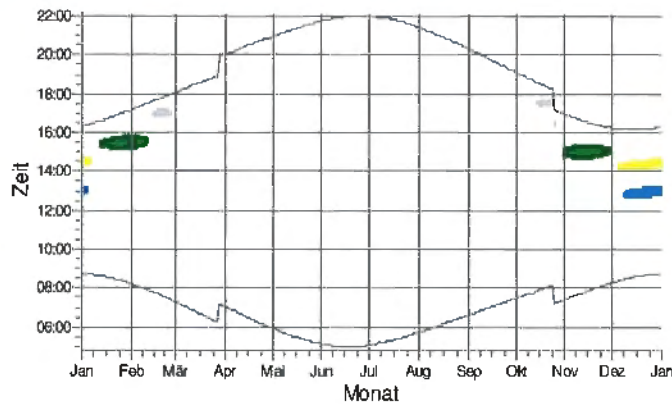
WEA 01: Enercon E-82 E2 TES (2,3 MW)  
WEA 02: Enercon E-82 E2 TES (2,3 MW)

WEA 03: Enercon E-82 E2 TES (2,3 MW)  
vorh. WEA 09: Enercon E-58/10.58

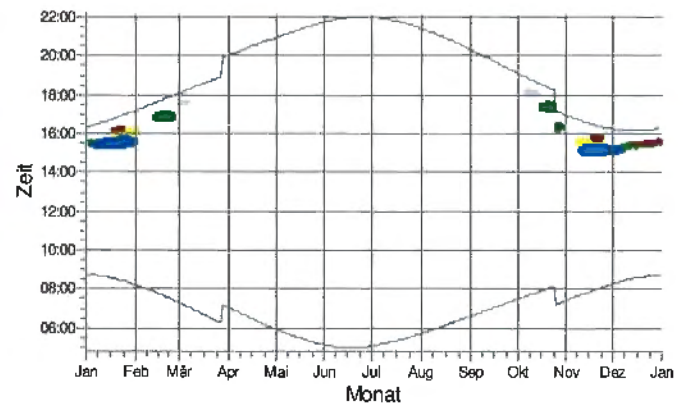
## SHADOW - Grafischer Kalender

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

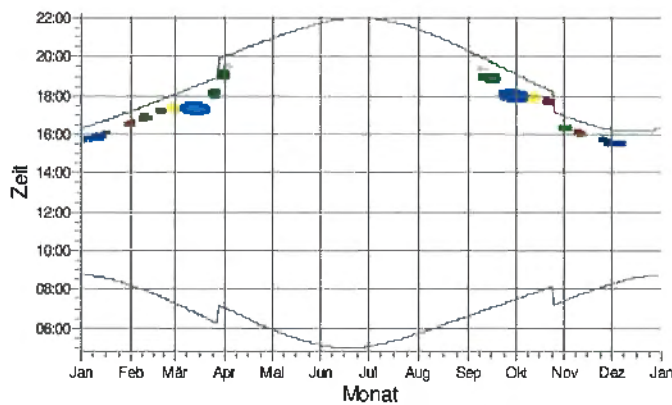
M: Dwoweg 38, Lehmden



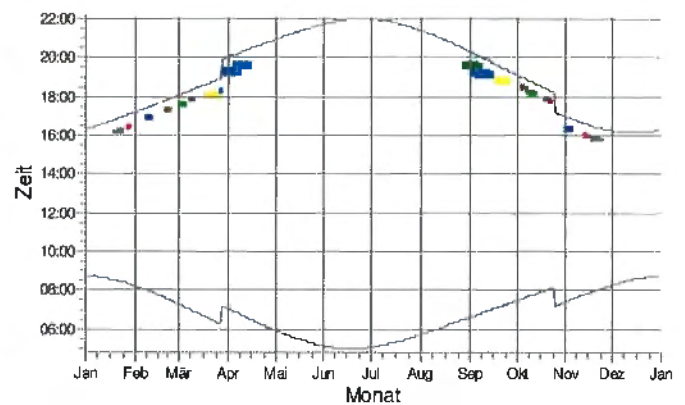
N: Dwoweg 156, Lehmden



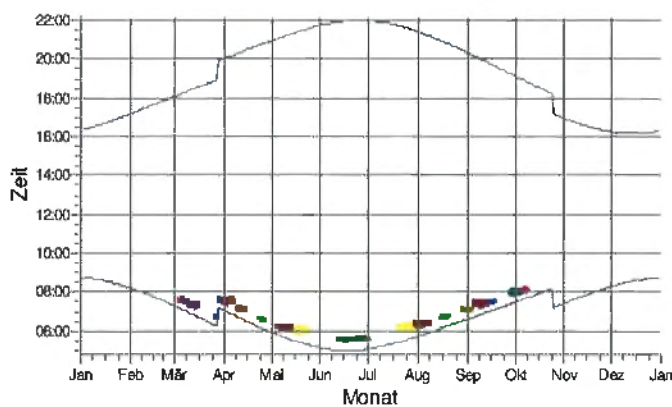
O: Dwoweg 190, Lehmden



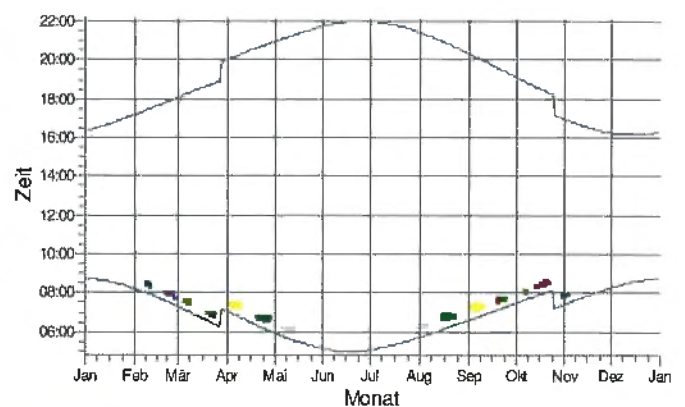
P: Weidenstr. 73, Kleibrok



R: Hohe Looe 2-8 (BÜFA GmbH)



S: Wilhelmshavener Str. 88, Liethe



### WEA

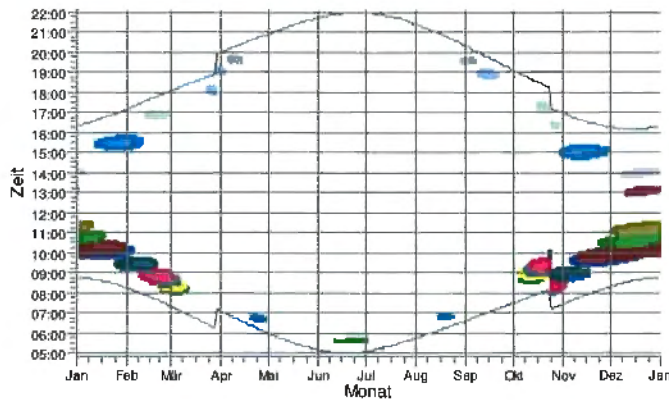
|  |                                      |
|--|--------------------------------------|
|  | WEA 01: Enercon E-82 E2 TES (2,3 MW) |
|  | WEA 02: Enercon E-82 E2 TES (2,3 MW) |
|  | WEA 03: Enercon E-82 E2 TES (2,3 MW) |
|  | vorh. WEA 01: NEG Micon NM52         |
|  | vorh. WEA 02: NEG Micon NM52         |
|  | vorh. WEA 03: NEG Micon NM52         |

|  |                                  |
|--|----------------------------------|
|  | vorh. WEA 04: NEG Micon NM52     |
|  | vorh. WEA 05: NEG Micon NM52     |
|  | vorh. WEA 06: NEG Micon NM52     |
|  | vorh. WEA 07: NEG Micon NM52     |
|  | vorh. WEA 08: NEG Micon NM52     |
|  | vorh. WEA 09: Enercon E-58/10.58 |

