

SCHATTENWURFPROGNOSE

für vier Windenergieanlagen

am Standort

Hillekopf-Winterberg | NRW

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Die vorliegende Schattenwurfprognose für den Standort Hillekopf-Winterberg (NRW) wurde der Ramboll Deutschland GmbH von der Enova Windpark Hillekopf-Hildfeld GmbH & Co. KG in Auftrag gegeben. Die Ramboll Deutschland GmbH ist nach DIN EN ISO/IEC 17025:2018 [1] u. a. für die Erstellung von Schattenwurfprognosen akkreditiert. Die firmenintern verwendeten Berechnungsverfahren gemäß den zuvor genannten Anforderungen sind in der Ramboll-Qualitätsmanagement Prozessbeschreibung „Schatten“ festgelegt und dokumentiert.

Die Ergebnisse basieren auf Berechnungen nach den Empfehlungen der Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI) [2] sowie den vom Auftraggeber und dem WEA-Hersteller gestellten Standort- und Anlagendaten. Die Berechnungen wurden mit dem Softwareprogramm windPRO (Modul SHADOW) von EMD International A/S [3] durchgeführt.

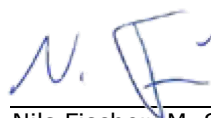
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Nr.	Datum	Bearbeiter:in	Beschreibung
001	20.03.2025	H. Ristow	Planung von vier WEA des Typs Enercon E-175 EP5 E2

Kassel, 20.03.2025



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1 ZUSAMMENFASSUNG

Am Windparkstandort Hillekopf-Winterberg wurden für 60 Immissionsorte (IO) die Beschattungsdauern durch vier neu geplante WEA des Typs Enercon E-175 EP5 E2 mit 175 m Nabenhöhe sowie eine Vorbelastungs-WEA entsprechend den WKA-Schattenwurfhinweisen [2] berechnet. Den Berechnungen wurde ein Worst-Case-Szenario zugrunde gelegt. Die Immissionsrichtwerte betragen dabei maximal 30 Stunden im Jahr und maximal 30 Minuten am Tag.

Diese Werte werden ohne schattenwurfbegrenzende Maßnahmen an 49 Immissionsorten überschritten (siehe Kapitel 3). Die WKA-Schattenwurfhinweise sehen für diesen Fall vor, dass der Schattenwurf der WEA, die eine erstmalige oder weitere Überschreitung verursachen, mittels einer Abschaltautomatik entsprechend den Richtwerten begrenzt wird. Im vorliegenden Fall betrifft dies die WEA Hild 2 und Hild 4.

Von einer schädlichen Umwelteinwirkung bzw. einer erheblichen Belästigung i. S. d. BImSchG ist bei entsprechenden Abschaltungen demnach nicht auszugehen.

Die Grundlagen für die Berechnung sowie die detaillierten Berechnungsergebnisse sind den folgenden Kapiteln zu entnehmen.

2 STANDORT- UND WEA-DATEN

2.1 Aufgabenstellung

Der Auftraggeber plant am Standort Hillekopf-Winterberg vier WEA des Typs Enercon E-175 EP5 E2 mit 175 m Nabenhöhe zu errichten (siehe Tabelle 1).

Tabelle 1: Kenndaten der geplanten WEA

Bez.	Hersteller / Typ	Nabenhöhe (m)	Koordinaten (UTM 32 ETRS89)	
			Ost	Nord
Hild 1	Enercon E-175 EP5 E2	175	471.323	5.676.485
Hild 2	Enercon E-175 EP5 E2	175	470.943	5.676.666
Hild 3	Enercon E-175 EP5 E2	175	471.192	5.675.968
Hild 4	Enercon E-175 EP5 E2	175	470.901	5.676.294

In der Nähe des geplanten Standorts existieren bereits drei weitere WEA bzw. befinden sich in einem Planungsstadium. Diese werden als Vorbelastungen untersucht und werden im folgenden Text als „Vorbelastung“ oder „VB“ bezeichnet (siehe 2.4).

Es sollen die Immissionen durch periodischen Schattenwurf der Windenergieanlagen nach den Grundlagen der WKA-Schattenwurfhinweise [2] an der umliegenden Bebauung berechnet werden.

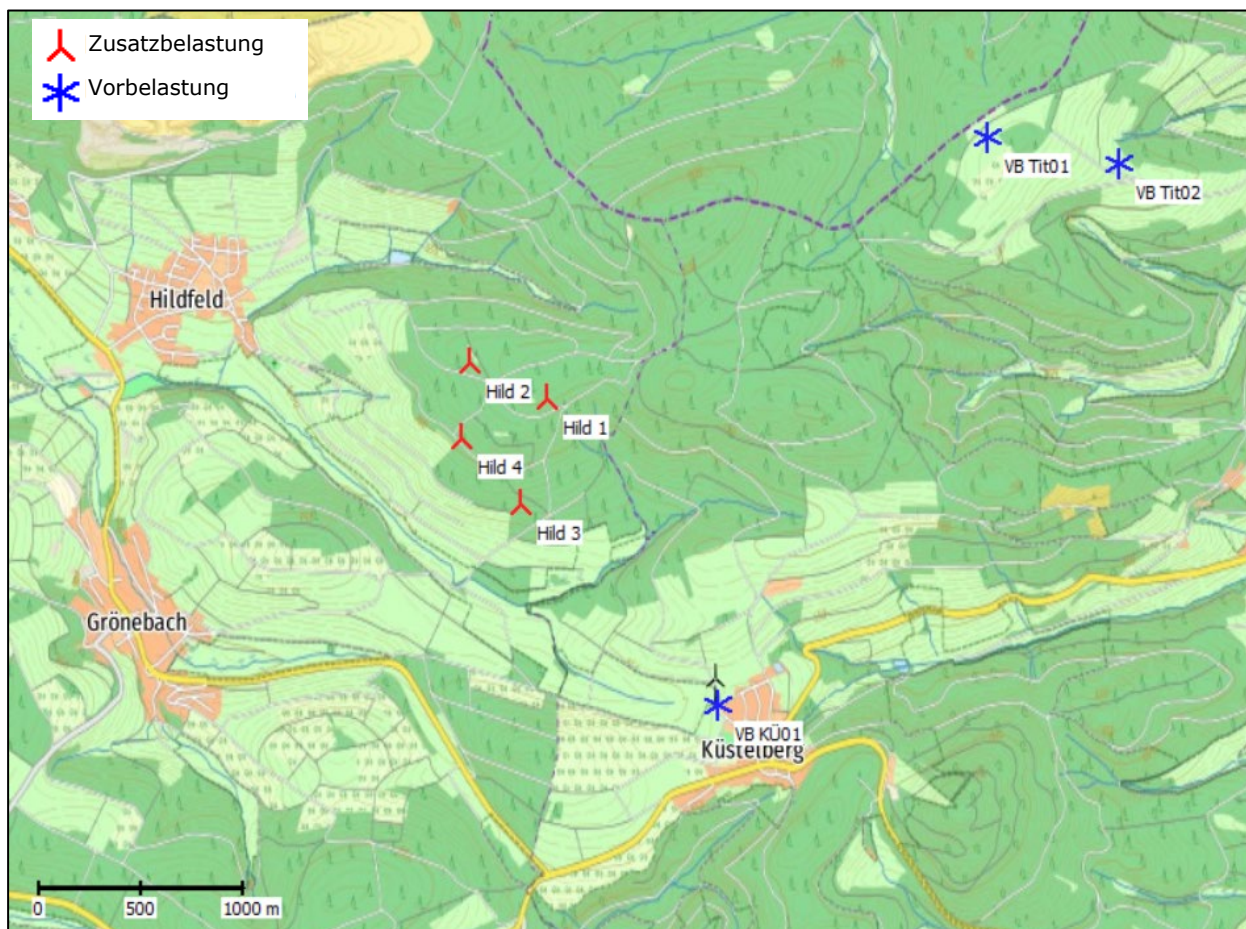


Abbildung 1: Übersichtskarte

Grundlage der Berechnung sind die vom Auftraggeber zur Verfügung gestellten Daten der geplanten WEA (Typ, Nabenhöhe, Koordinaten) sowie die bei der Standortbesichtigung am 30.10.2024 erhobenen Daten über relevante Immissionsorte und deren Umgebung. Das Höhenrelief wurde dem DGM5 NRW entnommen. Die Berechnung wurde mit der Software windPRO, Modul SHADOW [3] durchgeführt. Grundlagen zur Berechnung finden sich im Anhang.

2.2 Immissionsorte

Die *Maßgeblichen Immissionsorte* sind nach den WKA-Schattenwurfhinweisen schutzwürdige Räume sowie bebaubare Freiflächen. Sie werden nach den folgenden Bedingungen ausgewählt:

- Es muss geometrisch möglich sein, dass die Orte von den neu geplanten WEA im Jahresverlauf beschattet werden,
- Die Orte liegen innerhalb des Beschattungsbereichs der neu geplanten WEA nach dem 20%-Kriterium [4].

Die Grenzen des Beschattungsbereichs nach dem 20 %-Kriterium der WKA-Schattenwurfhinweise der geplanten WEA (Zusatzbelastung, „ZB“) sind auf der Karte in Abbildung 2 als rote Linie dargestellt.

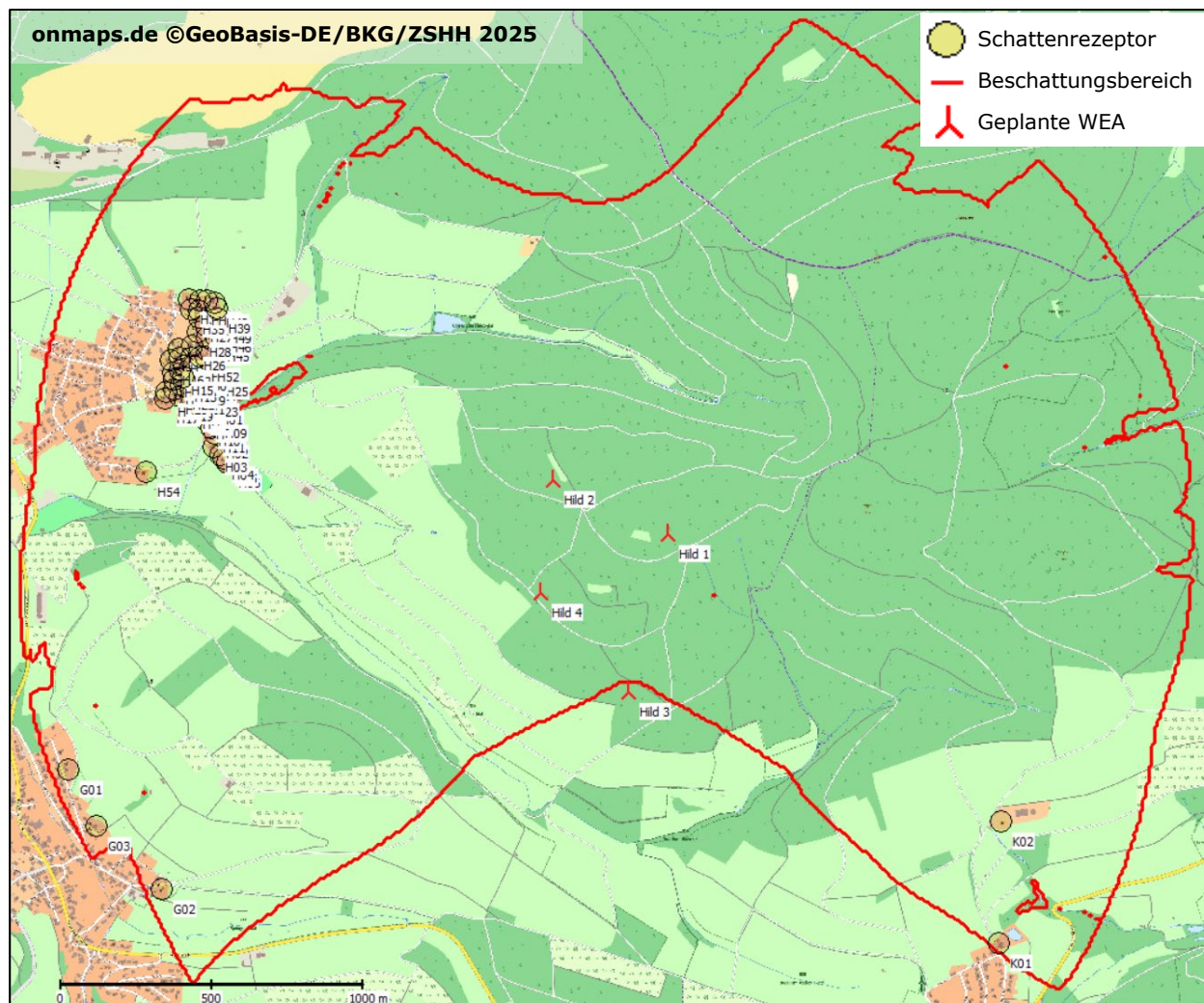


Abbildung 2: Beschattungsbereich der Zusatzbelastung

Nach diesen Kriterien wurden 60 Gebäude im schattenkritischen Bereich als relevante Immissionsorte ausgewählt (siehe Abschnitt 3.1). Bei der Standortbesichtigung am 30.10.2024 wurden diese Immissionsorte begutachtet und dokumentiert.

Die Immissionsorte werden entsprechend den WKA-Schattenwurfhinweisen im Modell als punktförmige Schatten-Rezeptoren (0,1 m x 0,1 m, horizontale Ausrichtung, 2 m ü. Gr.) nachgebildet, welche Schatten aus allen Richtungen empfangen (Gewächshaus-Modus). Die Lage der Rezeptoren ist in den folgenden Abbildungen eingezeichnet.

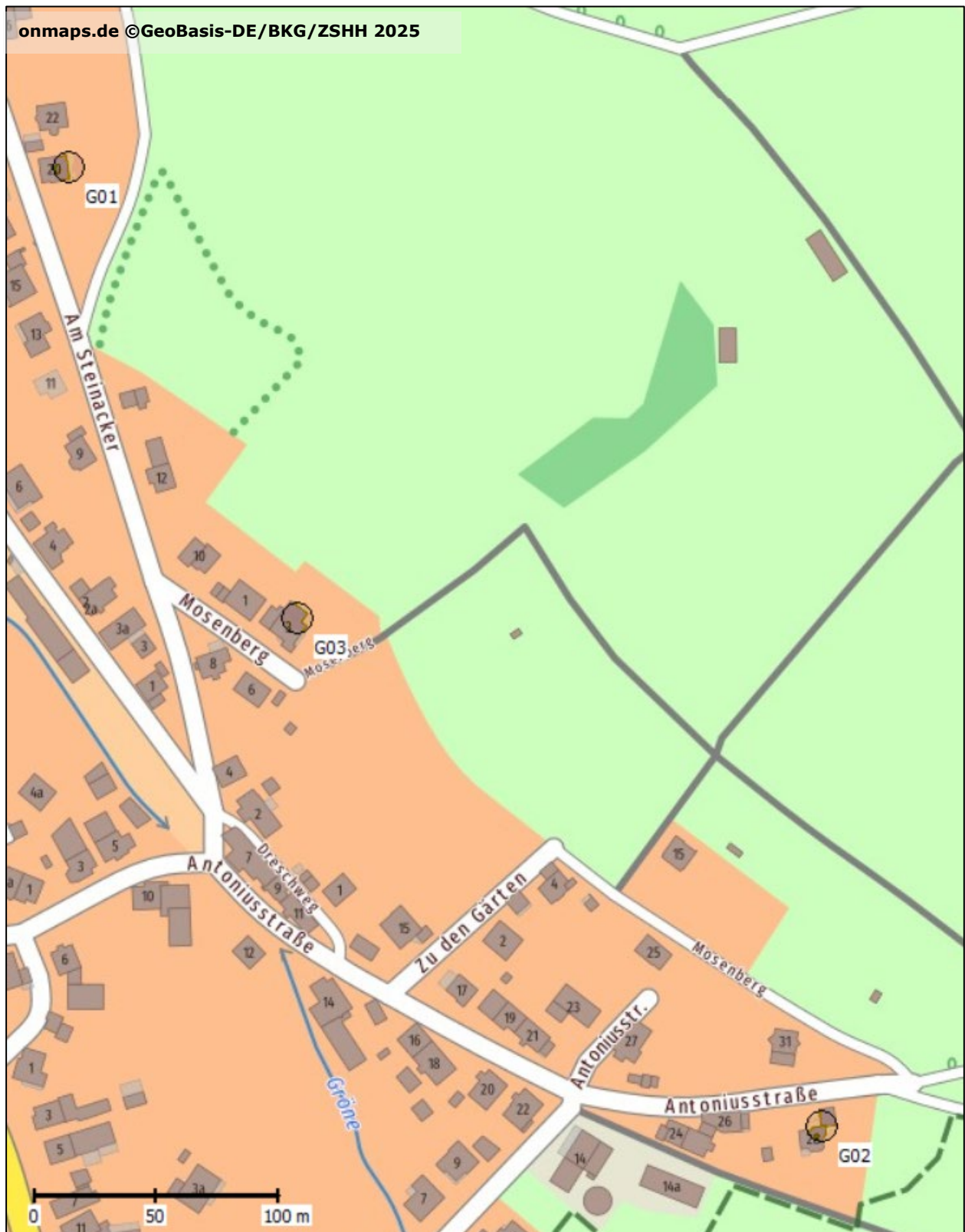


Abbildung 3: Lage der Immissionsorte G01 bis G03 in Grönebach

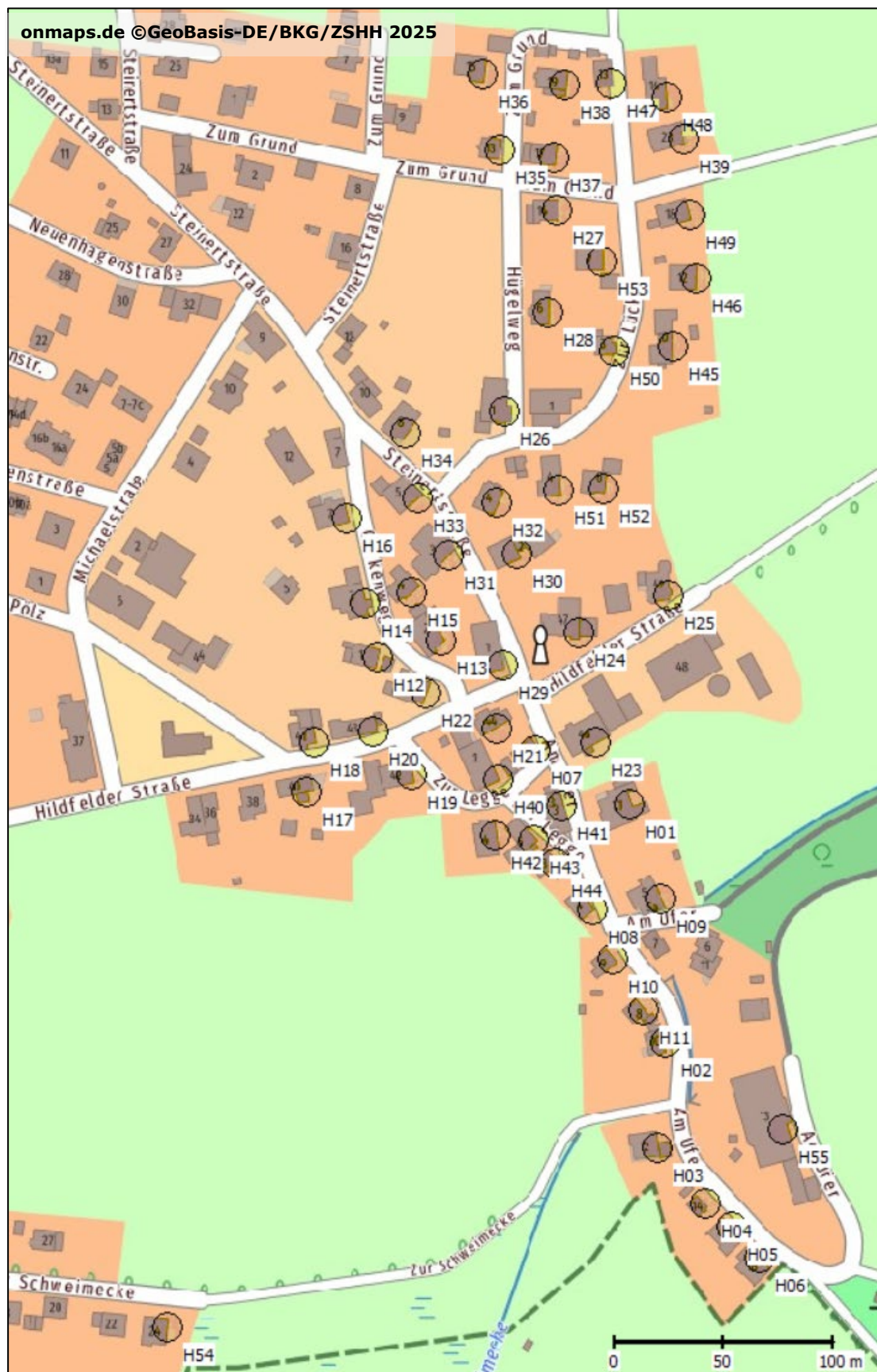


Abbildung 4: Lage der Immissionsorte H01 bis H55 in Hildfeld

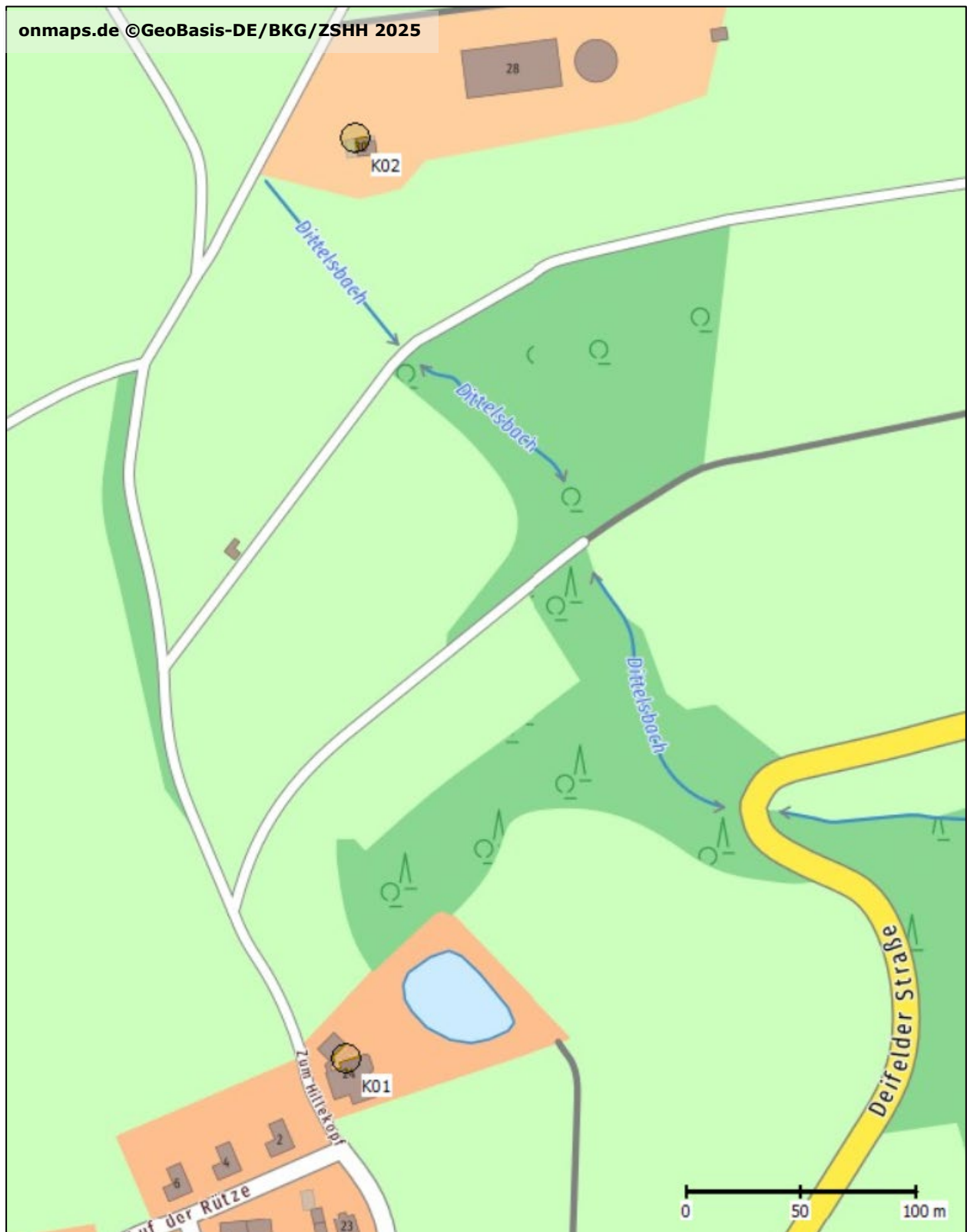


Abbildung 5: Lage der Immissionsorte K01 und K02 in Küstelberg

2.3 Immissionsrichtwerte

Für die Beurteilung der Erheblichkeit der Belästigung durch Schattenwurf [5] [6] wurden in den WKA-Schattenwurfhinweisen folgende Immissionsrichtwerte festgelegt:

Astronomisch maximal mögliche Beschattungsdauer (Worst-Case-Betrachtung):

- maximal 30 Stunden Beschattung pro Jahr,
- maximal 30 Minuten Beschattung pro Tag.

Reale jährliche Beschattungsdauer:

- maximal 8 Stunden Beschattung pro Jahr,
- maximal 30 Minuten Beschattung pro Tag.

Überschreiten die Beschattungsdauern die Richtwerte an den Immissionsorten müssen die Anlagen mit einer Schattenabschaltautomatik ausgestattet werden, die die Beschattungsdauer entsprechend den Richtwerten begrenzt. Die in Kapitel 4 dargestellten Beurteilungen und Empfehlungen basieren auf den Richtwerten für astronomisch maximal mögliche Beschattungszeiten.

2.4 Windenergieanlagen

Der Antragsteller plant am Standort Hillekopf-Winterberg die Errichtung von vier WEA.

In näherer Umgebung befindet sich eine WEA (HSW30¹ in Küstelberg) in Betrieb und 2 WEA (Vestas V172 in Titmaringhausen) befinden sich in einem Genehmigungsverfahren. Auf folgender Abbildung ist ersichtlich, dass sich innerhalb der Schnittmenge der Einwirkungsbereiche der geplanten WEA (rote Linie) und der beiden WEA in Titmaringhausen (blaue Linie) keine Immissionsorte befinden. Daher können die beiden WEA in Titmaringhausen bei der weiteren Untersuchung außer Betracht gelassen werden.

¹ Zum WEA-Typ HSW30 liegen leider keine Geometriedaten der Rotorblätter vor. Hilfsweise wurden Geometriedaten an die Dimensionen vergleichbarer WEA angepasst.

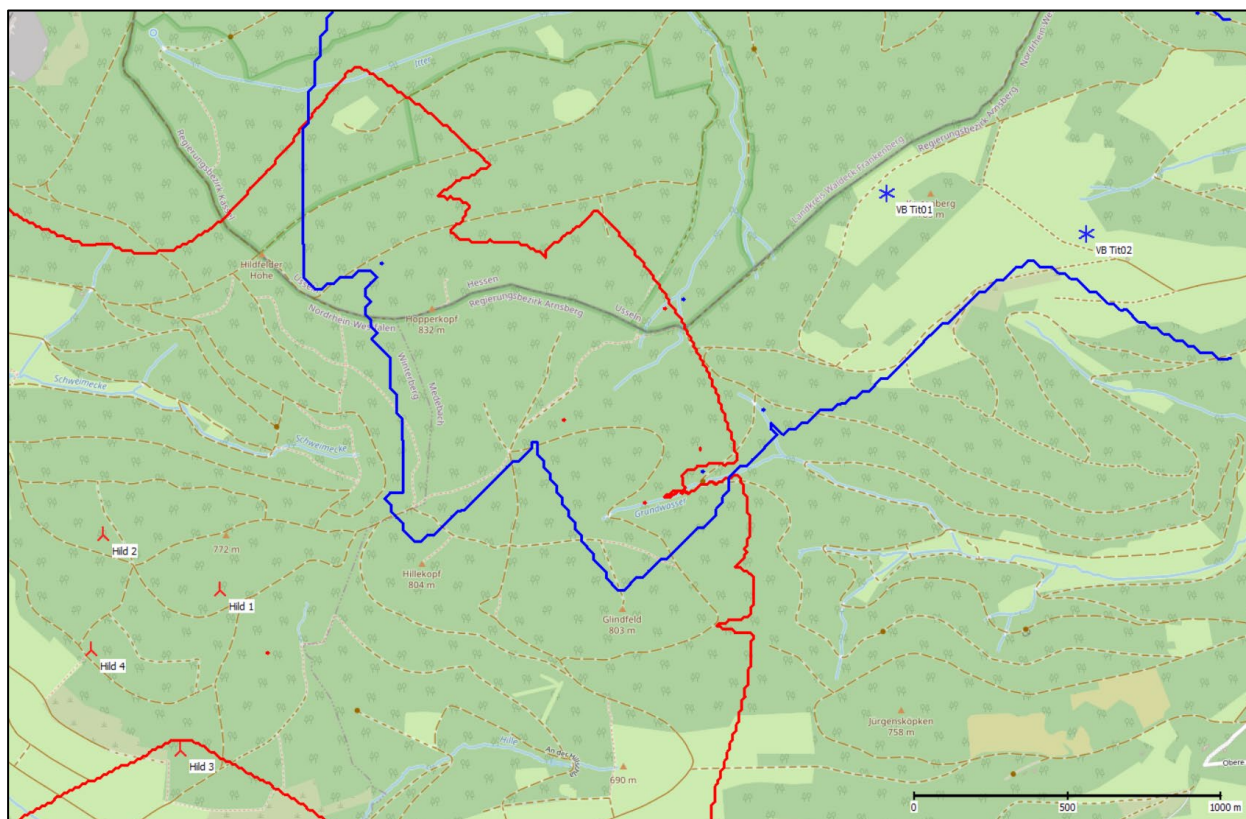


Abbildung 6: Einwirkbereiche der geplanten WEA (rote Linie) und der beiden beantragten WEA in Titmaringhausen (blaue Linie)

Innerhalb der Einwirkbereiche der geplanten WEA und der WEA in Küstelberg befinden sich Immissionsorte. Daher wird diese WEA als Vorbelastung berücksichtigt.

Die wesentlichen Kenndaten der neu geplanten WEA sowie der relevanten Vorbelastung sind Tabelle 2 zu entnehmen. Der Beschattungsbereich wurde nach dem 20 %-Kriterium [7] aus den Rotorblattdaten und der Nabenhöhe ermittelt.

Tabelle 2: Kenndaten Zusatzbelastung (fett) und relevante Vorbelastungs-WEA

Bez.	Typ	NH (m)	RD (m)	max. BT (m)	min. BT (m)	Ø BT (m)	BB (m)
Hild 4	E-175 EP5 E2	175,0	175,0	4,01	1,11	2,56	1.735
Hild 2	E-175 EP5 E2	175,0	175,0	4,01	1,11	2,56	1.735
Hild 3	E-175 EP5 E2	175,0	175,0	4,01	1,11	2,56	1.735
Hild 1	E-175 EP5 E2	175,0	175,0	4,01	1,11	2,56	1.735
VB KÜ01	HSW30	37,0	14,0	1,00	0,80	0,90	612

NH: Nabenhöhe, RD: Rotordurchmesser, BT: Blatttiefe, BB: Beschattungsbereich

3 SCHATTENWURFBERECHNUNGEN

3.1 Astronomisch maximal mögliche Beschattungsdauer

Für die geplanten und als Vorbelastung berücksichtigten WEA wurde die astronomisch maximal mögliche Beschattungsdauer an den relevanten Immissionsorten berechnet. Hierbei handelt sich um eine Worst-Case-Betrachtung, d. h. ohne Berücksichtigung von Bewölkung und Stillstandszeiten sowie unter Annahme eines immer zum Sonnenazimut ausgerichteten Rotors (maximale Schattenfläche). Die Berechnungen werden ohne Berücksichtigung der Sichtverschattung durch Bebauung und Bewuchs durchgeführt.

Es wurden folgende Berechnungen durchgeführt:

- Vorbelastung (VB) durch bestehende WEA
- Zusatzbelastung (ZB) durch die neu geplanten WEA
- Gesamtbelastung (GB) durch alle relevanten WEA (Es wurden nur die WEA berücksichtigt, in deren Beschattungsbereich ein Rezeptor liegt.)

Die Ergebnisse der Berechnungen können Kapitel 3.3 entnommen werden. Die fett hervorgehobenen Werte überschreiten die Immissionsrichtwerte nach den WKA-Schattenwurfhinweisen [2]. Die Beschattungszeiten im Tages- und Jahresverlauf können den tabellarischen und grafischen Kalendern in Anhang entnommen werden.

3.2 Meteorologisch wahrscheinliche Beschattungsdauer

Die jährlich im Mittel auftretende, meteorologisch wahrscheinliche Beschattungsdauer ist für die Genehmigung eines Vorhabens zunächst nicht relevant, sie kann jedoch den Behördenvertretern, Anlagenplanern und Betroffenen einen Eindruck über die tatsächliche, durchschnittlich zu erwartende Belastung geben. Zudem enthält sie Hinweise auf mögliche Abschalthäufigkeiten, da i. d. R. die Begrenzung auf die reale Beschattungsdauer von acht Stunden pro Jahr steuerungstechnisch umgesetzt wird (siehe Freund [8]). Sie berücksichtigt statistische Daten zu

- Sonnenscheinwahrscheinlichkeit (mittlere tägliche Sonnenscheinstunden) je Monat, nach Angaben der Sonnenschein-Datenbank für die Station Brilon,
- Betriebswahrscheinlichkeit der WEA je Richtungssektor sowie Rotorschattenstellung, ermittelt aus der sektoralen Windstatistik der DWD-Station Kahler Asten, der Anlaufgeschwindigkeit der WEA und der jeweiligen Lage der Rezeptoren.

Aus den Daten werden zeit- und ortsabhängig differenzierte Wahrscheinlichkeiten des Schattenwurfs berechnet und diese über das Jahr summiert. Da die Berechnung stark von der Qualität der meteorologischen Eingangsdaten abhängt und lokale Gegebenheiten davon abweichen können, sind die Berechnungsergebnisse mit Unsicherheiten von etwa 5-15 % behaftet und haben abschätzenden Charakter.

3.3 Darstellung der Berechnungsergebnisse

In den folgenden Tabellen werden die Berechnungsergebnisse für die Beschattungsdauern ohne Schattenwurfbegrenzende Maßnahmen für jeden der 60 untersuchten Immissionsorte dargestellt.

Tabelle 3: Astronomisch maximal mögliche Beschattungsdauern pro Jahr

Bez.	Adresse	Beschattungsdauer: Astronomisch maximal möglich					
		(Std./Jahr)			(Std./Tag)		
		VB	ZB	GB	VB	ZB	GB
G01	Grönebach, Am Steinacker 20	0:00	21:17	21:17	0:00	0:26	0:26
G02	Grönebach, Antoniusstr. 28	0:00	24:49	24:49	0:00	0:26	0:26
G03	Grönebach, Mosenberg 3	0:00	14:34	14:34	0:00	0:24	0:24
H01	Hildfeld, Am Ufer 1	0:00	52:55	52:55	0:00	0:33	0:33
H02	Hildfeld, Am Ufer 10	0:00	37:39	37:39	0:00	0:34	0:34
H03	Hildfeld, Am Ufer 12	0:00	60:07	60:07	0:00	0:35	0:35
H04	Hildfeld, Am Ufer 14	0:00	63:31	63:31	0:00	0:35	0:35
H05	Hildfeld, Am Ufer 16	0:00	65:03	65:03	0:00	0:36	0:36
H06	Hildfeld, Am Ufer 18	0:00	67:11	67:11	0:00	0:36	0:36
H07	Hildfeld, Am Ufer 2	0:00	38:49	38:49	0:00	0:32	0:32
H08	Hildfeld, Am Ufer 4	0:00	53:36	53:36	0:00	0:33	0:33
H09	Hildfeld, Am Ufer 5	0:00	36:21	36:21	0:00	0:34	0:34
H10	Hildfeld, Am Ufer 6	0:00	55:15	55:15	0:00	0:34	0:34
H11	Hildfeld, Am Ufer 8	0:00	57:15	57:15	0:00	0:34	0:34
H12	Hildfeld, Gerkenweg 1	0:00	34:10	34:10	0:00	0:30	0:30
H13	Hildfeld, Gerkenweg 2	0:00	35:14	35:14	0:00	0:31	0:31
H14	Hildfeld, Gerkenweg 3	0:00	28:34	28:34	0:00	0:30	0:30
H15	Hildfeld, Gerkenweg 4	0:00	34:10	34:10	0:00	0:30	0:30
H16	Hildfeld, Gerkenweg 7	0:00	27:56	27:56	0:00	0:30	0:30
H17	Hildfeld, Hildfelder Str. 40	0:00	28:16	28:16	0:00	0:30	0:30
H18	Hildfeld, Hildfelder Str. 41	0:00	28:12	28:12	0:00	0:30	0:30
H19	Hildfeld, Hildfelder Str. 42	0:00	36:12	36:12	0:00	0:31	0:31
H20	Hildfeld, Hildfelder Str. 43	0:00	34:43	34:43	0:00	0:30	0:30
H21	Hildfeld, Hildfelder Str. 44	0:00	37:33	37:33	0:00	0:32	0:32
H22	Hildfeld, Hildfelder Str. 45	0:00	35:31	35:31	0:00	0:31	0:31
H23	Hildfeld, Hildfelder Str. 46	0:00	51:03	51:03	0:00	0:33	0:33
H24	Hildfeld, Hildfelder Str. 47	0:00	38:22	38:22	0:00	0:32	0:32
H25	Hildfeld, Hildfelder Str. 49	0:00	50:37	50:37	0:00	0:33	0:33
H26	Hildfeld, Hügelweg 1	0:00	34:30	34:30	0:00	0:31	0:31
H27	Hildfeld, Hügelweg 14	0:00	34:35	34:35	0:00	0:32	0:32
H28	Hildfeld, Hügelweg 6	0:00	34:44	34:44	0:00	0:31	0:31
H29	Hildfeld, Steinertstr. 1	0:00	36:41	36:41	0:00	0:31	0:31

Bez.	Adresse	Beschattungsdauer: Astronomisch maximal möglich					
		(Std./Jahr)			(Std./Tag)		
		VB	ZB	GB	VB	ZB	GB
H30	Hildfeld, Steinertstr. 2	0:00	35:52	35:52	0:00	0:31	0:31
H31	Hildfeld, Steinertstr. 3	0:00	34:31	34:31	0:00	0:31	0:31
H32	Hildfeld, Steinertstr. 4	0:00	35:09	35:09	0:00	0:31	0:31
H33	Hildfeld, Steinertstr. 5	0:00	33:33	33:33	0:00	0:30	0:30
H34	Hildfeld, Steinertstr. 8	0:00	28:44	28:44	0:00	0:30	0:30
H35	Hildfeld, Zum Grund 13	0:00	30:12	30:12	0:00	0:30	0:30
H36	Hildfeld, Zum Grund 15	0:00	29:45	29:45	0:00	0:30	0:30
H37	Hildfeld, Zum Grund 17	0:00	34:25	34:25	0:00	0:32	0:32
H38	Hildfeld, Zum Grund 19	0:00	31:23	31:23	0:00	0:31	0:31
H39	Hildfeld, Zum Grund 23	0:00	37:42	37:42	0:00	0:35	0:35
H40	Hildfeld, Zur Legge 1	0:00	38:18	38:18	0:00	0:32	0:32
H41	Hildfeld, Zur Legge 3	0:00	50:57	50:57	0:00	0:33	0:33
H42	Hildfeld, Zur Legge 4	0:00	38:51	38:51	0:00	0:32	0:32
H43	Hildfeld, Zur Legge 6	0:00	50:45	50:45	0:00	0:32	0:32
H44	Hildfeld, Zur Legge 8	0:00	51:34	51:34	0:00	0:33	0:33
H45	Hildfeld, Zur Lücke 10	0:00	37:57	37:57	0:00	0:32	0:32
H46	Hildfeld, Zur Lücke 12	0:00	38:12	38:12	0:00	0:33	0:33
H47	Hildfeld, Zur Lücke 13	0:00	35:52	35:52	0:00	0:34	0:34
H48	Hildfeld, Zur Lücke 14	0:00	37:18	37:18	0:00	0:35	0:35
H49	Hildfeld, Zur Lücke 18	0:00	37:57	37:57	0:00	0:34	0:34
H50	Hildfeld, Zur Lücke 3	0:00	36:29	36:29	0:00	0:31	0:31
H51	Hildfeld, Zur Lücke 4	0:00	36:26	36:26	0:00	0:32	0:32
H52	Hildfeld, Zur Lücke 6	0:00	37:20	37:20	0:00	0:32	0:32
H53	Hildfeld, Zur Lücke 7	0:00	35:53	35:53	0:00	0:31	0:31
H54	Hildfeld, Zur Schweimecke 24	0:00	28:57	28:57	0:00	0:29	0:29
H55	Hildfeld, Am Ufer 13	0:00	65:29	65:29	0:00	0:36	0:36
K01	Küstelberg, Zum Hillekopf 24	2:18	3:58	6:16	0:11	0:14	0:14
K02	Küstelberg, Zum Hillekopf 30	0:00	52:23	52:23	0:00	0:46	0:46

Tabelle 4: Meteorologisch wahrscheinliche Beschattungsdauern pro Jahr

Bez.	Adresse	Beschattungsdauer: Meteorologisch wahrscheinlich (Std./Jahr)		
		VB	ZB	GB
G01	Grönebach, Am Steinacker 20	0:00	5:45	5:41
G02	Grönebach, Antoniusstr. 28	0:00	6:43	6:39
G03	Grönebach, Mosenberg 3	0:00	3:55	3:52