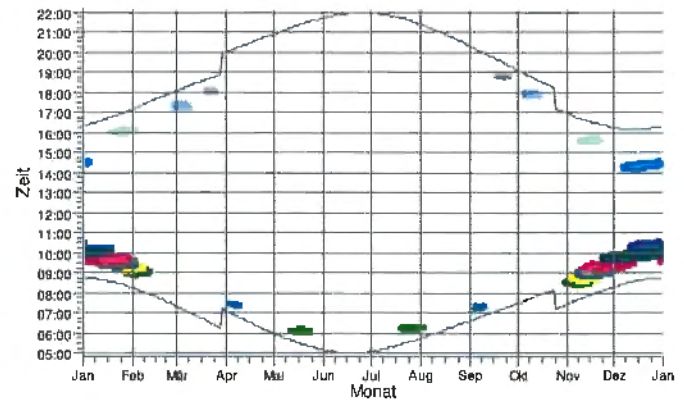
## SHADOW - Grafischer Kalender pro WEA

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

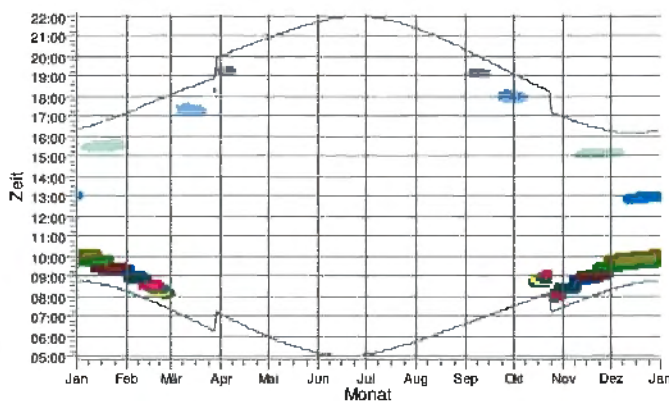
WEA 01: Enercon E-82 E2 TES (2,3 MW)



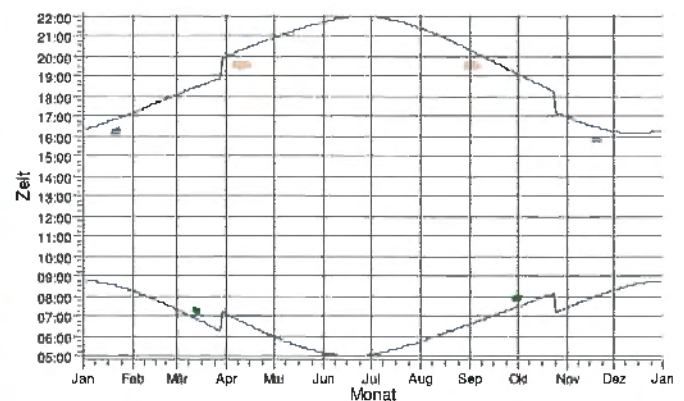
WEA 02: Enercon E-82 E2 TES (2,3 MW)



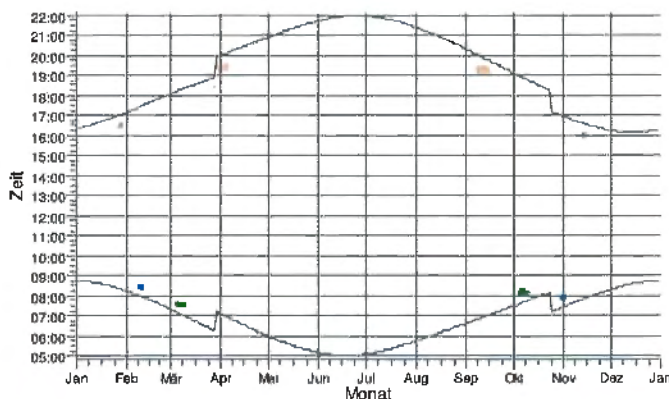
WEA 03: Enercon E-82 E2 TES (2,3 MW)