Bez.	Adresse	Beschattungsdauer: Meteorologisch wahrscheinlich (Std./Jahr)		
		VB	ZB	GB
H01	Hildfeld, Am Ufer 1	0:00	10:35	10:28
H02	Hildfeld, Am Ufer 10	0:00	8:43	8:37
H03	Hildfeld, Am Ufer 12	0:00	13:35	13:26
H04	Hildfeld, Am Ufer 14	0:00	14:31	14:22
H05	Hildfeld, Am Ufer 16	0:00	14:57	14:48
H06	Hildfeld, Am Ufer 18	0:00	15:34	15:24
H07	Hildfeld, Am Ufer 2	0:00	8:06	8:00
H08	Hildfeld, Am Ufer 4	0:00	11:10	11:02
H09	Hildfeld, Am Ufer 5	0:00	7:55	7:50
H10	Hildfeld, Am Ufer 6	0:00	11:42	11:34
H11	Hildfeld, Am Ufer 8	0:00	12:22	12:14
H12	Hildfeld, Gerkenweg 1	0:00	6:57	6:53
H13	Hildfeld, Gerkenweg 2	0:00	7:08	7:03
H14	Hildfeld, Gerkenweg 3	0:00	5:45	5:41
H15	Hildfeld, Gerkenweg 4	0:00	6:51	6:47
H16	Hildfeld, Gerkenweg 7	0:00	5:32	5:29
H17	Hildfeld, Hildfelder Str. 40	0:00	5:58	5:54
H18	Hildfeld, Hildfelder Str. 41	0:00	5:52	5:48
H19	Hildfeld, Hildfelder Str. 42	0:00	7:38	7:33
H20	Hildfeld, Hildfelder Str. 43	0:00	7:13	7:09
H21	Hildfeld, Hildfelder Str. 44	0:00	7:47	7:42
H22	Hildfeld, Hildfelder Str. 45	0:00	7:17	7:13
H23	Hildfeld, Hildfelder Str. 46	0:00	9:59	9:53
H24	Hildfeld, Hildfelder Str. 47	0:00	7:44	7:39
H25	Hildfeld, Hildfelder Str. 49	0:00	9:22	9:16
H26	Hildfeld, Hügelweg 1	0:00	6:38	6:34
H27	Hildfeld, Hügelweg 14	0:00	6:05	6:01
H28	Hildfeld, Hügelweg 6	0:00	6:25	6:21
H29	Hildfeld, Steinertstr. 1	0:00	7:28	7:23
H30	Hildfeld, Steinertstr. 2	0:00	7:08	7:03
H31	Hildfeld, Steinertstr. 3	0:00	6:53	6:48
H32	Hildfeld, Steinertstr. 4	0:00	6:55	6:51
H33	Hildfeld, Steinertstr. 5	0:00	6:38	6:33
H34	Hildfeld, Steinertstr. 8	0:00	5:35	5:31
H35	Hildfeld, Zum Grund 13	0:00	5:11	5:07
H36	Hildfeld, Zum Grund 15	0:00	4:55	4:51
H37	Hildfeld, Zum Grund 17	0:00	5:54	5:51

Bez.	Adresse	Beschattungsdauer: Meteorologisch wahrscheinlich (Std./Jahr)		
		VB	ZB	GB
H38	Hildfeld, Zum Grund 19	0:00	5:08	5:04
H39	Hildfeld, Zum Grund 23	0:00	6:16	6:12
H40	Hildfeld, Zur Legge 1	0:00	8:04	7:59
H41	Hildfeld, Zur Legge 3	0:00	10:14	10:08
H42	Hildfeld, Zur Legge 4	0:00	8:20	8:14
H43	Hildfeld, Zur Legge 6	0:00	10:20	10:13
H44	Hildfeld, Zur Legge 8	0:00	10:34	10:28
H45	Hildfeld, Zur Lücke 10	0:00	7:01	6:56
H46	Hildfeld, Zur Lücke 12	0:00	6:50	6:45
H47	Hildfeld, Zur Lücke 13	0:00	5:52	5:48
H48	Hildfeld, Zur Lücke 14	0:00	6:05	6:01
H49	Hildfeld, Zur Lücke 18	0:00	6:34	6:30
H50	Hildfeld, Zur Lücke 3	0:00	6:48	6:44
H51	Hildfeld, Zur Lücke 4	0:00	7:08	7:03
H52	Hildfeld, Zur Lücke 6	0:00	7:17	7:12
H53	Hildfeld, Zur Lücke 7	0:00	6:27	6:23
H54	Hildfeld, Zur Schweimecke 24	0:00	7:10	7:05
H55	Hildfeld, Am Ufer 13	0:00	14:34	14:24
K01	Küstelberg, Zum Hillekopf 24	0:24	0:58	1:23
K02	Küstelberg, Zum Hillekopf 30	0:00	13:27	13:18

4 BEWERTUNG DER ERGEBNISSE

4.1 Beurteilung der Berechnungen

Am Windparkstandort Hillekopf-Winterberg wurden für 60 Immissionsorte die Beschattungsdauern durch vier neu geplante WEA sowie eine Vorbelastungs-WEA entsprechend den WKA-Schattenwurfhinweisen [2] berechnet. Die Immissionsrichtwerte der Beschattungsdauern betragen maximal 30 Stunden im Jahr und maximal 30 Minuten am Tag.

IO G01, G02, G03, H14, H16, H17, H18, H34, H36, H54 und K01: An diesen Immissionsorten werden alle Richtwerte eingehalten.

IO H01 bis H13, H15, H19 bis H33, H35, H37 bis H55 und K02: An diesen Immissionsorten werden die Tages- und/oder Jahreskontingente (Richtwerte) ohne schattenwurfbegrenzende Maßnahmen durch den Einfluss der Zusatzbelastung überschritten.

Aufgrund der berechneten Überschreitungen empfehlen wir eine zeitgesteuerte Abschaltung durch geeignete steuerungstechnische Maßnahmen an den neu geplanten WEA Hild 2 und Hild 4 zu implementieren.

Von einer schädlichen Umwelteinwirkung bzw. einer erheblichen Belästigung i. S. d. BImSchG ist bei entsprechenden Abschaltungen demnach nicht auszugehen.

4.2 Hinweise zur Abschaltautomatik

Über die Programmierung einer Abschaltautomatik werden die Windenergieanlagen zu den Uhrzeiten abgeschaltet, zu denen ein durch sie hervorgerufener Schattenwurf an einem Immissionspunkt zu einer (weiteren) Überschreitung der o.g. Immissionsrichtwerte führt.

Abschaltautomatiken sind so zu programmieren, dass alle betroffenen Bereiche (Fenster, Balkone usw.) an allen relevanten Immissionspunkten im schattenkritischen Bereich berücksichtigt werden. In der Regel geschieht dies über die Erfassung betroffener Fassaden. Aus den hier (für punktförmige Rezeptoren) angegebenen Zeiten kann *nicht* direkt abgeleitet werden, wie viele Minuten die betreffende WEA tatsächlich abgeschaltet werden muss. Betroffene Gebäudebereiche mit nur seltener oder kurzzeitiger räumlicher Nutzung (z. B. Abstellräume, Toiletten o. ä.) sind in der Regel nicht zu berücksichtigen. Schlafräume, Wohnräume oder Küchen dagegen sind im Allgemeinen zu den fraglichen Tageszeiten wesentliche Aufenthaltsorte der Bewohner.

Das erlaubte Kontingent der tatsächlich auftretenden Beschattungszeit (unter Berücksichtigung von Bewölkungsereignissen mit diffusem oder keinem Schattenwurf) pro Immissionsort beträgt 8 Std. / Jahr, welches über einen zusätzlichen Bestrahlungsstärkesensor erfasst und berücksichtigt werden kann, jedoch in diesem Gutachten nicht bewertet wird. Der Sensor bewirkt einen Weiterbetrieb der Anlagen bei Umgebungshelligkeiten, in denen kein Schattenwurf auftritt (z. Bsp. bei $I < 120 \text{ W/m}^2$). Darüber hinaus

können sichtverschattende Objekte wie dauerhafter Bewuchs, Nebengebäude usw. einen Schattenwurf verhindern, wodurch auf eine Abschaltung für das jeweilige Gebäude verzichtet werden kann. Dies kann am einfachsten nach Errichtung der Anlage mit entsprechenden Fotos dokumentiert und berücksichtigt werden.

4.3 Genauigkeit der Prognose

Den Berechnungen nach den Vorgaben der WKA-Schattenwurfhinweise wird ein Worst-Case-Szenario zugrunde gelegt. In diesem Sinne wird die astronomisch maximal mögliche Beschattung zur Beurteilung herangezogen sowie keine lichtundurchlässigen Hindernisse, die den periodischen Schattenwurf von WEA begrenzen, berücksichtigt. Als Basis für die Bestimmung der Position der Immissionsorte dient Kartenmaterial, das auf den Gebäudeumringen des amtlichen Liegenschaftskataster Deutschland (ALKIS) basiert [9]. Das zugrunde gelegte Höhenmodell entspricht dem DGM5 NRW. Damit ist eine Grundgenauigkeit der in eine Prognose eingehenden geometrischen Parameter von mindestens ± 5 m gewährleistet. Die Schattenwurfzeiten werden mit einer Genauigkeit von 1 min pro Tag ausgewiesen. Insgesamt wird damit der geforderten Grundgenauigkeit der in eine Prognose eingehenden geometrischen Parameter (vgl. WKA-Schattenwurfhinweise) entsprochen. Basierend auf der Grundgenauigkeit der Eingangsdaten kann die Unsicherheit bei der Berechnung der Beschattungszeiten mit durchschnittlich ± 1 % angegeben werden [10].

Die detaillierten, auf Grundlage der in Kapitel 2 beschriebenen Daten erzielten Ergebnisse für den Standort Hillekopf-Winterberg sind in Kapitel 3 wiedergegeben. Änderungen an den Positionen der Anlagen, dem Anlagentyp, den in den Herstellerangaben des Anlagentyps genannten Anlagenspezifikationen oder sonstigen relevanten Einflussfaktoren für die Schattenberechnung erfordern neues Gutachten, geringfügige Änderungen der NH oder der Koordinaten von <1 m erfordern i. d. R. keine Neubewertung.

5 QUELLENVERZEICHNIS

- [1] Norm, „DIN EN ISO/IEC 17025:2018-03, Allgemeine Anforderungen an die Kompetenz von Prüf- und Kalibrierlaboratorien,“ 2018.
- [2] LAI, Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen Aktualisierung 2019 (WKA-Schattenwurfhinweise), Bund/Länder-Arbeitsgemeinschaft Immissionsschutz (LAI), 23.01.2020.
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- [5] J.Pohl, F.Faul, R.Mausfeld, Belästigung durch periodischen Schattenwurf von Windenergieanlagen, Feldstudie, Kiel: Institut für Psychologie der Christian-Albrechts-Universität zu Kiel, 31.07.1999.
- [6] J.Pohl, F.Faul, R.Mausfeld, Belästigung durch periodischen Schattenwurf von Windenergieanlagen, Laborpilotstudie, Kiel: Institut für Psychologie der Christian-Albrechts-Universität, 15.05.2000.
- [7] H. D. Freund, Die Reichweite des Schattenwurfs von Windkraftanlagen, Umweltforschungsbank UFORDAT, Juni 1999.
- [8] H. D. Freund, Effektive Einwirkzeit T_w des Schattenwurfs bei $T_{max} = 30$ h/Jahr, Kiel: Institut für Physik und Allgemeine Elektrotechnik, Fachhochschule Kiel, 24.01.2001.
- [9] geoGLIS_oHG, *onmaps GEOBasis-DE / BKG / NRW*, aktuelle Version.
- [10] Ramboll, Interne Analyse zur Sensitivität der Berechnungsergebnisse bezüglich der Genauigkeit der Positionsdaten, 2021-11.
- [11] Landesvermessungsamt des jeweiligen Bundeslandes, Topografische Karte im Maßstab 1:25.000, aktuellste Version.

6 ANHANG

- Beschattungskarten für den Windparkstandort Hillekopf-Winterberg
 - Zusatzbelastung
 - Gesamtbelastung
- Berechnungsergebnisse der Beschattungsdauern an den Immissionsorten
 - Vor- und Zusatzbelastung:
 - Hauptergebnis
 - Gesamtbelastung:
 - Hauptergebnis
 - tabellarische Kalender
 - grafische Kalender
- Akkreditierung
- Theoretische Grundlagen

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

H. Ristow / hri@ramboll.com

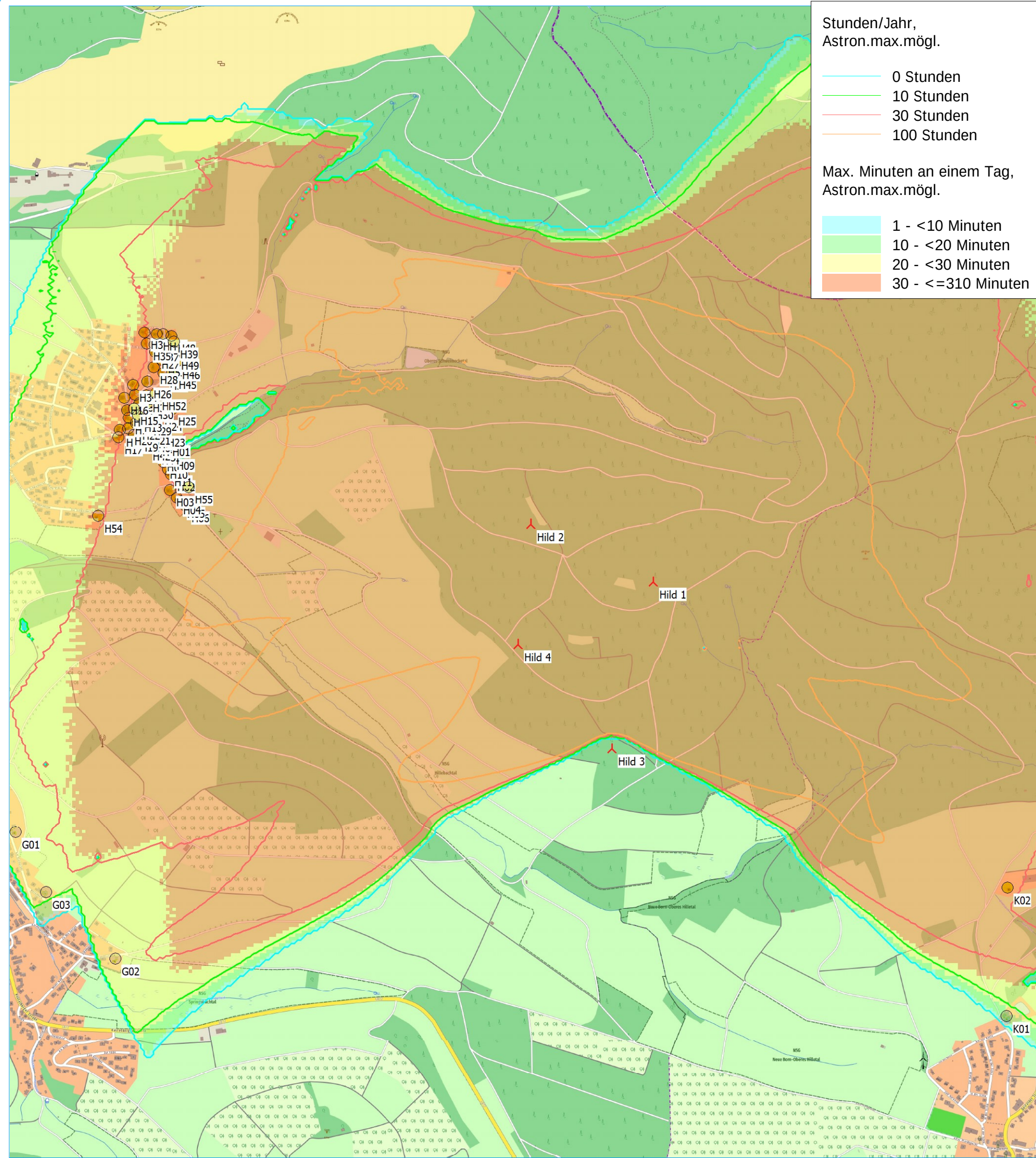
Berechnet:

21.03.2025 11:16/4.1.273

RAMBOLL

SHADOW - Karte

Berechnung: Zusatzbelastung



0 250 500 750 1000m

Karte: onmaps karte , Maßstab 1:12.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 470.924,78 Nord: 5.676.497,71

Neue WEA

Schattenrezeptor

Höhe der Schattenkarte: Höhenlinien: DGM5.wpo (1)

Zeitschritt: 2 Minuten, Schrittweite: 3 Tag(e), Kartenauflösung: 10 m, Sichtbarkeit Auflösung: 5 m, Augenhöhe: 1,5 m

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

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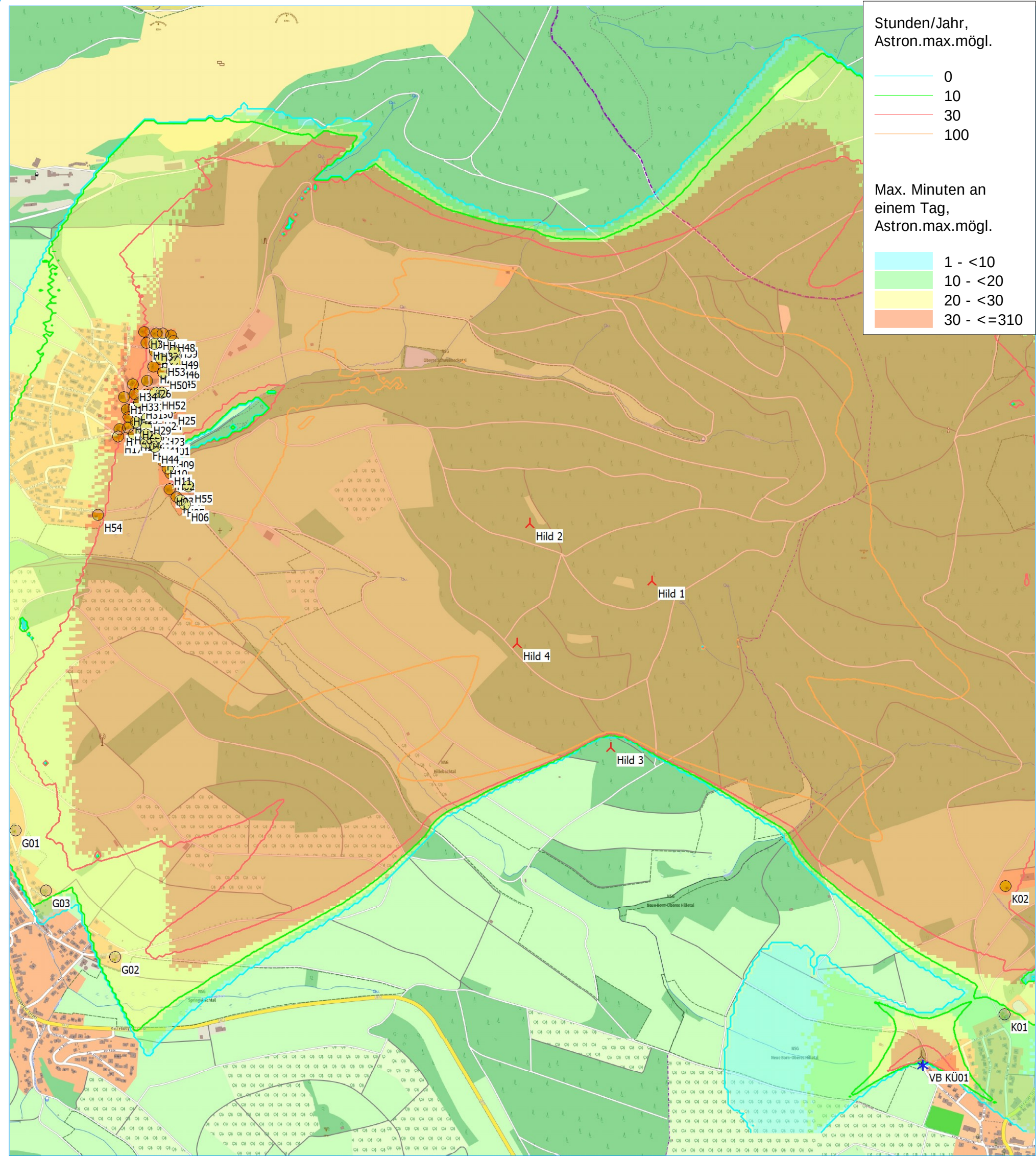
Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Karte

Berechnung: Gesamtbelastung



0 250 500 750 1000m

Karte: onmaps karte , Maßstab 1:12.000, Mitte: UTM (north)-ETRS89 Zone: 32 Ost: 470.924,78 Nord: 5.676.497,71

Neue WEA

Existierende WEA

Schattenrezeptor

Höhe der Schattenkarte: Höhenlinien: DGM5.wpo (1)

Zeitschritt: 2 Minuten, Schrittweite: 3 Tag(e), Kartenauflösung: 10 m, Sichtbarkeit Auflösung: 5 m, Augenhöhe: 1,5 m

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:09/4.1.273

SHADOW - Hauptergebnis

Berechnung: Vorbelastung

Annahmen für Schattenwurfberechnung

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °
Tage zwischen Berechnungen 1 Tag(e)
Berechnungszeitsprung 1 Minuten

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,58	2,64	3,90	5,63	6,26	6,50	6,48	6,13	4,67	3,19	1,70	1,23

Betriebsstunden ermittelt aus WEA in Berechnung und Windverteilung:
Terraindaten: ATLAS; 12 Sektoren; Radius: 20.000 m (29)

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
514	332	289	472	536	476	622	896	1.292	1.203	897	700	8.230

Monatliche Aggregation der met. wahrsch. Reduzierung

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

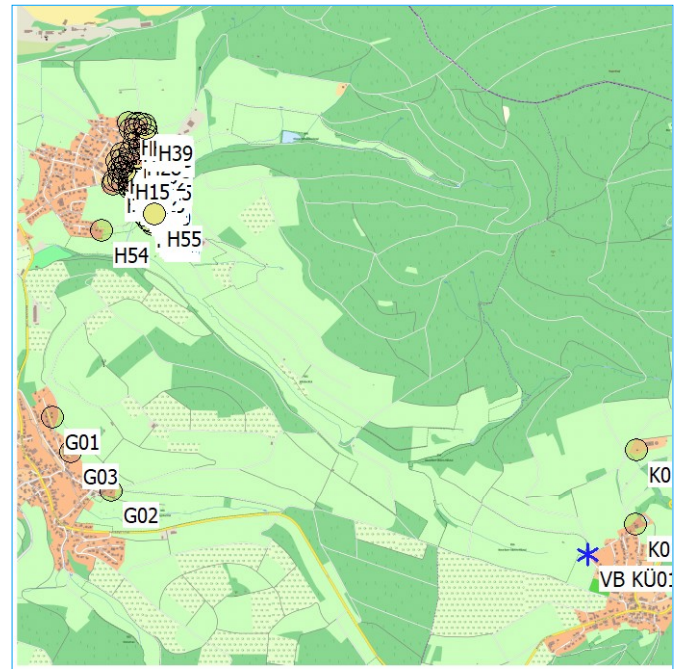
DHM: Höhenlinien: DGM5.wpo (1)

Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:

UTM (north)-ETRS89 Zone: 32

WEA



Maßstab 1:40.000

* Existierende WEA

● Schattenrezeptor

	Ost	Nord	Z	Beschreibung	WEA-Typ			Nennleistung	Rotor-durchmesser	NH	Schattendaten	
					Aktuell	Hersteller	Typ				Beschatt.-Bereich	U/min
			[m]					[kW]	[m]	[m]	[m]	[U/min]
VB KÜ01	472.158,11	5.674.976,46	660,3	HSW 30 30 14.0 !O! NH: 37,0 m (... Nein	HSW		30-30	30	14,0	37,0	612	24,5

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
G01	Grönebach, Am Steinacker 20	469.335,90	5.675.720,94	602,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G02	Grönebach, Antoniusstr. 28	469.643,23	5.675.326,15	599,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G03	Grönebach, Mosenberg 3	469.428,73	5.675.535,25	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H01	Hildfeld, Am Ufer 1	469.810,16	5.676.936,48	604,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H02	Hildfeld, Am Ufer 10	469.825,34	5.676.827,68	597,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H03	Hildfeld, Am Ufer 12	469.821,78	5.676.779,67	595,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H04	Hildfeld, Am Ufer 14	469.843,40	5.676.754,26	599,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H05	Hildfeld, Am Ufer 16	469.855,71	5.676.743,63	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H06	Hildfeld, Am Ufer 18	469.868,45	5.676.729,43	600,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H07	Hildfeld, Am Ufer 2	469.767,30	5.676.961,10	605,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H08	Hildfeld, Am Ufer 4	469.792,55	5.676.888,43	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H09	Hildfeld, Am Ufer 5	469.824,15	5.676.893,29	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H10	Hildfeld, Am Ufer 6	469.802,03	5.676.866,26	599,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H11	Hildfeld, Am Ufer 8	469.815,75	5.676.842,76	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H12	Hildfeld, Gerkenweg 1	469.694,94	5.677.004,19	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H13	Hildfeld, Gerkenweg 2	469.724,11	5.677.011,46	609,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H14	Hildfeld, Gerkenweg 3	469.689,48	5.677.028,60	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H15	Hildfeld, Gerkenweg 4	469.710,87	5.677.033,44	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H16	Hildfeld, Gerkenweg 7	469.681,59	5.677.067,28	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H17	Hildfeld, Hildfelder Str. 40	469.662,09	5.676.942,74	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H18	Hildfeld, Hildfelder Str. 41	469.665,98	5.676.965,67	605,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H19	Hildfeld, Hildfelder Str. 42	469.710,72	5.676.950,00	605,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H20	Hildfeld, Hildfelder Str. 43	469.692,99	5.676.970,37	606,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H21	Hildfeld, Hildfelder Str. 44	469.749,18	5.676.971,07	606,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H22	Hildfeld, Hildfelder Str. 45	469.716,76	5.676.987,42	607,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

(Fortsetzung nächste Seite)...

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:09/4.1.273

SHADOW - Hauptergebnis

Berechnung: Vorbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
H23	Hildfeld, Hildfelder Str. 46	469.794,91	5.676.964,84	607,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H24	Hildfeld, Hildfelder Str. 47	469.786,90	5.677.014,68	611,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H25	Hildfeld, Hildfelder Str. 49	469.828,48	5.677.031,14	613,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H26	Hildfeld, Hügelpweg 1	469.753,78	5.677.115,71	620,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H27	Hildfeld, Hügelpweg 14	469.778,15	5.677.207,20	630,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H28	Hildfeld, Hügelpweg 6	469.773,68	5.677.160,30	625,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H29	Hildfeld, Steinertstr. 1	469.752,40	5.677.000,22	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H30	Hildfeld, Steinertstr. 2	469.758,84	5.677.050,80	614,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H31	Hildfeld, Steinertstr. 3	469.727,76	5.677.050,16	612,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H32	Hildfeld, Steinertstr. 4	469.749,89	5.677.074,15	615,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H33	Hildfeld, Steinertstr. 5	469.714,24	5.677.075,99	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H34	Hildfeld, Steinertstr. 8	469.708,64	5.677.105,92	618,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H35	Hildfeld, Zum Grund 13	469.752,27	5.677.234,51	632,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H36	Hildfeld, Zum Grund 15	469.745,05	5.677.269,19	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H37	Hildfeld, Zum Grund 17	469.777,27	5.677.231,08	632,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H38	Hildfeld, Zum Grund 19	469.782,56	5.677.263,97	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H39	Hildfeld, Zum Grund 23	469.836,34	5.677.239,04	633,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H40	Hildfeld, Zur Legge 1	469.749,72	5.676.948,25	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H41	Hildfeld, Zur Legge 3	469.779,25	5.676.935,76	604,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H42	Hildfeld, Zur Legge 4	469.748,68	5.676.922,37	603,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H43	Hildfeld, Zur Legge 6	469.766,42	5.676.920,39	602,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H44	Hildfeld, Zur Legge 8	469.775,89	5.676.909,93	601,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H45	Hildfeld, Zur Lücke 10	469.831,04	5.677.144,95	623,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H46	Hildfeld, Zur Lücke 12	469.841,79	5.677.175,51	626,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H47	Hildfeld, Zur Lücke 13	469.803,63	5.677.264,73	635,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H48	Hildfeld, Zur Lücke 14	469.829,02	5.677.257,82	635,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H49	Hildfeld, Zur Lücke 18	469.839,38	5.677.204,33	629,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H50	Hildfeld, Zur Lücke 3	469.803,90	5.677.142,42	622,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H51	Hildfeld, Zur Lücke 4	469.778,58	5.677.079,48	616,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H52	Hildfeld, Zur Lücke 6	469.798,64	5.677.080,12	617,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H53	Hildfeld, Zur Lücke 7	469.798,64	5.677.183,42	627,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H54	Hildfeld, Zur Schweimecke 24	469.597,30	5.676.699,46	587,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H55	Hildfeld, Am Ufer 13	469.878,94	5.676.788,22	610,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K01	Küstelberg, Zum Hillekopf 24	472.413,94	5.675.132,36	655,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K02	Küstelberg, Zum Hillekopf 30	472.420,34	5.675.531,80	679,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

Berechnungsergebnisse

Schattenrezeptor

		astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer	
Nr.	Name	Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr	
		[h/a]	[d/a]	[h/d]	[h/a]	
G01	Grönebach, Am Steinacker 20	0:00	0	0:00	0:00	
G02	Grönebach, Antoniusstr. 28	0:00	0	0:00	0:00	
G03	Grönebach, Mosenberg 3	0:00	0	0:00	0:00	
H01	Hildfeld, Am Ufer 1	0:00	0	0:00	0:00	
H02	Hildfeld, Am Ufer 10	0:00	0	0:00	0:00	
H03	Hildfeld, Am Ufer 12	0:00	0	0:00	0:00	
H04	Hildfeld, Am Ufer 14	0:00	0	0:00	0:00	
H05	Hildfeld, Am Ufer 16	0:00	0	0:00	0:00	
H06	Hildfeld, Am Ufer 18	0:00	0	0:00	0:00	
H07	Hildfeld, Am Ufer 2	0:00	0	0:00	0:00	
H08	Hildfeld, Am Ufer 4	0:00	0	0:00	0:00	
H09	Hildfeld, Am Ufer 5	0:00	0	0:00	0:00	
H10	Hildfeld, Am Ufer 6	0:00	0	0:00	0:00	
H11	Hildfeld, Am Ufer 8	0:00	0	0:00	0:00	
H12	Hildfeld, Gerkenweg 1	0:00	0	0:00	0:00	
H13	Hildfeld, Gerkenweg 2	0:00	0	0:00	0:00	
H14	Hildfeld, Gerkenweg 3	0:00	0	0:00	0:00	
H15	Hildfeld, Gerkenweg 4	0:00	0	0:00	0:00	
H16	Hildfeld, Gerkenweg 7	0:00	0	0:00	0:00	
H17	Hildfeld, Hildfelder Str. 40	0:00	0	0:00	0:00	
H18	Hildfeld, Hildfelder Str. 41	0:00	0	0:00	0:00	
H19	Hildfeld, Hildfelder Str. 42	0:00	0	0:00	0:00	

(Fortsetzung nächste Seite)...

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:09/4.1.273

SHADOW - Hauptergebnis

Berechnung: Vorbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr
		[h/a]	[d/a]	[h/d]	[h/a]
H20	Hildfeld, Hildfelder Str. 43	0:00	0	0:00	0:00
H21	Hildfeld, Hildfelder Str. 44	0:00	0	0:00	0:00
H22	Hildfeld, Hildfelder Str. 45	0:00	0	0:00	0:00
H23	Hildfeld, Hildfelder Str. 46	0:00	0	0:00	0:00
H24	Hildfeld, Hildfelder Str. 47	0:00	0	0:00	0:00
H25	Hildfeld, Hildfelder Str. 49	0:00	0	0:00	0:00
H26	Hildfeld, Hügelweg 1	0:00	0	0:00	0:00
H27	Hildfeld, Hügelweg 14	0:00	0	0:00	0:00
H28	Hildfeld, Hügelweg 6	0:00	0	0:00	0:00
H29	Hildfeld, Steinertstr. 1	0:00	0	0:00	0:00
H30	Hildfeld, Steinertstr. 2	0:00	0	0:00	0:00
H31	Hildfeld, Steinertstr. 3	0:00	0	0:00	0:00
H32	Hildfeld, Steinertstr. 4	0:00	0	0:00	0:00
H33	Hildfeld, Steinertstr. 5	0:00	0	0:00	0:00
H34	Hildfeld, Steinertstr. 8	0:00	0	0:00	0:00
H35	Hildfeld, Zum Grund 13	0:00	0	0:00	0:00
H36	Hildfeld, Zum Grund 15	0:00	0	0:00	0:00
H37	Hildfeld, Zum Grund 17	0:00	0	0:00	0:00
H38	Hildfeld, Zum Grund 19	0:00	0	0:00	0:00
H39	Hildfeld, Zum Grund 23	0:00	0	0:00	0:00
H40	Hildfeld, Zur Legge 1	0:00	0	0:00	0:00
H41	Hildfeld, Zur Legge 3	0:00	0	0:00	0:00
H42	Hildfeld, Zur Legge 4	0:00	0	0:00	0:00
H43	Hildfeld, Zur Legge 6	0:00	0	0:00	0:00
H44	Hildfeld, Zur Legge 8	0:00	0	0:00	0:00
H45	Hildfeld, Zur Lücke 10	0:00	0	0:00	0:00
H46	Hildfeld, Zur Lücke 12	0:00	0	0:00	0:00
H47	Hildfeld, Zur Lücke 13	0:00	0	0:00	0:00
H48	Hildfeld, Zur Lücke 14	0:00	0	0:00	0:00
H49	Hildfeld, Zur Lücke 18	0:00	0	0:00	0:00
H50	Hildfeld, Zur Lücke 3	0:00	0	0:00	0:00
H51	Hildfeld, Zur Lücke 4	0:00	0	0:00	0:00
H52	Hildfeld, Zur Lücke 6	0:00	0	0:00	0:00
H53	Hildfeld, Zur Lücke 7	0:00	0	0:00	0:00
H54	Hildfeld, Zur Schweimecke 24	0:00	0	0:00	0:00
H55	Hildfeld, Am Ufer 13	0:00	0	0:00	0:00
K01	Küstelberg, Zum Hillekopf 24	2:18	16	0:11	0:24
K02	Küstelberg, Zum Hillekopf 30	0:00	0	0:00	0:00

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal Erwartet	
		[h/a]	[h/a]
VB KÜ01	HSW 30 30 14.0 !O! NH: 37,0 m (Ges:44,0 m) (28)	2:18	0:24

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:16/4.1.273

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

Annahmen für Schattenwurfberechnung

Beschattungsbereich der WEA

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

Siehe WEA-Tabelle

Minimale relevante Sonnenhöhe über Horizont 3 °
Tage zwischen Berechnungen 1 Tag(e)
Berechnungszeitsprung 1 Minuten

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,58	2,64	3,90	5,63	6,26	6,50	6,48	6,13	4,67	3,19	1,70	1,23

Betriebsstunden ermittelt aus WEA in Berechnung und Windverteilung:
Terraindaten: ATLAS; 12 Sektoren; Radius: 20.000 m (29)

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
543	350	305	499	566	502	657	947	1.365	1.271	948	740	8.694

Monatliche Aggregation der met. wahrsch. Reduzierung

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

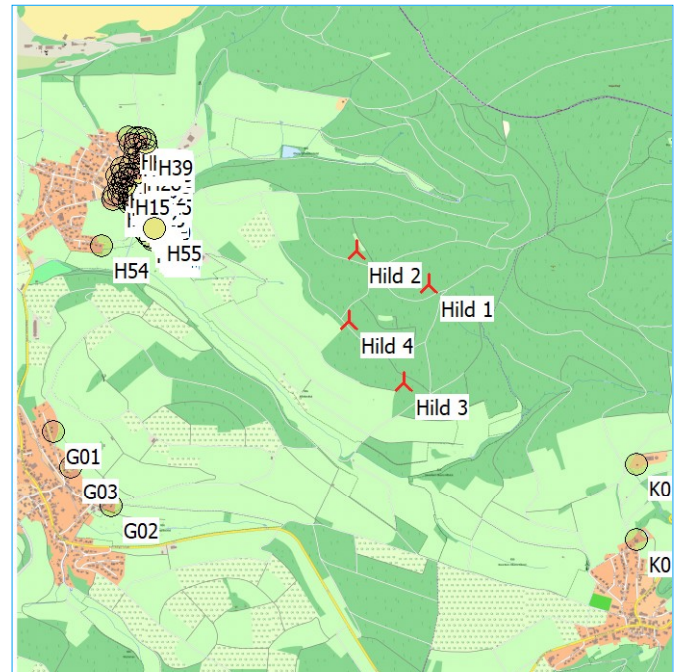
DHM: Höhenlinien: DGM5.wpo (1)

Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:

UTM (north)-ETRS89 Zone: 32

WEA



Maßstab 1:40.000

Neue WEA

Schattenrezeptor

	Ost	Nord	Z	Beschreibung	WEA-Typ			Nennleistung	Rotor-durchmesser	NH	Schattendaten	
					Aktuell	Hersteller	Typ				Beschatt.-Bereich	U/min
			[m]					[kW]	[m]	[m]	[m]	[U/min]
Hild 1	471.323,00	5.676.485,00	750,0	ENERCON E-175 EP5 ...Ja		ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 2	470.943,00	5.676.666,00	740,9	ENERCON E-175 EP5 ...Ja		ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 3	471.192,00	5.675.968,00	667,2	ENERCON E-175 EP5 ...Ja		ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 4	470.901,00	5.676.294,00	709,3	ENERCON E-175 EP5 ...Ja		ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0

Schattenrezeptor-Eingabe

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
G01	Grönebach, Am Steinacker 20	469.335,90	5.675.720,94	602,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G02	Grönebach, Antoniusstr. 28	469.643,23	5.675.326,15	599,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G03	Grönebach, Mosenberg 3	469.428,73	5.675.535,25	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H01	Hildfeld, Am Ufer 1	469.810,16	5.676.936,48	604,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H02	Hildfeld, Am Ufer 10	469.825,34	5.676.827,68	597,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H03	Hildfeld, Am Ufer 12	469.821,78	5.676.779,67	595,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H04	Hildfeld, Am Ufer 14	469.843,40	5.676.754,26	599,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H05	Hildfeld, Am Ufer 16	469.855,71	5.676.743,63	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H06	Hildfeld, Am Ufer 18	469.868,45	5.676.729,43	600,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H07	Hildfeld, Am Ufer 2	469.767,30	5.676.961,10	605,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H08	Hildfeld, Am Ufer 4	469.792,55	5.676.888,43	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H09	Hildfeld, Am Ufer 5	469.824,15	5.676.893,29	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H10	Hildfeld, Am Ufer 6	469.802,03	5.676.866,26	599,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H11	Hildfeld, Am Ufer 8	469.815,75	5.676.842,76	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H12	Hildfeld, Gerkenweg 1	469.694,94	5.677.004,19	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H13	Hildfeld, Gerkenweg 2	469.724,11	5.677.011,46	609,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H14	Hildfeld, Gerkenweg 3	469.689,48	5.677.028,60	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H15	Hildfeld, Gerkenweg 4	469.710,87	5.677.033,44	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H16	Hildfeld, Gerkenweg 7	469.681,59	5.677.067,28	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H17	Hildfeld, Hildfelder Str. 40	469.662,09	5.676.942,74	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H18	Hildfeld, Hildfelder Str. 41	469.665,98	5.676.965,67	605,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H19	Hildfeld, Hildfelder Str. 42	469.710,72	5.676.950,00	605,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

(Fortsetzung nächste Seite)...

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
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Berechnet:

21.03.2025 11:16/4.1.273

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
H20	Hildfeld, Hildfelder Str. 43	469.692,99	5.676.970,37	606,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H21	Hildfeld, Hildfelder Str. 44	469.749,18	5.676.971,07	606,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H22	Hildfeld, Hildfelder Str. 45	469.716,76	5.676.987,42	607,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H23	Hildfeld, Hildfelder Str. 46	469.794,91	5.676.964,84	607,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H24	Hildfeld, Hildfelder Str. 47	469.786,90	5.677.014,68	611,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H25	Hildfeld, Hildfelder Str. 49	469.828,48	5.677.031,14	613,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H26	Hildfeld, Hügelfweg 1	469.753,78	5.677.115,71	620,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H27	Hildfeld, Hügelfweg 14	469.778,15	5.677.207,20	630,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H28	Hildfeld, Hügelfweg 6	469.773,68	5.677.160,35	625,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H29	Hildfeld, Steinertstr. 1	469.752,40	5.677.000,22	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H30	Hildfeld, Steinertstr. 2	469.758,84	5.677.050,80	614,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H31	Hildfeld, Steinertstr. 3	469.727,76	5.677.050,16	612,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H32	Hildfeld, Steinertstr. 4	469.749,89	5.677.074,15	615,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H33	Hildfeld, Steinertstr. 5	469.714,24	5.677.075,99	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H34	Hildfeld, Steinertstr. 8	469.708,64	5.677.105,92	618,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H35	Hildfeld, Zum Grund 13	469.752,27	5.677.234,51	632,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H36	Hildfeld, Zum Grund 15	469.745,05	5.677.269,19	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H37	Hildfeld, Zum Grund 17	469.777,27	5.677.231,08	632,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H38	Hildfeld, Zum Grund 19	469.782,56	5.677.263,97	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H39	Hildfeld, Zum Grund 23	469.836,34	5.677.239,04	633,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H40	Hildfeld, Zur Legge 1	469.749,72	5.676.948,25	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H41	Hildfeld, Zur Legge 3	469.779,25	5.676.935,76	604,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H42	Hildfeld, Zur Legge 4	469.748,68	5.676.922,37	603,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H43	Hildfeld, Zur Legge 6	469.766,42	5.676.920,39	602,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H44	Hildfeld, Zur Legge 8	469.775,89	5.676.909,93	601,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H45	Hildfeld, Zur Lücke 10	469.831,04	5.677.144,95	623,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H46	Hildfeld, Zur Lücke 12	469.841,79	5.677.175,51	626,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H47	Hildfeld, Zur Lücke 13	469.803,63	5.677.264,73	635,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H48	Hildfeld, Zur Lücke 14	469.829,02	5.677.257,82	635,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H49	Hildfeld, Zur Lücke 18	469.839,38	5.677.204,33	629,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H50	Hildfeld, Zur Lücke 3	469.803,90	5.677.142,42	622,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H51	Hildfeld, Zur Lücke 4	469.778,58	5.677.079,48	616,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H52	Hildfeld, Zur Lücke 6	469.798,64	5.677.080,12	617,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H53	Hildfeld, Zur Lücke 7	469.798,64	5.677.183,42	627,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H54	Hildfeld, Zur Schweimecke 24	469.597,30	5.676.699,46	587,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H55	Hildfeld, Am Ufer 13	469.878,94	5.676.788,22	610,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K01	Küstelberg, Zum Hillekopf 24	472.413,94	5.675.132,36	655,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K02	Küstelberg, Zum Hillekopf 30	472.420,34	5.675.531,80	679,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

Berechnungsergebnisse

Schattenrezeptor

		astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer
Nr.	Name	Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr
		[h/a]	[d/a]	[h/d]	[h/a]
G01	Grönebach, Am Steinacker 20	21:17	68	0:26	5:45
G02	Grönebach, Antoniusstr. 28	24:49	84	0:26	6:43
G03	Grönebach, Mosenberg 3	14:34	45	0:24	3:55
H01	Hildfeld, Am Ufer 1	52:55	136	0:33	10:35
H02	Hildfeld, Am Ufer 10	37:39	86	0:34	8:43
H03	Hildfeld, Am Ufer 12	60:07	145	0:35	13:35
H04	Hildfeld, Am Ufer 14	63:31	149	0:35	14:31
H05	Hildfeld, Am Ufer 16	65:03	151	0:36	14:57
H06	Hildfeld, Am Ufer 18	67:11	154	0:36	15:34
H07	Hildfeld, Am Ufer 2	38:49	98	0:32	8:06
H08	Hildfeld, Am Ufer 4	53:36	137	0:33	11:10
H09	Hildfeld, Am Ufer 5	36:21	85	0:34	7:55
H10	Hildfeld, Am Ufer 6	55:15	139	0:34	11:42
H11	Hildfeld, Am Ufer 8	57:15	143	0:34	12:22
H12	Hildfeld, Gerkenweg 1	34:10	91	0:30	6:57
H13	Hildfeld, Gerkenweg 2	35:14	92	0:31	7:08
H14	Hildfeld, Gerkenweg 3	28:34	76	0:30	5:45
H15	Hildfeld, Gerkenweg 4	34:10	91	0:30	6:51
H16	Hildfeld, Gerkenweg 7	27:56	75	0:30	5:32

(Fortsetzung nächste Seite)...