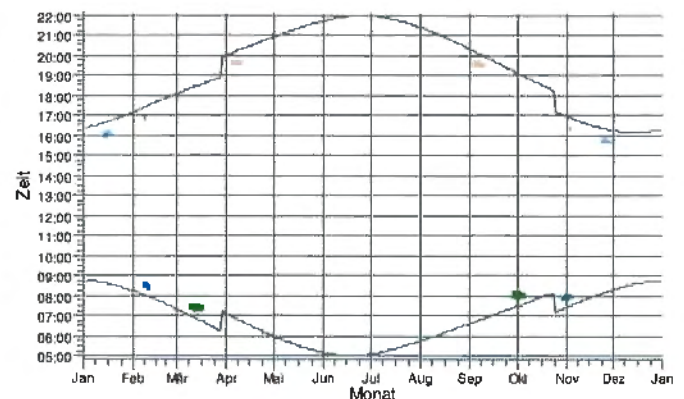
vorh. WEA 01: NEG Micon NM52



vorh. WEA 02: NEG Micon NM52



vorh. WEA 03: NEG Micon NM52



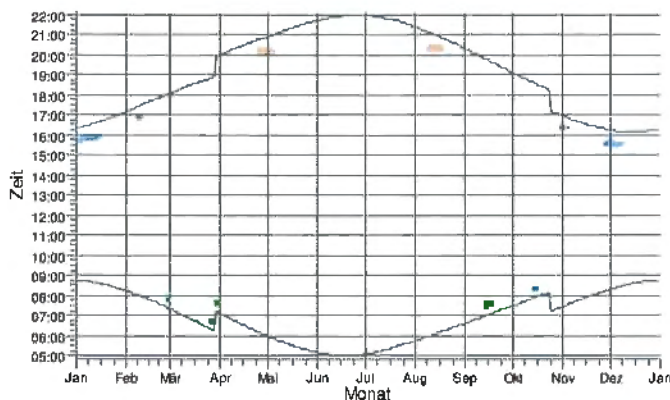
### Schattenrezeptoren

|                               |                              |                                    |
|-------------------------------|------------------------------|------------------------------------|
| A: Lehmden Str. 99, Lehmden   | H: Lehmden Str. 145, Lehmden | O: Dwoweg 190, Lehmden             |
| B: Lehmden Str. 103, Lehmden  | I: Dwoweg 1, Lehmden         | P: Weidenstr. 73, Kleibrok         |
| C: Lehmden Str. 109, Lehmden  | J: Dwoweg 11, Lehmden        | Q: Strothweg 20, Kleibrok          |
| D: Lehmden Str. 109a, Lehmden | K: Dwoweg 39, Lehmden        | R: Hohe Loohe 2-8 (BÜFA GmbH)      |
| E: Lehmden Str. 121, Lehmden  | L: Dwoweg 70, Lehmden        | S: Wilhelmshavener Str. 88, Liethe |
| F: Lehmden Str. 125, Lehmden  | M: Dwoweg 38, Lehmden        |                                    |
| G: Lehmden Str. 143, Lehmden  | N: Dwoweg 156, Lehmden       |                                    |