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:16/4.1.273

SHADOW - Hauptergebnis

Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

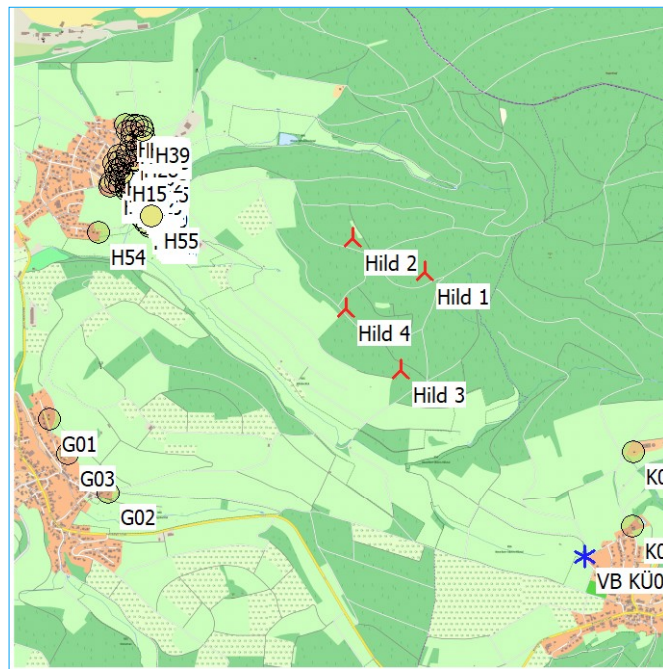
Nr.	Name	astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr
		[h/a]	[d/a]	[h/d]	[h/a]
H17	Hildfeld, Hildfelder Str. 40	28:16	75	0:30	5:58
H18	Hildfeld, Hildfelder Str. 41	28:12	75	0:30	5:52
H19	Hildfeld, Hildfelder Str. 42	36:12	94	0:31	7:38
H20	Hildfeld, Hildfelder Str. 43	34:43	92	0:30	7:13
H21	Hildfeld, Hildfelder Str. 44	37:33	96	0:32	7:47
H22	Hildfeld, Hildfelder Str. 45	35:31	93	0:31	7:17
H23	Hildfeld, Hildfelder Str. 46	51:03	132	0:33	9:59
H24	Hildfeld, Hildfelder Str. 47	38:22	97	0:32	7:44
H25	Hildfeld, Hildfelder Str. 49	50:37	129	0:33	9:22
H26	Hildfeld, Hügelweg 1	34:30	91	0:31	6:38
H27	Hildfeld, Hügelweg 14	34:35	91	0:32	6:05
H28	Hildfeld, Hügelweg 6	34:44	90	0:31	6:25
H29	Hildfeld, Steinertstr. 1	36:41	94	0:31	7:28
H30	Hildfeld, Steinertstr. 2	35:52	91	0:31	7:08
H31	Hildfeld, Steinertstr. 3	34:31	89	0:31	6:53
H32	Hildfeld, Steinertstr. 4	35:09	91	0:31	6:55
H33	Hildfeld, Steinertstr. 5	33:33	89	0:30	6:38
H34	Hildfeld, Steinertstr. 8	28:44	77	0:30	5:35
H35	Hildfeld, Zum Grund 13	30:12	82	0:30	5:11
H36	Hildfeld, Zum Grund 15	29:45	79	0:30	4:55
H37	Hildfeld, Zum Grund 17	34:25	90	0:32	5:54
H38	Hildfeld, Zum Grund 19	31:23	83	0:31	5:08
H39	Hildfeld, Zum Grund 23	37:42	94	0:35	6:16
H40	Hildfeld, Zur Legge 1	38:18	97	0:32	8:04
H41	Hildfeld, Zur Legge 3	50:57	131	0:33	10:14
H42	Hildfeld, Zur Legge 4	38:51	99	0:32	8:20
H43	Hildfeld, Zur Legge 6	50:45	133	0:32	10:20
H44	Hildfeld, Zur Legge 8	51:34	135	0:33	10:34
H45	Hildfeld, Zur Lücke 10	37:57	95	0:32	7:01
H46	Hildfeld, Zur Lücke 12	38:12	95	0:33	6:50
H47	Hildfeld, Zur Lücke 13	35:52	90	0:34	5:52
H48	Hildfeld, Zur Lücke 14	37:18	92	0:35	6:05
H49	Hildfeld, Zur Lücke 18	37:57	95	0:34	6:34
H50	Hildfeld, Zur Lücke 3	36:29	93	0:31	6:48
H51	Hildfeld, Zur Lücke 4	36:26	93	0:32	7:08
H52	Hildfeld, Zur Lücke 6	37:20	95	0:32	7:17
H53	Hildfeld, Zur Lücke 7	35:53	92	0:31	6:27
H54	Hildfeld, Zur Schweimecke 24	28:57	78	0:29	7:10
H55	Hildfeld, Am Ufer 13	65:29	153	0:36	14:34
K01	Küstelberg, Zum Hillekopf 24	3:58	21	0:14	0:58
K02	Küstelberg, Zum Hillekopf 30	52:23	112	0:46	13:27

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal Erwartet	
		[h/a]	[h/a]
Hild 1	ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)	49:44	10:33
Hild 2	ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)	100:32	23:36
Hild 3	ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (101)	86:11	19:20
Hild 4	ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)	153:28	32:59

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

Die Berechnung der Gesamtsumme für einen Rezeptor arbeitet mit einer gemittelten Richtungskorrektur für alle WEA, die an einem gegebenen Tag zur Beschattung beitragen. Wenn der Schattenwurf durch mehrere WEA an einem Tag nicht gleichzeitig stattfindet, kann die so ermittelte Summe geringfügig von der Summe der Beschattungszeiten abweichen, die für die individuellen WEA berechnet werden.



	Ost	Nord	Z	Beschreibung	WEA-Typ			Nennleistung	Rotordurchmesser	NH	Schattendaten	
					Aktuell	Hersteller	Typ				Beschatt.-Bereich	U/min
			[m]					[kW]	[m]	[m]	[m]	[U/min]
Hild 1	471.323,00	5.676.485,00	750,0	ENERCON E-175 E...	Ja	ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 2	470.943,00	5.676.666,00	740,9	ENERCON E-175 E...	Ja	ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 3	471.192,00	5.675.968,00	667,2	ENERCON E-175 E...	Ja	ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
Hild 4	470.901,00	5.676.294,00	709,3	ENERCON E-175 E...	Ja	ENERCON	E-175 EP5 E2-7.000	7.000	175,0	175,0	1.735	9,0
VB KÜ01	472.158,11	5.674.976,46	660,3	HSW 30 30 14,0	Nein	HSW	30-30	30	14,0	37,0	612	24,5

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
G01	Grönebach, Am Steinacker 20	469.335,90	5.675.720,94	602,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G02	Grönebach, Antoniusstr. 28	469.643,23	5.675.326,15	599,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
G03	Grönebach, Mosenberg 3	469.428,73	5.675.535,25	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H01	Hildfeld, Am Ufer 1	469.810,16	5.676.936,48	604,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H02	Hildfeld, Am Ufer 10	469.825,34	5.676.827,68	597,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H03	Hildfeld, Am Ufer 12	469.821,78	5.676.779,67	595,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H04	Hildfeld, Am Ufer 14	469.843,40	5.676.754,26	599,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H05	Hildfeld, Am Ufer 16	469.855,71	5.676.743,63	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H06	Hildfeld, Am Ufer 18	469.868,45	5.676.729,43	600,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H07	Hildfeld, Am Ufer 2	469.767,30	5.676.961,10	605,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H08	Hildfeld, Am Ufer 4	469.792,55	5.676.888,43	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H09	Hildfeld, Am Ufer 5	469.824,15	5.676.893,29	600,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H10	Hildfeld, Am Ufer 6	469.802,03	5.676.866,26	599,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H11	Hildfeld, Am Ufer 8	469.815,75	5.676.842,76	598,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H12	Hildfeld, Gerkenweg 1	469.694,94	5.677.004,19	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H13	Hildfeld, Gerkenweg 2	469.724,11	5.677.011,46	609,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H14	Hildfeld, Gerkenweg 3	469.689,48	5.677.028,60	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H15	Hildfeld, Gerkenweg 4	469.710,87	5.677.033,44	611,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H16	Hildfeld, Gerkenweg 7	469.681,59	5.677.067,28	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H17	Hildfeld, Hildfelder Str. 40	469.662,09	5.676.942,74	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Hauptergebnis

Berechnung: Gesamtbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	Ost	Nord	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
H18	Hildfeld, Hildfelder Str. 41	469.665,98	5.676.965,67	605,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H19	Hildfeld, Hildfelder Str. 42	469.710,72	5.676.950,00	605,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H20	Hildfeld, Hildfelder Str. 43	469.692,99	5.676.970,37	606,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H21	Hildfeld, Hildfelder Str. 44	469.749,18	5.676.971,07	606,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H22	Hildfeld, Hildfelder Str. 45	469.716,76	5.676.987,42	607,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H23	Hildfeld, Hildfelder Str. 46	469.794,91	5.676.964,84	607,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H24	Hildfeld, Hildfelder Str. 47	469.786,90	5.677.014,68	611,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H25	Hildfeld, Hildfelder Str. 49	469.828,48	5.677.031,14	613,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H26	Hildfeld, Hügelsweg 1	469.753,78	5.677.115,71	620,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H27	Hildfeld, Hügelsweg 14	469.778,15	5.677.207,20	630,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H28	Hildfeld, Hügelsweg 6	469.773,68	5.677.160,30	625,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H29	Hildfeld, Steinertstr. 1	469.752,40	5.677.000,22	609,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H30	Hildfeld, Steinertstr. 2	469.758,84	5.677.050,80	614,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H31	Hildfeld, Steinertstr. 3	469.727,76	5.677.050,16	612,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H32	Hildfeld, Steinertstr. 4	469.749,89	5.677.074,15	615,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H33	Hildfeld, Steinertstr. 5	469.714,24	5.677.075,99	615,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H34	Hildfeld, Steinertstr. 8	469.708,64	5.677.105,92	618,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H35	Hildfeld, Zum Grund 13	469.752,27	5.677.234,51	632,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H36	Hildfeld, Zum Grund 15	469.745,05	5.677.269,19	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H37	Hildfeld, Zum Grund 17	469.777,27	5.677.231,08	632,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H38	Hildfeld, Zum Grund 19	469.782,56	5.677.263,97	635,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H39	Hildfeld, Zum Grund 23	469.836,34	5.677.239,04	633,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H40	Hildfeld, Zur Legge 1	469.749,72	5.676.948,25	605,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H41	Hildfeld, Zur Legge 3	469.779,25	5.676.935,76	604,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H42	Hildfeld, Zur Legge 4	469.748,68	5.676.922,37	603,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H43	Hildfeld, Zur Legge 6	469.766,42	5.676.920,39	602,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H44	Hildfeld, Zur Legge 8	469.775,89	5.676.909,93	601,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H45	Hildfeld, Zur Lücke 10	469.831,04	5.677.144,95	623,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H46	Hildfeld, Zur Lücke 12	469.841,79	5.677.175,51	626,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H47	Hildfeld, Zur Lücke 13	469.803,63	5.677.264,73	635,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H48	Hildfeld, Zur Lücke 14	469.829,02	5.677.257,82	635,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H49	Hildfeld, Zur Lücke 18	469.839,38	5.677.204,33	629,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H50	Hildfeld, Zur Lücke 3	469.803,90	5.677.142,42	622,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H51	Hildfeld, Zur Lücke 4	469.778,58	5.677.079,48	616,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H52	Hildfeld, Zur Lücke 6	469.798,64	5.677.080,12	617,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H53	Hildfeld, Zur Lücke 7	469.798,64	5.677.183,42	627,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H54	Hildfeld, Zur Schweimecke 24	469.597,30	5.676.699,46	587,2	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
H55	Hildfeld, Am Ufer 13	469.878,94	5.676.788,22	610,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K01	Küstelberg, Zum Hillekopf 24	472.413,94	5.675.132,36	655,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
K02	Küstelberg, Zum Hillekopf 30	472.420,34	5.675.531,80	679,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

Berechnungsergebnisse

Schattenrezeptor

		astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer	
Nr.	Name	Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr	
		[h/a]	[d/a]	[h/d]	[h/a]	
G01	Grönebach, Am Steinacker 20	21:17	68	0:26	5:41	
G02	Grönebach, Antoniusstr. 28	24:49	84	0:26	6:39	
G03	Grönebach, Mosenberg 3	14:34	45	0:24	3:52	
H01	Hildfeld, Am Ufer 1	52:55	136	0:33	10:28	
H02	Hildfeld, Am Ufer 10	37:39	86	0:34	8:37	
H03	Hildfeld, Am Ufer 12	60:07	145	0:35	13:26	
H04	Hildfeld, Am Ufer 14	63:31	149	0:35	14:22	
H05	Hildfeld, Am Ufer 16	65:03	151	0:36	14:48	
H06	Hildfeld, Am Ufer 18	67:11	154	0:36	15:24	
H07	Hildfeld, Am Ufer 2	38:49	98	0:32	8:00	
H08	Hildfeld, Am Ufer 4	53:36	137	0:33	11:02	
H09	Hildfeld, Am Ufer 5	36:21	85	0:34	7:50	
H10	Hildfeld, Am Ufer 6	55:15	139	0:34	11:34	
H11	Hildfeld, Am Ufer 8	57:15	143	0:34	12:14	
H12	Hildfeld, Gerkenweg 1	34:10	91	0:30	6:53	
H13	Hildfeld, Gerkenweg 2	35:14	92	0:31	7:03	
H14	Hildfeld, Gerkenweg 3	28:34	76	0:30	5:41	

(Fortsetzung nächste Seite)...

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Hauptergebnis

Berechnung: Gesamtbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	astron. max. mögl. Beschattungsdauer			met. wahrsch. Beschattungsdauer
		Stunden/Jahr	Schattentage/Jahr	Max.Schattendauer/Tag	Stunden/Jahr
		[h/a]	[d/a]	[h/d]	[h/a]
H15	Hildfeld, Gerkenweg 4	34:10	91	0:30	6:47
H16	Hildfeld, Gerkenweg 7	27:56	75	0:30	5:29
H17	Hildfeld, Hildfelder Str. 40	28:16	75	0:30	5:54
H18	Hildfeld, Hildfelder Str. 41	28:12	75	0:30	5:48
H19	Hildfeld, Hildfelder Str. 42	36:12	94	0:31	7:33
H20	Hildfeld, Hildfelder Str. 43	34:43	92	0:30	7:09
H21	Hildfeld, Hildfelder Str. 44	37:33	96	0:32	7:42
H22	Hildfeld, Hildfelder Str. 45	35:31	93	0:31	7:13
H23	Hildfeld, Hildfelder Str. 46	51:03	132	0:33	9:53
H24	Hildfeld, Hildfelder Str. 47	38:22	97	0:32	7:39
H25	Hildfeld, Hildfelder Str. 49	50:37	129	0:33	9:16
H26	Hildfeld, Hügelweg 1	34:30	91	0:31	6:34
H27	Hildfeld, Hügelweg 14	34:35	91	0:32	6:01
H28	Hildfeld, Hügelweg 6	34:44	90	0:31	6:21
H29	Hildfeld, Steinertstr. 1	36:41	94	0:31	7:23
H30	Hildfeld, Steinertstr. 2	35:52	91	0:31	7:03
H31	Hildfeld, Steinertstr. 3	34:31	89	0:31	6:48
H32	Hildfeld, Steinertstr. 4	35:09	91	0:31	6:51
H33	Hildfeld, Steinertstr. 5	33:33	89	0:30	6:33
H34	Hildfeld, Steinertstr. 8	28:44	77	0:30	5:31
H35	Hildfeld, Zum Grund 13	30:12	82	0:30	5:07
H36	Hildfeld, Zum Grund 15	29:45	79	0:30	4:51
H37	Hildfeld, Zum Grund 17	34:25	90	0:32	5:51
H38	Hildfeld, Zum Grund 19	31:23	83	0:31	5:04
H39	Hildfeld, Zum Grund 23	37:42	94	0:35	6:12
H40	Hildfeld, Zur Legge 1	38:18	97	0:32	7:59
H41	Hildfeld, Zur Legge 3	50:57	131	0:33	10:08
H42	Hildfeld, Zur Legge 4	38:51	99	0:32	8:14
H43	Hildfeld, Zur Legge 6	50:45	133	0:32	10:13
H44	Hildfeld, Zur Legge 8	51:34	135	0:33	10:28
H45	Hildfeld, Zur Lücke 10	37:57	95	0:32	6:56
H46	Hildfeld, Zur Lücke 12	38:12	95	0:33	6:45
H47	Hildfeld, Zur Lücke 13	35:52	90	0:34	5:48
H48	Hildfeld, Zur Lücke 14	37:18	92	0:35	6:01
H49	Hildfeld, Zur Lücke 18	37:57	95	0:34	6:30
H50	Hildfeld, Zur Lücke 3	36:29	93	0:31	6:44
H51	Hildfeld, Zur Lücke 4	36:26	93	0:32	7:03
H52	Hildfeld, Zur Lücke 6	37:20	95	0:32	7:12
H53	Hildfeld, Zur Lücke 7	35:53	92	0:31	6:23
H54	Hildfeld, Zur Schweimecke 24	28:57	78	0:29	7:05
H55	Hildfeld, Am Ufer 13	65:29	153	0:36	14:24
K01	Küstelberg, Zum Hillekopf 24	6:16	37	0:14	1:23
K02	Küstelberg, Zum Hillekopf 30	52:23	112	0:46	13:18

Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal	Erwartet
		[h/a]	[h/a]
	Hild 1 ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)	49:44	10:26
	Hild 2 ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)	100:32	23:21
	Hild 3 ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (101)	86:11	19:08
	Hild 4 ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)	153:28	32:38
	VB KÜ01 HSW 30 30 14.0 !O! NH: 37,0 m (Ges:44,0 m) (28)	2:18	0:26

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

Die Berechnung der Gesamtsumme für einen Rezeptor arbeitet mit einer gemittelten Richtungskorrektur für alle WEA, die an einem gegebenen Tag zur Beschattung beitragen. Wenn der Schattenwurf durch mehrere WEA an einem Tag nicht gleichzeitig stattfindet, kann die so ermittelte Summe geringfügig von der Summe der Beschattungszeiten abweichen, die für die individuellen WEA berechnet werden.