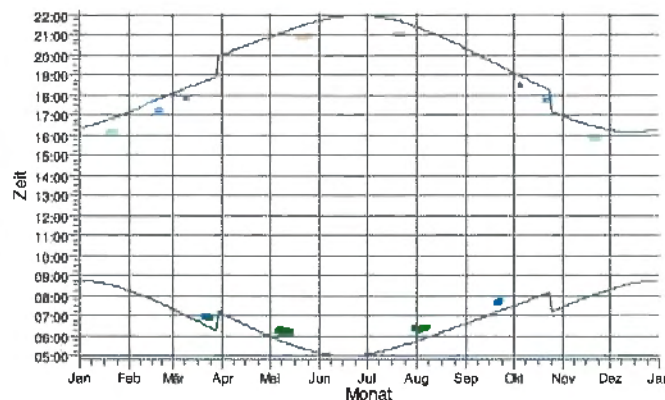
## SHADOW - Grafischer Kalender pro WEA

**Berechnung:** Gesamtbelastung durch 3 gepl. WEA E-82 E2 (TES) und 9 vorh. WEA

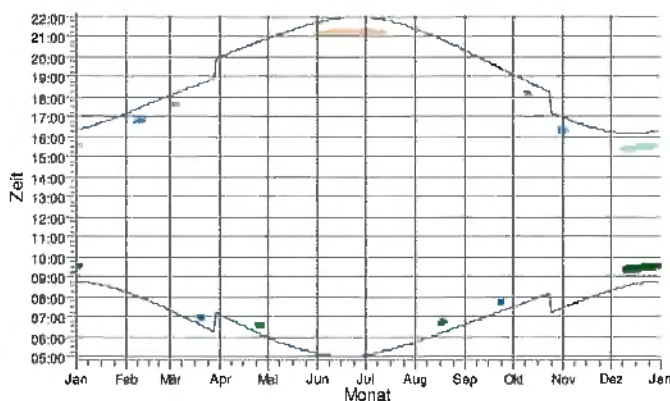
vorh. WEA 04: NEG Micon NM52



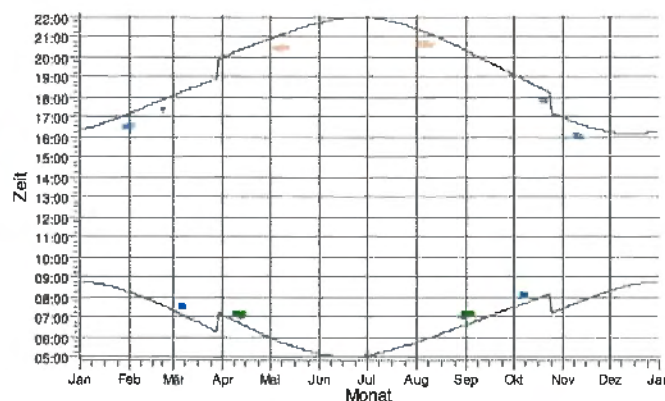
vorh. WEA 05: NEG Micon NM52



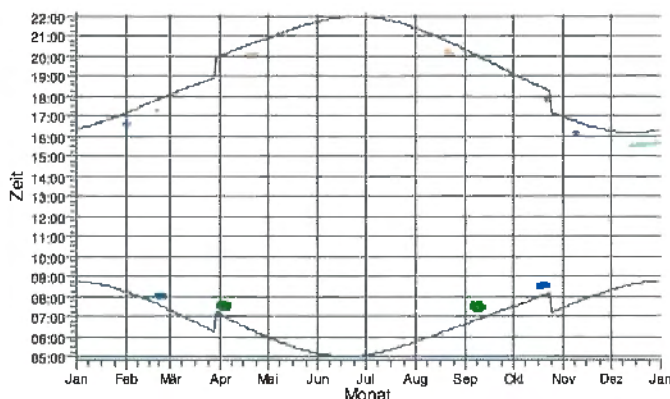
vorh. WEA 06: NEG Micon NM52



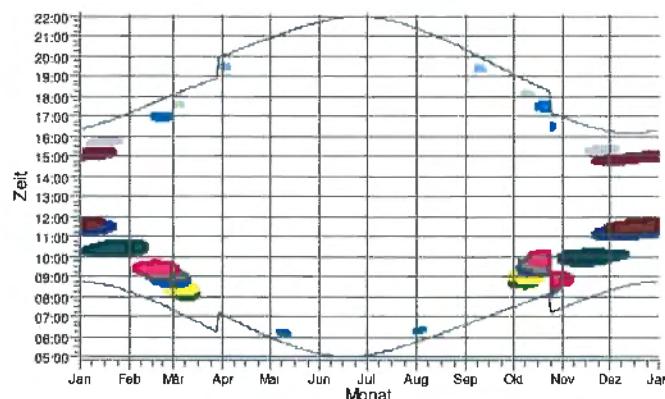
vorh. WEA 07: NEG Micon NM52



vorh. WEA 08: NEG Micon NM52



vorh. WEA 09: Enercon E-58/10.58

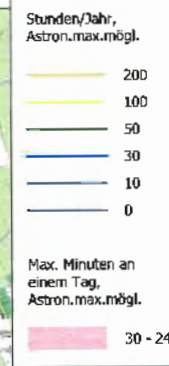
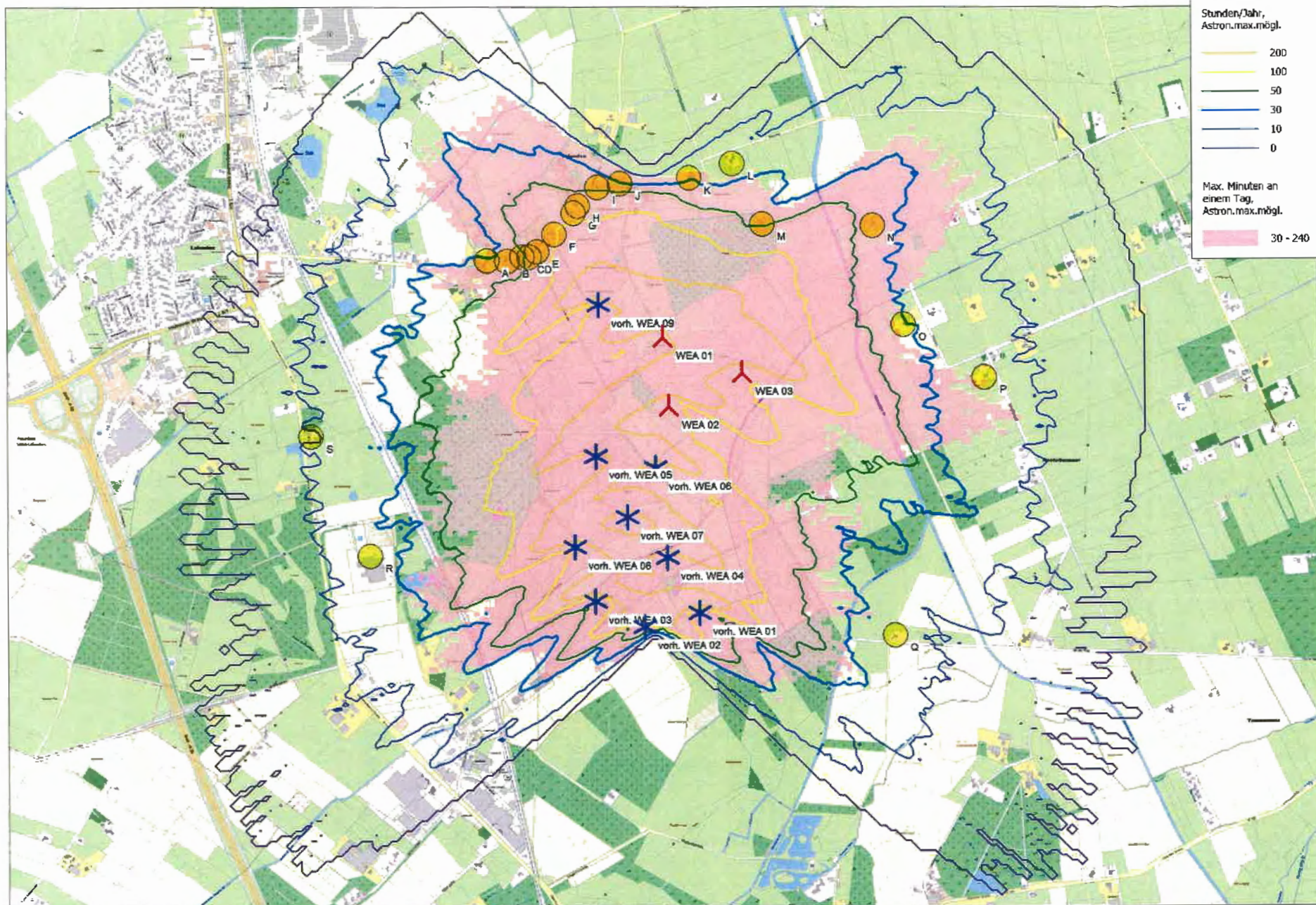


### Schattenrezeptoren

|                               |
|-------------------------------|
| A: Lehmden Str. 99, Lehmden   |
| B: Lehmden Str. 103, Lehmden  |
| C: Lemder Str. 109, Lehmden   |
| D: Lehmden Str. 109a, Lehmden |
| E: Lehmden Str. 121, Lehmden  |
| F: Lehmden Str. 125, Lehmden  |

|                              |
|------------------------------|
| G: Lehmden Str. 143, Lehmden |
| H: Lehmden Str. 145, Lehmden |
| K: Dwoweg 39, Lehmden        |
| L: Dwoweg 70, Lehmden        |
| M: Dwoweg 38, Lehmden        |
| N: Dwoweg 156, Lehmden       |

|                                    |
|------------------------------------|
| O: Dwoweg 190, Lehmden             |
| P: Weidenstr. 73, Kleibrok         |
| Q: Strothweg 20, Kleibrok          |
| R: Hohe Looge 2-8 (BÜFA GmbH)      |
| S: Wilhelmshavener Str. 88, Liethe |



▲ Neue WEA      \* Existierende WEA

Karte: AKS LGLN Rastede, Maßstab 1:15.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 446.020 Nord: 5.903.560  
 ☉ Schattenrezeptor  
 Höhe der Schattenkarte: Höhenlinien: Orographie Lehmden Liethe final bearb..wpo (7)

**SHADOW - Karte**  
 Berechnung:  
 Gens. Information durch 3. vgl. WEA 0.02 (100) und 9. vgl. WEA

Lieferanten Anbieter:  
**Ingenieurbüro PLANKON**  
 Blumenstrasse 26  
 DE-26121 Oldenburg  
 0441 390 34 - 0