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: G01 - Grönebach, Am Steinacker 20

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: G02 - Grönebach, Antoniusstr. 28

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai		Juni		Juli		August		September	Oktober	November	Dezember
1	08:31	08:05	07:13	07:04	06:01		05:17		06:20 (Hild 3)	05:14		06:30 (Hild 3)	05:50		06:34 (Hild 3)	06:38
	16:29	17:15	18:05	19:58	20:47		21:32		06:42 (Hild 3)	21:45	13	06:43 (Hild 3)	21:15	12	06:46 (Hild 3)	20:14
2	08:31	08:04	07:11	07:02	05:59		05:16		06:20 (Hild 3)	05:15		06:30 (Hild 3)	05:51		06:36 (Hild 3)	06:39
	16:30	17:17	18:07	20:00	20:49		21:33	21	06:41 (Hild 3)	21:45	14	06:44 (Hild 3)	21:13	8	06:44 (Hild 3)	20:12
3	08:31	08:02	07:09	07:00	05:57		05:15		06:20 (Hild 3)	05:16		06:29 (Hild 3)	05:53		06:41	07:28
	16:31	17:19	18:09	20:01	20:50		21:34	21	06:41 (Hild 3)	21:45	15	06:44 (Hild 3)	21:11		20:10	19:02
4	08:30	08:00	07:07	06:57	05:55		05:15		06:21 (Hild 3)	05:16		06:29 (Hild 3)	05:54		06:42	07:30
	16:32	17:21	18:11	20:03	20:52		21:35	20	06:41 (Hild 3)	21:44	16	06:45 (Hild 3)	21:10		20:08	18:59
5	08:30	07:59	07:05	06:55	05:53		05:14		06:21 (Hild 3)	05:17		06:29 (Hild 3)	05:56		06:44	07:32
	16:33	17:22	18:12	20:04	20:54		21:36	19	06:40 (Hild 3)	21:44	17	06:46 (Hild 3)	21:08		20:05	18:57
6	08:30	07:57	07:02	06:53	05:52		05:13		06:22 (Hild 3)	05:18		06:29 (Hild 3)	05:57		06:46	07:33
	16:34	17:24	18:14	20:06	20:55		21:37	18	06:40 (Hild 3)	21:43	17	06:46 (Hild 3)	21:06		20:03	18:55
7	08:29	07:56	07:00	06:51	05:50		05:13		06:23 (Hild 3)	05:19		06:29 (Hild 3)	05:59		06:47	07:35
	16:35	17:26	18:16	20:08	20:57		21:38	17	06:40 (Hild 3)	21:43	18	06:47 (Hild 3)	21:05		20:01	18:53
8	08:29	07:54	06:58	06:48	05:48		05:12		06:24 (Hild 3)	05:20		06:28 (Hild 3)	06:00		06:49	07:37
	16:37	17:28	18:18	20:09	20:58		21:38	16	06:40 (Hild 3)	21:42	19	06:47 (Hild 3)	21:03		19:59	18:51
9	08:29	07:52	06:56	06:46	05:46		05:12		06:25 (Hild 3)	05:21		06:28 (Hild 3)	06:02		06:50	07:38
	16:38	17:30	18:19	20:11	21:00		21:39	15	06:40 (Hild 3)	21:42	20	06:48 (Hild 3)	21:01		19:56	18:48
10	08:28	07:50	06:54	06:44	05:45		05:11		06:25 (Hild 3)	05:22		06:27 (Hild 3)	06:03		06:52	07:40
	16:39	17:31	18:21	20:13	21:02		21:40	14	06:39 (Hild 3)	21:41	21	06:48 (Hild 3)	20:59		19:54	18:46
11	08:28	07:49	06:51	06:42	05:43		06:24 (Hild 3)	05:11	06:26 (Hild 3)	05:23		06:27 (Hild 3)	06:05		06:53	07:42
	16:41	17:33	18:23	20:14	21:03	10	06:34 (Hild 3)	21:41	06:39 (Hild 3)	21:40	22	06:49 (Hild 3)	20:57		19:52	18:44
12	08:27	07:47	06:49	06:40	05:42		06:23 (Hild 3)	05:11	06:26 (Hild 3)	05:24		06:27 (Hild 3)	06:06		06:55	07:43
	16:42	17:35	18:24	20:16	21:05	14	06:37 (Hild 3)	21:41	06:39 (Hild 3)	21:39	22	06:49 (Hild 3)	20:55		19:50	18:42
13	08:26	07:45	06:47	06:37	05:40		06:21 (Hild 3)	05:10	06:27 (Hild 3)	05:25		06:27 (Hild 3)	06:08		06:57	07:45
	16:44	17:37	18:26	20:18	21:06	16	06:37 (Hild 3)	21:42	06:39 (Hild 3)	21:38	23	06:50 (Hild 3)	20:54		19:47	18:40
14	08:26	07:43	06:45	06:35	05:38		06:20 (Hild 3)	05:10	06:28 (Hild 3)	05:26		06:27 (Hild 3)	06:09		06:58	07:47
	16:45	17:39	18:28	20:19	21:08	19	06:39 (Hild 3)	21:43	06:38 (Hild 3)	21:38	23	06:50 (Hild 3)	20:52		19:45	18:37
15	08:25	07:41	06:42	06:33	05:37		06:20 (Hild 3)	05:10	06:28 (Hild 3)	05:27		06:27 (Hild 3)	06:11		07:00	07:48
	16:47	17:40	18:29	20:21	21:09	20	06:40 (Hild 3)	21:43	06:37 (Hild 3)	21:37	24	06:51 (Hild 3)	20:50		19:43	18:35
16	08:24	07:39	06:40	06:31	05:35		06:18 (Hild 3)	05:10	06:29 (Hild 3)	05:28		06:26 (Hild 3)	06:13		07:01	07:50
	16:48	17:42	18:31	20:23	21:11	22	06:40 (Hild 3)	21:44	06:37 (Hild 3)	21:36	25	06:51 (Hild 3)	20:48		19:40	18:33
17	08:23	07:37	06:38	06:29	05:34		06:18 (Hild 3)	05:10	06:29 (Hild 3)	05:29		06:27 (Hild 3)	06:14		07:03	07:52
	16:50	17:44	18:33	20:24	21:12	23	06:41 (Hild 3)	21:44	06:37 (Hild 3)	21:35	25	06:52 (Hild 3)	20:46		19:38	18:31
18	08:22	07:36	06:36	06:27	05:33		06:18 (Hild 3)	05:10	06:30 (Hild 3)	05:30		06:27 (Hild 3)	06:16		07:05	07:53
	16:51	17:46	18:35	20:26	21:14	24	06:42 (Hild 3)	21:45	06:37 (Hild 3)	21:34	25	06:52 (Hild 3)	20:44		19:36	18:29
19	08:21	07:34	06:33	06:25	05:31		06:17 (Hild 3)	05:10	06:31 (Hild 3)	05:32		06:27 (Hild 3)	06:17		07:06	07:55
	16:53	17:48	18:36	20:28	21:15	24	06:41 (Hild 3)	21:45	06:37 (Hild 3)	21:33	25	06:52 (Hild 3)	20:42		19:34	18:27
20	08:20	07:32	06:31	06:23	05:30		06:17 (Hild 3)	05:10	06:32 (Hild 3)	05:33		06:27 (Hild 3)	06:19		07:08	07:57
	16:55	17:49	18:38	20:29	21:16	25	06:42 (Hild 3)	21:45	06:37 (Hild 3)	21:31	25	06:52 (Hild 3)	20:40		19:31	18:25
21	08:19	07:30	06:29	06:21	05:29		06:17 (Hild 3)	05:10	06:32 (Hild 3)	05:34		06:27 (Hild 3)	06:20		07:09	07:58
	16:56	17:51	18:40	20:31	21:18	25	06:42 (Hild 3)	21:46	06:37 (Hild 3)	21:30	25	06:52 (Hild 3)	20:38		19:29	18:23
22	08:18	07:28	06:27	06:18	05:27		06:17 (Hild 3)	05:10	06:32 (Hild 3)	05:36		06:28 (Hild 3)	06:22		07:11	08:00
	16:58	17:53	18:41	20:33	21:19	25	06:42 (Hild 3)	21:46	06:37 (Hild 3)	21:29	25	06:53 (Hild 3)	20:36		19:27	18:21
23	08:17	07:26	06:24	06:16	05:26		06:17 (Hild 3)	05:11	06:31 (Hild 3)	05:37		06:28 (Hild 3)	06:24		07:12	08:02
	16:59	17:55	18:43	20:34	21:21	25	06:42 (Hild 3)	21:46	06:37 (Hild 3)	21:28	24	06:52 (Hild 3)	20:34		19:24	18:19
24	08:16	07:24	06:22	06:14	05:25		06:17 (Hild 3)	05:11	06:32 (Hild 3)	05:38		06:27 (Hild 3)	06:25		07:14	08:04
	17:01	17:57	18:45	20:36	21:22	26	06:43 (Hild 3)	21:46	06:38 (Hild 3)	21:26	25	06:52 (Hild 3)	20:31		19:22	18:17
25	08:15	07:21	06:20	06:12	05:24		06:18 (Hild 3)	05:11	06:31 (Hild 3)	05:40		06:27 (Hild 3)	06:27		07:16	07:05
	17:03	17:58	18:46	20:37	21:23	25	06:43 (Hild 3)	21:46	06:39 (Hild 3)	21:25	24	06:51 (Hild 3)	20:29		19:20	17:15
26	08:13	07:19	06:18	06:10	05:23		06:18 (Hild 3)	05:12	06:31 (Hild 3)	05:41		06:29 (Hild 3)	06:28		07:17	07:07
	17:05	18:00	18:48	20:39	21:25	24	06:42 (Hild 3)	21:46	06:39 (Hild 3)	21:24	23	06:52 (Hild 3)	20:27		19:18	17:13
27	08:12	07:17	06:15	06:08	05:22		06:18 (Hild 3)	05:12	06:31 (Hild 3)	05:42		06:29 (Hild 3)	06:30		07:19	07:09
	17:06	18:02	18:50	20:41	21:26	24	06:42 (Hild 3)	21:46	06:40 (Hild 3)	21:22	22	06:51 (Hild 3)	20:25		19:15	17:11
28	08:11	07:15	06:13	06:06	05:21		06:18 (Hild 3)	05:12	06:30 (Hild 3)	05:44		06:29 (Hild 3)	06:31		07:20	07:11
	17:08	18:04	18:51	20:42	21:27	24	06:42 (Hild 3)	21:46	06:40 (Hild 3)	21:21	21	06:50 (Hild 3)	20:23		19:13	17:09
29	08:09		07:11	06:05	05:20		06:18 (Hild 3)	05:13	06:31 (Hild 3)	05:45		06:30 (Hild 3)	06:33		07:22	07:12
	17:10		19:53	20:44	21:28	24	06:42 (Hild 3)	21:46	06:41 (Hild 3)	21:19	20	06:50 (Hild 3)	20:21		19:11	17:07
30	08:08		07:09	06:03	05:19		06:18 (Hild 3)	05:14	06:31 (Hild 3)	05:47		06:31 (Hild 3)	06:35		07:24	07:14
	17:12		19:55	20:46	21:29	24	06:42 (Hild 3)	21:46	06:43 (Hild 3)	21:18	18	06:49 (Hild 3)	20:19		19:08	17:05
31	08:07		07:06		05:18		06:20 (Hild 3)			05:48		06:32 (Hild 3)	06:36			07:16
	17:13		19:56		21:31	22	06:42 (Hild 3)			21:16	15	06:47 (Hild 3)	20:16			17:03
Sonnenscheinstunden	262	279	367	415	482		495		498		452		380		333	269
astr.max.mögl.Beschattung					465		353		651							247
Red.Sonnenscheinwahrsch.					0,40		0,39		0,40				20			
Reduktion Betriebsdauer					0,98		0,98		0,98				0,42			
Reduktion Windrichtung					0,68		0,68		0,68				0,68			
Gesamte Reduktion					0,27		0,26		0,27				0,28			
Met.wahrsch.Beschattung					125		93		175				6			

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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Projekt:	Beschreibung:	Lizenzierter Anwender:
24-1-3219-001	Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW	Ramboll Deutschland GmbH Elisabeth-Consbruch-Straße 3 DE-34131 Kassel - H. Ristow / hri@ramboll.com Berechnet: 21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: G03 - Grönebach, Mosenberg 3

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,58	2,64	3,90	5,63	6,26	6,50	6,48	6,13	4,67	3,19	1,70	1,23

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
538	347	302	494	560	497	650	937	1.350	1.257	937	732	8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:31 16:29	08:05 17:15	07:13 18:05	07:04 19:58	06:01 20:47	05:17 21:32	06:13 (Hild 4) 21:45	05:50 21:15	06:38 20:14	07:25 19:06	07:18 17:02	08:07 16:23
2	08:31 16:30	08:04 17:17	07:11 18:07	07:02 20:00	05:59 20:49	05:16 21:33	06:12 (Hild 4) 21:45	05:51 21:13	06:39 20:12	07:27 19:04	07:19 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	07:00 20:01	05:57 20:51	05:15 21:34	06:11 (Hild 4) 21:45	05:53 21:11	06:41 20:10	07:28 19:02	07:21 16:58	08:10 16:21
4	08:30 16:32	08:00 17:21	07:07 18:11	06:57 20:03	05:55 20:52	05:15 21:35	06:11 (Hild 4) 21:44	05:54 21:10	06:42 20:08	07:30 18:59	07:23 16:56	08:11 16:21
5	08:30 16:33	07:59 17:22	07:05 18:12	06:55 20:04	05:53 20:54	05:14 21:36	06:10 (Hild 4) 21:44	05:56 21:08	06:44 20:05	07:32 18:57	07:24 16:55	08:13 16:20
6	08:30 16:34	07:57 17:24	07:02 18:14	06:53 20:06	05:52 20:55	05:13 21:37	06:10 (Hild 4) 21:43	05:57 21:06	06:46 20:03	07:33 18:55	07:26 16:53	08:14 16:20
7	08:30 16:35	07:56 17:26	07:00 18:16	06:51 20:08	05:50 20:57	05:13 21:38	06:10 (Hild 4) 21:43	05:59 21:05	06:47 20:01	07:35 18:53	07:28 16:51	08:15 16:20
8	08:29 16:37	07:54 17:28	06:58 18:18	06:48 20:09	05:48 20:58	05:12 21:38	06:10 (Hild 4) 21:42	06:00 21:03	06:49 19:59	07:37 18:51	07:30 16:50	08:16 16:19
9	08:29 16:38	07:52 17:30	06:56 18:19	06:46 20:11	05:46 21:00	05:12 21:39	06:10 (Hild 4) 21:42	06:02 21:01	06:50 19:56	07:38 18:48	07:31 16:48	08:17 16:19
10	08:28 16:39	07:50 17:31	06:54 18:21	06:44 20:13	05:45 21:02	05:11 21:40	06:09 (Hild 4) 21:41	06:03 20:59	06:52 19:54	07:40 18:46	07:33 16:46	08:18 16:19
11	08:28 16:41	07:49 17:33	06:51 18:23	06:42 20:14	05:43 21:03	05:11 21:41	06:10 (Hild 4) 21:40	06:05 20:57	06:54 19:52	07:42 18:44	07:35 16:45	08:20 16:19
12	08:27 16:42	07:47 17:35	06:49 18:24	06:40 20:16	05:42 21:05	05:11 21:41	06:10 (Hild 4) 21:39	06:06 20:55	06:55 19:50	07:43 18:42	07:37 16:43	08:21 16:19
13	08:26 16:44	07:45 17:37	06:47 18:26	06:37 20:18	05:40 21:06	05:10 21:42	06:10 (Hild 4) 21:39	06:08 20:54	06:57 19:47	07:45 18:40	07:38 16:42	08:22 16:18
14	08:26 16:45	07:43 17:39	06:45 18:28	06:35 20:19	05:38 21:08	05:10 21:43	06:10 (Hild 4) 21:38	06:09 20:52	06:58 19:45	07:47 18:37	07:40 16:41	08:22 16:19
15	08:25 16:47	07:41 17:41	06:42 18:30	06:33 20:21	05:37 21:09	05:10 21:43	06:09 (Hild 4) 21:37	06:11 20:50	07:00 19:43	07:48 18:35	07:42 16:39	08:23 16:19
16	08:24 16:48	07:39 17:42	06:40 18:31	06:31 20:23	05:35 21:11	05:10 21:44	06:10 (Hild 4) 21:36	06:13 20:48	07:01 19:40	07:50 18:33	07:44 16:38	08:24 16:19
17	08:23 16:50	07:37 17:44	06:38 18:33	06:29 20:24	05:34 21:12	05:10 21:44	06:10 (Hild 4) 21:35	06:14 20:46	07:03 19:38	07:52 18:31	07:45 16:36	08:25 16:19
18	08:22 16:51	07:36 17:46	06:36 18:35	06:27 20:26	05:33 21:14	05:10 21:45	06:10 (Hild 4) 21:34	06:16 20:44	07:05 19:36	07:53 18:29	07:47 16:35	08:26 16:19
19	08:21 16:53	07:34 17:48	06:33 18:36	06:25 20:28	05:31 21:15	05:10 21:45	06:11 (Hild 4) 21:33	06:17 20:42	07:06 19:34	07:55 18:27	07:49 16:34	08:26 16:19
20	08:20 16:55	07:32 17:49	06:31 18:38	06:23 20:29	05:30 21:17	05:10 21:45	06:11 (Hild 4) 21:31	06:19 20:40	07:08 19:31	07:57 18:25	07:50 16:33	08:27 16:20
21	08:19 16:56	07:30 17:51	06:29 18:40	06:21 20:31	05:29 21:18	05:10 21:46	06:11 (Hild 4) 21:30	06:20 20:38	07:09 19:29	07:58 18:23	07:52 16:32	08:28 16:20
22	08:18 16:58	07:28 17:53	06:27 18:41	06:18 20:33	05:27 21:19	05:10 21:46	06:11 (Hild 4) 21:29	06:22 20:36	07:11 19:27	08:00 18:21	07:53 16:30	08:28 16:21
23	08:17 16:59	07:26 17:55	06:24 18:43	06:16 20:34	05:26 21:21	05:11 21:46	06:11 (Hild 4) 21:28	06:24 20:34	07:12 19:24	08:02 18:19	07:55 16:29	08:29 16:21
24	08:16 17:01	07:24 17:57	06:22 18:45	06:14 20:36	05:25 21:22	05:11 21:46	06:12 (Hild 4) 21:26	06:25 20:31	07:14 19:22	08:04 18:17	07:57 16:28	08:29 16:22
25	08:15 17:03	07:21 17:58	06:20 18:46	06:12 20:37	05:24 21:23	05:11 21:46	06:12 (Hild 4) 21:25	06:27 20:29	07:16 19:20	08:05 17:15	07:58 16:27	08:30 16:22
26	08:13 17:05	07:19 18:00	06:18 18:48	06:10 20:39	05:23 21:25	05:12 21:46	06:12 (Hild 4) 21:24	06:28 20:27	07:17 19:18	08:07 17:13	08:00 16:26	08:30 16:23
27	08:12 17:06	07:17 18:02	06:15 18:50	06:08 20:41	05:22 21:26	05:12 21:46	06:12 (Hild 4) 21:22	06:30 20:25	07:19 19:15	08:09 17:11	08:01 16:26	08:30 16:24
28	08:11 17:08	07:15 18:04	06:13 18:51	06:06 20:42	05:21 21:27	05:12 21:46	06:12 (Hild 4) 21:21	06:31 20:23	07:20 19:13	08:11 17:09	08:03 16:25	08:30 16:25
29	08:09 17:10		07:11 19:53	06:05 20:44	05:20 21:28	05:13 21:46	06:13 (Hild 4) 21:19	06:33 20:21	07:22 19:11	08:12 17:07	08:04 16:24	08:31 16:25
30	08:08 17:12		07:09 19:55	06:03 20:46	05:19 21:29	05:14 21:46	06:14 (Hild 4) 21:18	06:35 20:19	07:24 19:08	08:14 17:05	08:06 16:23	08:31 16:26
31	08:07 17:13		07:06 19:56	06:05 21:31	05:18 21:31	05:18 21:46	06:15 (Hild 4) 21:16	06:36 20:16	07:24 19:08	08:15 17:03	08:07 16:27	08:31 16:27
Sonnenscheinstunden	262	279	367	415	482	495	498	452	380	333	269	247
astr.max.mögl.Beschattung					13	637	224					
Red.Sonnenscheinwahrsch.					0,40	0,39	0,40					
Reduktion Betriebsdauer					0,98	0,98	0,98					
Reduktion Windrichtung					0,68	0,68	0,68					
Gesamte Reduktion					0,27	0,26	0,27					
Met.wahrsch.Beschattung					4	169	61					

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

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

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H01 - Hildfeld, Am Ufer 1

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 08:05	08:49 (Hild 3) 07:13	08:28 (Hild 4) 07:04	08:59 (Hild 4) 19:58	08:31 (Hild 2) 06:01	05:17 05:14	05:49 06:38	06:38	07:25	08:25 (Hild 1) 07:18	08:08 (Hild 3) 08:07	
2	08:31 08:04	08:45 (Hild 3) 07:11	08:29 (Hild 4) 07:02	08:59 (Hild 4) 20:00	08:31 (Hild 2) 05:59	21:32 21:45	21:15 20:14	20:14	19:06	08:43 (Hild 1) 17:02	25 08:33 (Hild 3) 16:22	
3	08:31 08:02	08:42 (Hild 3) 07:09	08:29 (Hild 4) 07:00	08:59 (Hild 4) 20:00	08:32 (Hild 2) 05:49	21:33 21:45	21:13 20:12	20:12	19:04	08:41 (Hild 1) 17:00	24 08:33 (Hild 3) 16:22	
4	08:30 08:00	08:42 (Hild 3) 07:07	08:30 (Hild 4) 06:57	08:59 (Hild 4) 20:01	08:32 (Hild 2) 05:55	21:34 21:45	21:11 20:10	20:10	19:02	08:37 (Hild 1) 16:58	23 08:32 (Hild 3) 16:21	
5	08:30 07:59	08:41 (Hild 3) 07:05	08:29 (Hild 4) 06:55	08:59 (Hild 4) 20:03	08:32 (Hild 2) 05:52	21:35 21:44	21:10 20:08	20:08	18:59	08:37 (Hild 1) 16:56	22 08:31 (Hild 3) 16:21	
6	08:30 07:57	08:40 (Hild 3) 07:02	08:31 (Hild 4) 06:53	08:59 (Hild 4) 20:04	08:32 (Hild 2) 05:54	21:36 21:44	21:08 20:05	20:05	18:57	08:37 (Hild 1) 16:55	21 08:31 (Hild 3) 16:20	
7	08:30 07:56	08:39 (Hild 3) 07:00	08:32 (Hild 4) 06:51	08:59 (Hild 4) 20:06	08:33 (Hild 2) 05:50	21:37 21:43	21:06 20:03	20:03	18:55	08:37 (Hild 1) 16:53	20 08:30 (Hild 3) 16:19	
8	08:29 07:54	08:39 (Hild 3) 06:58	08:34 (Hild 4) 06:48	08:59 (Hild 4) 20:08	08:33 (Hild 2) 05:48	21:38 21:43	21:05 20:01	20:01	18:53	08:37 (Hild 1) 16:51	19 08:29 (Hild 3) 16:18	
9	08:29 07:52	08:39 (Hild 3) 06:56	08:36 (Hild 4) 06:46	08:59 (Hild 4) 20:11	08:33 (Hild 2) 05:46	21:39 21:42	21:03 20:00	20:00	18:51	08:37 (Hild 1) 16:50	18 08:29 (Hild 3) 16:17	
10	08:28 07:50	08:39 (Hild 3) 06:54	08:36 (Hild 4) 06:44	08:59 (Hild 4) 20:13	08:33 (Hild 2) 05:44	21:40 21:41	20:59 19:54	19:54	18:49	08:37 (Hild 1) 16:49	17 08:28 (Hild 3) 16:16	
11	08:28 07:49	08:39 (Hild 3) 06:51	08:36 (Hild 4) 06:42	08:59 (Hild 4) 20:14	08:33 (Hild 2) 05:42	21:41 21:41	20:57 19:52	19:52	18:47	08:37 (Hild 1) 16:47	16 08:28 (Hild 3) 16:15	
12	08:27 07:47	08:39 (Hild 3) 06:49	08:36 (Hild 4) 06:40	08:59 (Hild 4) 20:16	08:33 (Hild 2) 05:40	21:42 21:42	20:55 19:50	19:50	18:45	08:37 (Hild 1) 16:45	15 08:28 (Hild 3) 16:14	
13	08:26 07:45	08:39 (Hild 3) 06:47	08:36 (Hild 4) 06:37	08:59 (Hild 4) 20:18	08:33 (Hild 2) 05:38	21:43 21:43	20:52 19:47	19:47	18:43	08:37 (Hild 1) 16:43	14 08:28 (Hild 3) 16:13	
14	08:26 07:43	08:39 (Hild 3) 06:45	08:36 (Hild 4) 06:35	08:59 (Hild 4) 20:20	08:33 (Hild 2) 05:36	21:44 21:44	20:50 19:43	19:43	18:41	08:37 (Hild 1) 16:41	13 08:28 (Hild 3) 16:12	
15	08:25 07:41	08:40 (Hild 3) 06:42	08:37 (Hild 4) 06:33	08:59 (Hild 4) 20:22	08:33 (Hild 2) 05:34	21:45 21:45	20:48 19:36	19:36	18:39	08:37 (Hild 1) 16:39	12 08:28 (Hild 3) 16:11	
16	08:24 07:39	08:41 (Hild 3) 06:40	08:38 (Hild 4) 06:30	08:59 (Hild 4) 20:24	08:33 (Hild 2) 05:32	21:46 21:46	20:41 19:31	19:31	18:37	08:37 (Hild 1) 16:37	11 08:28 (Hild 3) 16:10	
17	08:23 07:37	08:42 (Hild 3) 06:38	08:39 (Hild 4) 06:29	08:59 (Hild 4) 20:26	08:34 (Hild 2) 05:29	21:47 21:47	20:36 19:24	19:24	18:35	08:37 (Hild 1) 16:35	10 08:28 (Hild 3) 16:09	
18	08:22 07:36	08:43 (Hild 3) 06:36	08:40 (Hild 4) 06:27	08:59 (Hild 4) 20:28	08:35 (Hild 2) 05:28	21:48 21:48	20:25 19:13	19:13	18:31	08:37 (Hild 1) 16:31	9 08:28 (Hild 3) 16:08	
19	08:21 07:34	08:44 (Hild 3) 06:34	08:41 (Hild 4) 06:25	08:59 (Hild 4) 20:30	08:35 (Hild 2) 05:26	21:49 21:49	20:14 19:02	19:02	18:29	08:37 (Hild 1) 16:29	8 08:28 (Hild 3) 16:07	
20	08:20 07:32	08:45 (Hild 3) 06:32	08:42 (Hild 4) 06:23	08:59 (Hild 4) 20:32	08:36 (Hild 2) 05:25	21:50 21:50	20:01 18:49	18:49	18:27	08:37 (Hild 1) 16:27	7 08:28 (Hild 3) 16:06	
21	08:19 07:30	08:46 (Hild 3) 06:30	08:43 (Hild 4) 06:21	08:59 (Hild 4) 20:34	08:36 (Hild 2) 05:24	21:51 21:51	20:00 18:47	18:47	18:25	08:37 (Hild 1) 16:25	6 08:28 (Hild 3) 16:05	
22	08:18 07:28	08:47 (Hild 3) 06:28	08:44 (Hild 4) 06:19	08:59 (Hild 4) 20:36	08:37 (Hild 2) 05:22	21:52 21:52	20:00 18:45	18:45	18:23	08:37 (Hild 1) 16:23	5 08:28 (Hild 3) 16:04	
23	08:17 07:26	08:48 (Hild 3) 06:26	08:45 (Hild 4) 06:17	08:59 (Hild 4) 20:38	08:37 (Hild 2) 05:20	21:53 21:53	20:00 18:43	18:43	18:21	08:37 (Hild 1) 16:21	4 08:28 (Hild 3) 16:03	
24	08:16 07:24	08:49 (Hild 3) 06:24	08:46 (Hild 4) 06:15	08:59 (Hild 4) 20:40	08:38 (Hild 2) 05:18	21:54 21:54	20:00 18:41	18:41	18:19	08:37 (Hild 1) 16:19	3 08:28 (Hild 3) 16:02	
25	08:15 07:21	08:50 (Hild 3) 06:22	08:47 (Hild 4) 06:12	08:59 (Hild 4) 20:42	08:38 (Hild 2) 05:16	21:55 21:55	20:00 18:39	18:39	18:17	08:37 (Hild 1) 16:17	2 08:28 (Hild 3) 16:01	
26	08:14 07:19	08:51 (Hild 3) 06:20	08:48 (Hild 4) 06:10	08:59 (Hild 4) 20:44	08:39 (Hild 2) 05:14	21:56 21:56	20:00 18:37	18:37	18:15	08:37 (Hild 1) 16:15	1 08:28 (Hild 3) 16:00	
27	08:13 07:17	08:52 (Hild 3) 06:18	08:49 (Hild 4) 06:08	08:59 (Hild 4) 20:46	08:39 (Hild 2) 05:12	21:57 21:57	20:00 18:35	18:35	18:13	08:37 (Hild 1) 16:13	0 08:28 (Hild 3) 15:59	
28	08:12 07:15	08:53 (Hild 3) 06:16	08:50 (Hild 4) 06:06	08:59 (Hild 4) 20:48	08:40 (Hild 2) 05:10	21:58 21:58	20:00 18:33	18:33	18:11	08:37 (Hild 1) 16:11	0 08:28 (Hild 3) 15:57	
29	08:11 07:13	08:54 (Hild 3) 06:14	08:51 (Hild 4) 06:04	08:59 (Hild 4) 20:50	08:40 (Hild 2) 05:08	21:59 21:59	20:00 18:31	18:31	18:09	08:37 (Hild 1) 16:09	0 08:28 (Hild 3) 15:55	
30	08:10 07:11	08:55 (Hild 3) 06:12	08:52 (Hild 4) 06:02	08:59 (Hild 4) 20:52	08:41 (Hild 2) 05:06	22:00 22:00	20:00 18:29	18:29	18:07	08:37 (Hild 1) 16:07	0 08:28 (Hild 3) 15:53	
31	08:09 07:10	08:56 (Hild 3) 06:10	08:53 (Hild 4) 06:00	08:59 (Hild 4) 20:54	08:41 (Hild 2) 05:04	22:01 22:01	20:00 18:27	18:27	18:05	08:37 (Hild 1) 16:05	0 08:28 (Hild 3) 15:51	
32	08:08 07:12	08:57 (Hild 3) 06:08	08:54 (Hild 4) 05:58	08:59 (Hild 4) 20:56	08:42 (Hild 2) 05:02	22:02 22:02	20:00 18:25	18:25	18:03	08:37 (Hild 1) 16:03	0 08:28 (Hild 3) 15:49	
33	08:07 07:13	08:58 (Hild 3) 06:06	08:55 (Hild 4) 05:56	08:59 (Hild 4) 20:58	08:42 (Hild 2) 05:00	22:03 22:03	20:00 18:23	18:23	18:01	08:37 (Hild 1) 16:01	0 08:28 (Hild 3) 15:47	
34	08:06 07:14	08:59 (Hild 3) 06:04	08:56 (Hild 4) 05:54	08:59 (Hild 4) 20:60	08:43 (Hild 2) 04:58	22:04 22:04	20:00 18:21	18:21	18:00	08:37 (Hild 1) 16:00	0 08:28 (Hild 3) 15:45	
35	08:05 07:15	09:00 (Hild 3) 06:02	08:57 (Hild 4) 05:52	08:59 (Hild 4) 20:62	08:43 (Hild 2) 04:56	22:05 22:05	20:00 18:19	18:19	17:58	08:37 (Hild 1) 15:58	0 08:28 (Hild 3) 15:43	
36	08:04 07:16	09:01 (Hild 3) 06:00	08:58 (Hild 4) 05:50	08:59 (Hild 4) 20:64	08:44 (Hild 2) 04:54	22:06 22:06	20:00 18:17	18:17	17:56	08:37 (Hild 1) 15:56	0 08:28 (Hild 3) 15:41	
37	08:03 07:17	09:02 (Hild 3) 05:58	08:59 (Hild 4) 05:48	08:59 (Hild 4) 20:66	08:44 (Hild 2) 04:52	22:07 22:07	20:00 18:15	18:15	17:54	08:37 (Hild 1) 15:54	0 08:28 (Hild 3) 15:39	
38	08:02 07:18	09:03 (Hild 3) 05:56	09:00 (Hild 4) 05:46	08:59 (Hild 4) 20:68	08:45 (Hild 2) 04:50	22:08 22:08	20:00 18:13	18:13	17:52	08:37 (Hild 1) 15:52	0 08:28 (Hild 3) 15:37	
39	08:01 07:19	09:04 (Hild 3) 05:54	09:01 (Hild 4) 05:44	08:59 (Hild 4) 20:70	08:45 (Hild 2) 04:48	22:09 22:09	20:00 18:11	18:11	17:50	08:37 (Hild 1) 15:50	0 08:28 (Hild 3) 15:35	
40	08:00 07:20	09:05 (Hild 3) 05:52	09:02 (Hild 4) 05:42	08:59 (Hild 4) 20:72	08:46 (Hild 2) 04:46	22:10 22:10	20:00 18:09	18:09	17:48	08:37 (Hild 1) 15:48	0 08:28 (Hild 3) 15:33	
41	07:59 07:21	09:06 (Hild 3) 05:50	09:03 (Hild 4) 05:40	08:59 (Hild 4) 20:74	08:46 (Hild 2) 04:44	22:11 22:11	20:00 18:07	18:07	17:46	08:37 (Hild 1) 15:46	0 08:28 (Hild 3) 15:31	
42	07:58 07:22	09:07 (Hild 3) 05:48	09:04 (Hild 4) 05:38	08:59 (Hild 4) 20:76	08:47 (Hild 2) 04:42	22:12 22:12	20:00 18:05	18:05	17:44	08:37 (Hild 1) 15:44	0 08:28 (Hild 3) 15:29	
43	07:57 07:23	09:08 (Hild 3) 05:46	09:05 (Hild 4) 05:36	08:59 (Hild 4) 20:78	08:47 (Hild 2) 04:40	22:13 22:13	20:00 18:03	18:03	17:42	08:37 (Hild 1) 15:42	0 08:28 (Hild 3) 15:27	
44	07:56 07:24	09:09 (Hild 3) 05:44	09:06 (Hild 4) 05:34	08:59 (Hild 4) 20:80	08:48 (Hild 2) 04:38	22:14 22:14	20:00 18:01	18:01	17:40	08:37 (Hild 1) 15:40	0 08:28 (Hild 3) 15:25	
45	07:55 07:25	09:10 (Hild 3) 05:42	09:07 (Hild 4) 05:32	08:59 (Hild 4) 20:82	08:48 (Hild 2) 04:36	22:15 22:15	20:00 17:59	17:59	17:38	08:37 (Hild 1) 15:38	0 08:28 (Hild 3) 15:23	
46	07:54 07:26	09:11 (Hild 3) 05:40	09:08 (Hild 4) 05:30	08:59 (Hild 4) 20:84	08:49 (Hild 2) 04:34	22:16 22:16	20:00 17:57	17:57	17:36	08:37 (Hild 1) 15:36	0 08:28 (Hild 3) 15:21	
47	07:53 07:27	09:12 (Hild 3) 05:38	09:09 (Hild 4) 05:28	08:59 (Hild 4) 20:86	08:49 (Hild 2) 04:32	22:17 22:17	20:00 17:55	17:55	17:34	08:37 (Hild 1) 15:34	0 08:28 (Hild 3) 15:19	
48	07:52 07:28	09:13 (Hild 3) 05:36	09:10 (Hild 4) 05:26	08:59 (Hild 4) 20:88	08:50 (Hild 2) 04:30	22:18 22:18	20:00 17:53	17:53	17:32	08:37 (Hild 1) 15:32	0 08:28 (Hild 3) 15:17	
49	07:51 07:29	09:14 (Hild 3) 05:34	09:11 (Hild 4) 05:24	08:59 (Hild 4) 20:90	08:50 (Hild 2) 04:28	22:19 22:19	20:00 17:51	17:51	17:30	08:37 (Hild 1) 15:30	0 08:28 (Hild 3) 15:15	
50	07:50 07:30	09:15 (Hild 3) 05:32	09:12 (Hild 4) 05:22	08:59 (Hild 4) 20:92	08:51 (Hild 2) 04:26	22:20 22:20	20:00 17:49	17:49	17:28	08:37 (Hild 1) 15:28	0 08:28 (Hild 3) 15:13	
51	07:49 07:31	09:16 (Hild 3) 05:30	09:13 (Hild 4) 05:20	08:59 (Hild 4) 20:94	08:51 (Hild 2) 04:24	22:21 22:21	20:00 17:47	17:47	17:26	08:37 (Hild 1) 15:26	0 08:28 (Hild 3) 15:11	
52	07:48 07:32	09:17 (Hild 3) 05:28	09:14 (Hild 4) 05:18	08:59 (Hild 4) 20:96	08:52 (Hild 2) 04:22	22:22 22:22	20:00 17:45	17:45	17:24	08:37 (Hild 1) 15:24	0 08:28 (Hild 3) 15:09	
53	07:47 07:33	09:18 (Hild 3) 05:26	09:15 (Hild 4) 05:16	08:59 (Hild 4) 20:98	08:52 (Hild 2) 04:20	22:23 22:23	20:00 17:43	17:43	17:22	08:37 (Hild 1) 15:22	0 08:28 (Hild 3) 15:07	