Berechnet:  
 11.07.2016 13:03/3.0.629

## Station OLDENBURG

Breite 53 Grad 6 Min. N  
 Laenge 8 Grad 15 Min. E  
 Hoehe 5m ueber NN  
 Zahl der verwendeten Jahre: 28

|      | LUFTTEMPERATUR             |                          |                          |                        |                        | Zahl der     |                |                 | FEUCHTE                            |                                          | NIEDERSCHLAG                                   |                                                                 |       | SONNE                                              | WOLKEN                              |
|------|----------------------------|--------------------------|--------------------------|------------------------|------------------------|--------------|----------------|-----------------|------------------------------------|------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|-------|----------------------------------------------------|-------------------------------------|
|      | mittl.<br>Tages-<br>mittel | mittl.<br>taegl.<br>Max. | mittl.<br>taegl.<br>Min. | abs.<br>taegl.<br>Max. | abs.<br>taegl.<br>Min. | Eis-<br>tage | Frost-<br>tage | Sommer-<br>tage | mittl.<br>Dampf-<br>druck<br>(hPa) | mittl.<br>relat.<br>Feuchte<br>(Prozent) | mittl.<br>Nieder-<br>schlags-<br>Hoehe<br>(mm) | mittlere Zahl<br>der Tage mit<br>Niederschlag<br>von mindestens |       | mittl.<br>Sonnen-<br>schein-<br>dauer<br>(Stunden) | mittlere<br>Bewoelkung<br>(Prozent) |
|      |                            |                          | (GradC)                  |                        |                        |              |                |                 |                                    |                                          |                                                | 1 mm                                                            | 10 mm |                                                    |                                     |
| Jan. | .7                         | 2.9                      | -1.9                     | 13.0                   | -20.5                  | 7            | 17             |                 | 6.0                                | 87                                       | 66.1                                           | 13                                                              | 1     |                                                    | 81                                  |
| Feb. | 1.1                        | 3.9                      | -1.8                     | 16.8                   | -18.5                  | 5            | 17             |                 | 5.8                                | 84                                       | 41.3                                           | 10                                                              | 1     |                                                    | 77                                  |
| Mrz. | 3.8                        | 7.5                      | .5                       | 23.7                   | -19.7                  | 1            | 13             |                 | 6.6                                | 80                                       | 55.7                                           | 12                                                              | 1     |                                                    | 74                                  |
| Apr. | 7.5                        | 12.2                     | 3.1                      | 29.4                   | -6.8                   |              | 5              | 0               | 7.9                                | 76                                       | 48.5                                           | 11                                                              | 1     |                                                    | 68                                  |
| Mai  | 12.2                       | 17.0                     | 7.2                      | 31.0                   | -2.2                   |              | 1              | 2               | 10.5                               | 74                                       | 65.0                                           | 11                                                              | 2     |                                                    | 68                                  |
| Juni | 15.3                       | 20.2                     | 10.3                     | 32.8                   | 1.0                    |              |                | 5               | 13.2                               | 75                                       | 74.5                                           | 12                                                              | 2     |                                                    | 68                                  |
| Juli | 16.6                       | 21.3                     | 12.0                     | 35.0                   | 3.7                    |              |                | 6               | 15.0                               | 78                                       | 74.3                                           | 11                                                              | 2     |                                                    | 69                                  |
| Aug. | 16.4                       | 21.5                     | 11.8                     | 34.3                   | 3.1                    |              |                | 6               | 14.8                               | 79                                       | 68.8                                           | 11                                                              | 2     |                                                    | 64                                  |
| Sep. | 13.5                       | 18.4                     | 9.4                      | 28.4                   | -.2                    |              | 0              | 1               | 13.0                               | 83                                       | 58.1                                           | 10                                                              | 1     |                                                    | 66                                  |
| Okt. | 9.6                        | 13.5                     | 6.2                      | 25.2                   | -3.8                   |              | 2              | 0               | 10.5                               | 85                                       | 61.0                                           | 11                                                              | 2     |                                                    | 72                                  |
| Nov. | 5.2                        | 7.8                      | 2.5                      | 19.0                   | -11.7                  | 1            | 7              |                 | 8.0                                | 87                                       | 67.4                                           | 13                                                              | 2     |                                                    | 80                                  |
| Dez. | 2.1                        | 4.2                      | -.3                      | 15.0                   | -17.0                  | 6            | 15             |                 | 6.6                                | 88                                       | 69.3                                           | 13                                                              | 2     |                                                    | 82                                  |
| Jahr | 8.7                        | 12.5                     | 4.9                      | 35.0                   | -20.5                  | 19           | 74             | 20              | 9.8                                | 81                                       | 749.9                                          | 138                                                             | 18    |                                                    | 72                                  |