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H02 - Hildfeld, Am Ufer 10

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H03 - Hildfeld, Am Ufer 12

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 08:05		07:13		08:24 (Hild 4) 07:04	21	08:22 (Hild 1) 06:01	05:17	05:14	05:49		
2	18:26 17:15		18:05	5	08:29 (Hild 4) 19:58		08:43 (Hild 1) 20:47	21:32	21:45	21:15		
3	08:31 08:04		07:11		08:19 (Hild 4) 07:02		08:21 (Hild 2) 05:59	05:16	05:15	05:51		
4	16:30 17:17		18:07	15	08:34 (Hild 4) 20:00	21	08:42 (Hild 1) 20:49	21:33	21:45	21:13		
5	08:31 08:02		07:09		08:17 (Hild 4) 07:00		08:17 (Hild 2) 05:57	05:15	05:15	05:52		
6	16:31 17:18		18:09	19	08:36 (Hild 4) 20:01	23	08:40 (Hild 1) 20:51	21:34	21:45	21:11		
7	08:30 08:00		07:07		08:15 (Hild 4) 06:57	23	08:15 (Hild 2) 05:55	05:15	05:16	05:54		
8	16:32 17:21		18:11	23	08:38 (Hild 4) 20:03	23	08:38 (Hild 1) 20:52	21:35	21:44	21:10		
9	08:30 07:59		07:05		08:12 (Hild 4) 06:55		08:12 (Hild 2) 05:53	05:14	05:17	05:55		
10	16:33 17:22		18:12	27	08:39 (Hild 4) 20:04	26	08:38 (Hild 1) 20:54	21:36	21:44	21:08		
11	08:29 07:54		06:58		08:10 (Hild 4) 06:48		08:09 (Hild 2) 05:48	05:12	05:20	06:00		
12	16:34 17:24		18:14	29	08:40 (Hild 4) 20:06	28	08:39 (Hild 1) 20:55	21:37	21:43	21:06		
13	08:30 07:56		07:00		08:11 (Hild 4) 06:51		08:10 (Hild 2) 05:50	05:13	05:19	05:59		
14	16:35 17:26		18:16	29	08:40 (Hild 4) 20:08	30	08:40 (Hild 1) 20:57	21:38	21:43	21:05		
15	08:29 07:54		06:58		08:10 (Hild 4) 06:48		08:09 (Hild 2) 05:48	05:12	05:20	06:00		
16	16:37 17:28		18:18	31	08:41 (Hild 4) 20:09	31	08:40 (Hild 1) 20:59	21:39	21:42	21:03		
17	08:29 07:52		06:56		08:08 (Hild 4) 06:46		08:08 (Hild 2) 05:46	05:12	05:20	06:02		
18	16:38 17:30		18:19	32	08:40 (Hild 4) 20:11	33	08:41 (Hild 1) 21:00	21:39	21:42	21:01		
19	08:28 07:50		06:54		08:08 (Hild 4) 06:44		08:07 (Hild 2) 05:45	05:11	05:21	06:03		
20	16:39 17:31		18:21	33	08:41 (Hild 4) 20:13	33	08:40 (Hild 1) 21:02	21:40	21:41	20:59		
21	08:28 07:49	08:33 (Hild 3) 06:51			08:08 (Hild 4) 06:42		08:06 (Hild 2) 05:43	05:11	05:22	06:05		
22	16:41 17:33	9 08:42 (Hild 3) 18:23	33	08:41 (Hild 4) 20:14	34	08:40 (Hild 1) 21:03	21:41	21:40	20:57			
23	08:27 07:47	08:30 (Hild 3) 06:49			08:08 (Hild 4) 06:40		08:06 (Hild 2) 05:42	05:11	05:24	06:06		
24	16:42 17:35	15 08:45 (Hild 3) 18:24	33	08:41 (Hild 4) 20:16	34	08:40 (Hild 1) 21:05	21:42	21:39	20:55			
25	08:26 07:45	08:29 (Hild 3) 06:47			08:07 (Hild 4) 06:37		08:06 (Hild 2) 05:40	05:10	05:25	06:08		
26	16:44 17:37	17 08:46 (Hild 3) 18:26	32	08:39 (Hild 4) 20:18	34	08:40 (Hild 1) 21:06	21:42	21:39	20:54			
27	08:26 07:43	08:27 (Hild 3) 06:45			08:07 (Hild 4) 06:35		08:05 (Hild 2) 05:38	05:10	05:26	06:09		
28	16:45 17:39	21 08:48 (Hild 3) 18:28	32	08:39 (Hild 4) 20:19	34	08:39 (Hild 1) 21:08	21:43	21:38	20:52			
29	08:25 07:41	08:26 (Hild 3) 06:42			08:08 (Hild 4) 06:33		08:05 (Hild 2) 05:37	05:10	05:27	06:11		
30	16:47 17:40	22 08:48 (Hild 3) 18:29	30	08:38 (Hild 4) 20:21	34	08:39 (Hild 1) 21:09	21:43	21:37	20:50			
31	08:24 07:39	08:26 (Hild 3) 06:40			08:09 (Hild 4) 06:31		08:06 (Hild 2) 05:35	05:10	05:28	06:13		
1	16:48 17:42	23 08:49 (Hild 3) 18:31	29	08:38 (Hild 4) 20:23	32	08:38 (Hild 1) 21:11	21:44	21:36	20:48			
2	08:23 07:37	08:25 (Hild 3) 06:38			08:08 (Hild 4) 06:29		08:06 (Hild 2) 05:34	05:10	05:29	06:14		
3	16:50 17:44	25 08:50 (Hild 3) 18:33	27	08:35 (Hild 4) 20:24	31	08:37 (Hild 1) 21:12	21:44	21:35	20:46			
4	08:22 07:36	08:25 (Hild 3) 06:36			08:10 (Hild 4) 06:27		08:06 (Hild 2) 05:33	05:10	05:30	06:16		
5	16:51 17:46	25 08:50 (Hild 3) 18:35	24	08:34 (Hild 4) 20:26	30	08:36 (Hild 1) 21:14	21:45	21:34	20:44			
6	08:21 07:34	08:25 (Hild 3) 06:33			08:11 (Hild 4) 06:25		08:07 (Hild 2) 05:31	05:10	05:32	06:17		
7	16:53 17:48	25 08:50 (Hild 3) 18:36	21	08:32 (Hild 4) 20:28	28	08:35 (Hild 1) 21:15	21:45	21:33	20:42	12		
8	08:20 07:32	08:25 (Hild 3) 06:31			08:08 (Hild 4) 06:23		08:08 (Hild 2) 05:30	05:10	05:33	06:19		
9	16:54 17:49	25 08:50 (Hild 3) 18:38	26	08:29 (Hild 4) 20:29	26	08:34 (Hild 1) 21:17	21:45	21:31	20:40	17		
10	08:19 07:30	08:25 (Hild 3) 06:29			08:08 (Hild 4) 06:20		08:08 (Hild 2) 05:28	05:10	05:34	06:20		
11	16:56 17:51	25 08:50 (Hild 3) 18:40	25	08:26 (Hild 4) 20:31	24	08:32 (Hild 1) 21:18	21:46	21:30	20:38	22		
12	08:18 07:28	08:25 (Hild 3) 06:27			07:27 (Hild 1) 06:18		08:10 (Hild 2) 05:27	05:10	05:35	06:22		
13	16:58 17:53	24 08:49 (Hild 3) 18:41	19	07:46 (Hild 1) 20:33	21	08:31 (Hild 1) 21:19	21:46	21:29	20:36	24		
14	08:17 07:26	08:26 (Hild 3) 06:24			07:26 (Hild 1) 06:16		08:11 (Hild 2) 05:26	05:10	05:37	06:24		
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17	17:01 17:57	21 08:48 (Hild 3) 18:45	23	07:47 (Hild 1) 20:36	11	08:25 (Hild 1) 21:22	21:46	21:26	20:31	29		
18	08:15 07:21	08:28 (Hild 3) 06:20			07:23 (Hild 1) 06:12		08:14 (Hild 2) 05:24	05:11	05:39	06:27		
19	17:03 17:58	18 08:46 (Hild 3) 18:46	25	07:48 (Hild 1) 20:37		07:23 (Hild 1) 06:10	05:23	05:11	05:41	06:28		
20	08:13 07:19	08:29 (Hild 3) 06:18			07:48 (Hild 1) 20:39		07:23 (Hild 1) 06:08	05:21	05:12	05:42		
21	17:05 18:00	16 08:45 (Hild 3) 18:48	25	07:48 (Hild 1) 20:41		07:22 (Hild 1) 06:06	05:20	05:12	05:44	06:31		
22	08:12 07:17	08:32 (Hild 3) 06:15			07:48 (Hild 1) 20:41		07:22 (Hild 1) 06:06	05:20	05:12	05:44		
23	17:06 18:02	10 08:42 (Hild 3) 18:50	25	07:48 (Hild 1) 20:41		07:22 (Hild 1) 06:06	05:20	05:12	05:44	06:31		
24	08:11 07:15		06:13		07:47 (Hild 1) 20:36		07:22 (Hild 1) 06:06	05:20	05:12	05:44		
25	17:08 18:04		18:51	25	07:47 (Hild 1) 20:36		07:22 (Hild 1) 06:06	05:20	05:12	05:44		
26	08:09		07:11		08:22 (Hild 1) 06:05		08:19 (Hild 1) 20:44	05:19	05:13	05:45		
27	17:10		19:53	25	08:47 (Hild 1) 20:44		08:19 (Hild 1) 20:44	05:19	05:13	05:45		
28	08:08		07:09		08:22 (Hild 1) 06:03		08:19 (Hild 1) 20:44	05:19	05:13	05:45		
29	17:12		19:55	24	08:46 (Hild 1) 20:46		08:19 (Hild 1) 20:46	05:19	05:13	05:45		
30	08:07		07:06		08:21 (Hild 1)		08:19 (Hild 1) 20:46	05:19	05:13	05:45		
31	17:13		19:56	23	08:44 (Hild 1)		08:19 (Hild 1) 20:46	05:19	05:13	05:45		
Sonnenscheinstunden												
astr.max.mögl.Beschattung												
Red.Sonnenscheinwahrsch.												
Reduktion Betriebsdauer												
Reduktion Windrichtung												
Gesamte Reduktion												
Met.wahrsch.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)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H05 - Hildfeld, Am Ufer 16

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:26 16:30	08:05 17:15 18:04	07:13 18:05 18:07	07:04 19:56 20:00	06:01 20:47 20:49	05:17 21:32 21:33	05:14 21:45 21:45	05:49 21:15 21:13	06:38 20:14 20:12	08:02 (Hild 2) 19:06 19:04	07:25 17:02 17:00	08:44 (Hild 4) 17:19 17:00
2	08:31 16:30 16:30	08:02 17:17 18:04	07:09 18:07 18:07	07:00 19:56 20:00	06:01 20:47 20:49	05:17 21:32 21:33	05:14 21:45 21:45	05:49 21:15 21:13	06:38 20:14 20:12	08:02 (Hild 2) 19:06 19:04	07:25 17:02 17:00	08:44 (Hild 4) 17:19 17:00
3	08:31 16:31 16:31	08:02 17:18 18:04	07:09 18:08 18:07	07:00 19:59 20:00	06:01 20:51 20:51	05:17 21:34 21:34	05:14 21:45 21:45	05:49 21:11 21:11	06:41 20:10 20:10	08:03 (Hild 2) 19:02 19:02	07:28 16:58 16:58	08:44 (Hild 4) 17:21 17:21
4	08:30 16:32 16:32	08:00 17:21 18:04	07:07 18:11 18:11	07:07 18:11 18:11	06:57 20:53 20:53	05:15 21:34 21:34	05:15 21:44 21:44	05:54 21:10 21:10	06:42 20:08 20:08	08:04 (Hild 2) 18:59 18:59	07:30 16:56 16:56	08:44 (Hild 4) 17:23 17:23
5	08:30 16:33 16:33	07:59 17:22 18:04	07:05 18:12 18:12	06:55 18:12 18:12	06:55 20:54 20:54	05:15 21:34 21:34	05:15 21:44 21:44	05:55 21:10 21:10	06:44 20:05 20:05	08:05 (Hild 2) 18:57 18:57	07:32 16:55 16:55	08:45 (Hild 4) 17:25 17:25
6	08:30 16:34 16:34	07:57 17:24 18:04	07:02 18:14 18:14	07:02 18:14 18:14	06:53 20:56 20:56	05:15 21:35 21:35	05:15 21:44 21:44	05:57 21:10 21:10	06:46 20:03 20:03	08:07 (Hild 2) 18:55 18:55	07:33 16:53 16:53	08:45 (Hild 4) 17:26 17:26
7	08:30 16:35 16:35	07:56 17:26 18:04	07:00 18:16 18:16	07:00 18:16 18:16	06:51 20:58 20:58	05:15 21:36 21:36	05:15 21:45 21:45	05:59 21:10 21:10	06:47 20:01 20:01	08:09 (Hild 2) 18:53 18:53	07:35 16:51 16:51	08:46 (Hild 4) 17:28 17:28
8	08:29 16:35 16:35	07:54 17:26 18:04	06:58 18:16 18:16	06:58 18:16 18:16	06:48 20:59 20:59	05:12 21:38 21:38	05:12 21:45 21:45	06:00 21:10 21:10	06:49 20:01 20:01	08:14 (Hild 2) 18:53 18:53	07:30 16:50 16:50	08:47 (Hild 4) 17:30 17:30
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13	08:26 16:44 16:44	07:45 17:37 18:04	06:47 18:26 18:26	06:47 18:26 18:26	06:37 21:08 21:08	05:10 21:42 21:42	05:10 21:45 21:45	06:08 21:10 21:10	06:57 20:06 20:06	08:09 (Hild 1) 18:44 18:44	07:38 16:42 16:42	08:52 (Hild 4) 17:38 17:38
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21	08:19 16:56 16:56	07:30 17:51 18:04	06:29 18:40 18:40	06:29 18:40 18:40	06:32 21:16 21:16	05:10 21:46 21:46	05:10 21:45 21:45	06:20 21:10 21:10	06:59 20:14 20:14	08:16 (Hild 1) 18:35 18:35	07:52 16:33 16:33	09:00 (Hild 4) 17:52 17:52
22	08:18 16:58 16:58	07:28 17:53 18:04	06:27 18:41 18:41	06:27 18:41 18:41	06:32 21:17 21:17	05:10 21:46 21:46	05:10 21:45 21:45	06:22 21:10 21:10	06:59 20:15 20:15	08:17 (Hild 1) 18:34 18:34	07:53 16:32 16:32	09:01 (Hild 4) 17:53 17:53
23	08:17 16:59 16:59	07:26 17:55 18:04	06:24 18:43 18:43	06:24 18:43 18:43	06:33 21:18 21:18	05:10 21:47 21:47	05:10 21:45 21:45	06:24 21:10 21:10	06:58 20:16 20:16	08:18 (Hild 1) 18:33 18:33	07:55 16:31 16:31	09:02 (Hild 4) 17:55 17:55
24	08:16 17:01 17:01	07:24 17:57 18:04	06:22 18:44 18:44	06:22 18:44 18:44	06:34 21:19 21:19	05:10 21:48 21:48	05:10 21:45 21:45	06:25 21:10 21:10	06:58 20:17 20:17	08:19 (Hild 1) 18:32 18:32	07:57 16:30 16:30	09:03 (Hild 4) 17:57 17:57
25	08:15 17:03 17:03	07:23 17:58 18:04	06:21 18:45 18:45	06:21 18:45 18:45	06:35 21:20 21:20	05:10 21:49 21:49	05:10 21:45 21:45	06:26 21:10 21:10	06:59 20:18 20:18	08:20 (Hild 1) 18:31 18:31	07:58 16:29 16:29	09:04 (Hild 4) 17:58 17:58
26	08:13 17:05 17:05	07:19 18:00 18:04	06:18 18:46 18:46	06:18 18:46 18:46	06:36 21:21 21:21	05:11 21:50 21:50	05:11 21:45 21:45	06:28 21:10 21:10	06:59 20:19 20:19	08:21 (Hild 1) 18:30 18:30	07:59 16:28 16:28	09:05 (Hild 4) 17:59 17:59
27	08:12 17:06 17:06	07:17 18:02 18:04	06:15 18:47 18:47	06:15 18:47 18:47	06:37 21:22 21:22	05:11 21:51 21:51	05:11 21:45 21:45	06:29 21:10 21:10	06:59 20:20 20:20	08:22 (Hild 1) 18:29 18:29	08:00 16:27 16:27	09:06 (Hild 4) 18:00 18:00
28	08:11 17:08 17:08	07:15 18:04 18:04	06:13 18:48 18:48	06:13 18:48 18:48	06:38 21:23 21:23	05:11 21:52 21:52	05:11 21:45 21:45	06:30 21:10 21:10	06:59 20:21 20:21	08:23 (Hild 1) 18:28 18:28	08:01 16:26 16:26	09:07 (Hild 4) 18:01 18:01
29	08:09 17:10 17:10	07:13 18:05 18:05	06:11 18:49 18:49	06:11 18:49 18:49	06:39 21:24 21:24	05:11 21:53 21:53	05:11 21:45 21:45	06:31 21:10 21:10	06:59 20:22 20:22	08:24 (Hild 1) 18:27 18:27	08:03 16:25 16:25	09:08 (Hild 4) 18:03 18:03
30	08:08 17:12 17:12	07:11 18:06 18:06	06:10 18:50 18:50	06:10 18:50 18:50	06:40 21:25 21:25	05:11 21:54 21:54	05:11 21:45 21:45	06:32 21:10 21:10	06:59 20:23 20:23	08:25 (Hild 1) 18:26 18:26	08:04 16:24 16:24	09:09 (Hild 4) 18:04 18:04
31	08:07 17:13 17:13	07:10 18:07 18:07	06:09 18:51 18:51	06:09 18:51 18:51	06:41 21:26 21:26	05:11 21:55 21:55	05:11 21:45 21:45	06:33 21:10 21:10	06:59 20:24 20:24	08:26 (Hild 1) 18:25 18:25	08:05 16:23 16:23	09:10 (Hild 4) 18:05 18:05
Sonnenscheinstunden												
astr.max.mögl.Beschattung												
Red. Sonnenscheinwahrsch.												
Reduktion Betriebsdauer												
Reduktion Windrichtung												
Gesamte Reduktion												
Met. wahrsch. 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)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
	Minuten mit Schatten	

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H06 - Hildfeld, Am Ufer 18

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H07 - Hildfeld, Am Ufer 2

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28 2	08:05 17:15 08:04	07:13 18:05	08:28 (Hild 4) 07:04 19:58	08:33 (Hild 2) 06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	07:25 19:06	08:24 (Hild 1) 07:18 17:02	08:07 16:22
2	08:31 16:30 3	08:04 17:17 08:02	07:11 18:07	08:28 (Hild 4) 07:02 19:58	08:34 (Hild 2) 05:59 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:25 (Hild 1) 07:19 17:00	08:09 16:22
3	08:31 16:31 4	08:02 17:19 08:00	07:09 18:09	08:29 (Hild 4) 07:00 19:59	08:35 (Hild 2) 05:57 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:28 19:02	08:26 (Hild 1) 07:21 16:58	08:10 16:21
4	08:30 16:32 5	08:00 17:21 07:59	07:07 18:11	08:30 (Hild 4) 06:57 19:55	08:36 (Hild 2) 05:55 20:52	05:15 21:35	05:15 21:44	05:54 21:10	06:42 20:08	07:30 18:59	08:29 (Hild 1) 07:23 16:56	08:11 16:21
5	08:30 16:33 6	07:59 17:22 07:57	07:05 18:12	08:30 (Hild 4) 06:55 19:53	08:37 (Hild 2) 05:53 20:54	05:14 21:36	05:14 21:44	05:55 21:08	06:44 20:05	07:32 18:57	08:38 (Hild 1) 07:25 16:55	08:13 16:20
6	08:30 16:34 7	07:57 17:24 07:56	07:02 18:14	08:32 (Hild 4) 06:53 19:51	08:40 (Hild 2) 05:52 20:55	05:13 21:37	05:13 21:43	05:57 21:06	06:46 20:03	07:33 18:55	09:11 (Hild 4) 07:26 16:53	08:14 16:20
7	08:30 16:35 8	07:56 17:26 07:54	07:00 18:16	08:34 (Hild 4) 06:51 19:48	08:40 (Hild 2) 05:50 20:57	05:13 21:38	05:13 21:43	05:59 21:05	06:47 20:01	07:35 18:53	09:09 (Hild 4) 07:28 16:51	08:15 16:19
8	08:29 16:37 9	07:54 17:28 07:52	06:58 18:18	08:38 (Hild 4) 06:48 19:58	08:44 (Hild 2) 05:48 20:59	05:12 21:39	05:12 21:42	06:00 21:03	06:49 20:59	07:37 18:51	09:07 (Hild 4) 07:30 16:50	08:16 16:19
9	08:29 16:38 10	07:52 17:30 07:50	06:56 18:19	08:44 (Hild 4) 06:46 19:55	08:50 (Hild 2) 05:46 21:00	05:12 21:40	05:12 21:42	06:02 21:01	06:50 20:56	07:38 18:52	09:05 (Hild 4) 07:31 16:48	08:17 16:19
10	08:28 16:39 11	07:50 17:31 07:49	06:54 18:20	08:53 (Hild 1) 06:44 19:52	08:50 (Hild 2) 05:45 21:02	05:11 21:40	05:11 21:42	06:03 21:01	06:52 20:56	07:40 18:54	09:04 (Hild 4) 07:33 16:46	08:19 16:19
11	08:28 16:41 12	07:49 17:33 07:47	06:51 18:23	08:53 (Hild 1) 06:42 19:51	08:50 (Hild 2) 05:43 21:03	05:11 21:41	05:11 21:42	06:05 21:01	06:53 20:57	07:42 18:54	09:03 (Hild 4) 07:35 16:45	08:20 16:19
12	08:27 16:42 13	07:47 17:35 07:45	06:49 18:24	08:54 (Hild 1) 06:40 19:50	08:51 (Hild 2) 05:42 21:04	05:11 21:42	05:11 21:43	06:06 21:01	06:55 20:58	07:43 18:55	09:01 (Hild 4) 07:37 16:43	08:21 16:18
13	08:26 16:44 14	07:45 17:37 07:43	06:47 18:26	08:54 (Hild 1) 06:37 19:48	08:52 (Hild 2) 05:40 21:06	05:10 21:42	05:10 21:43	06:08 21:01	06:57 20:59	07:45 18:56	09:01 (Hild 4) 07:38 16:42	08:22 16:18
14	08:26 16:45 15	07:43 17:39 07:41	06:45 18:28	08:54 (Hild 1) 06:35 19:46	08:53 (Hild 2) 05:38 21:08	05:10 21:43	05:10 21:44	06:09 21:02	06:58 20:59	07:47 18:57	09:01 (Hild 4) 07:40 16:40	08:23 16:18
15	08:25 16:47 16	07:41 17:40 07:39	06:42 18:29	08:54 (Hild 1) 06:33 19:45	08:54 (Hild 2) 05:37 21:11	05:10 21:43	05:10 21:44	06:11 21:03	07:00 20:58	07:48 18:58	09:01 (Hild 4) 07:42 16:39	08:24 16:19
16	08:24 16:48 17	07:39 17:42 07:38	06:40 18:31	08:54 (Hild 1) 06:31 19:44	08:55 (Hild 2) 05:35 21:12	05:10 21:44	05:10 21:45	06:13 21:04	07:01 20:57	07:50 18:59	09:00 (Hild 4) 07:44 16:38	08:25 16:19
17	08:23 16:50 18	07:38 17:44 07:36	06:38 (Hild 4) 06:38 18:33	08:55 (Hild 1) 06:29 19:43	08:56 (Hild 2) 05:34 21:13	05:10 21:45	05:10 21:46	06:14 21:05	07:03 20:58	07:52 18:59	09:00 (Hild 4) 07:45 16:36	08:26 16:19
18	08:22 16:51 19	07:36 17:46 07:34	06:36 (Hild 4) 06:36 18:35	08:56 (Hild 1) 06:27 19:42	08:57 (Hild 2) 05:33 21:14	05:10 21:46	05:10 21:47	06:16 21:06	07:04 20:59	07:53 18:59	09:01 (Hild 4) 07:47 16:35	08:27 16:19
19	08:21 16:53 20	07:34 17:48 07:32	06:34 (Hild 4) 06:33 18:36	08:57 (Hild 1) 06:25 19:41	08:58 (Hild 2) 05:31 21:15	05:10 21:47	05:10 21:48	06:17 21:07	07:06 20:59	07:55 18:59	09:01 (Hild 4) 07:49 16:34	08:28 16:19
20	08:20 16:54 21	07:32 17:49 07:30	06:33 (Hild 4) 06:31 18:38	08:58 (Hild 1) 06:23 19:40	08:59 (Hild 2) 05:30 21:17	05:10 21:48	05:10 21:49	06:19 21:08	07:08 20:59	07:57 18:59	09:02 (Hild 4) 07:50 16:33	08:29 16:20
21	08:19 16:56 22	07:30 17:51 07:28	06:31 (Hild 4) 06:29 18:40	08:59 (Hild 1) 06:20 19:39	09:00 (Hild 2) 05:28 21:18	05:10 21:49	05:10 21:50	06:20 21:09	07:09 20:59	07:58 18:59	09:02 (Hild 4) 07:52 16:32	08:30 16:20
22	08:18 16:58 23	07:28 17:53 07:26	06:28 (Hild 4) 06:27 18:41	09:01 (Hild 1) 06:18 19:38	09:02 (Hild 2) 05:27 21:19	05:10 21:50	05:10 21:51	06:22 21:11	07:11 20:59	08:00 18:59	09:03 (Hild 4) 07:53 16:30	08:31 16:21
23	08:17 16:59 24	07:26 17:55 07:24	06:26 (Hild 4) 06:24 18:43	09:03 (Hild 1) 06:16 19:39	09:04 (Hild 2) 05:26 21:20	05:10 21:51	05:10 21:52	06:24 21:12	07:12 20:59	08:02 18:59	09:05 (Hild 4) 07:55 16:29	08:32 16:21
24	08:16 17:01 25	07:24 17:57 07:22	06:24 (Hild 4) 06:22 18:45	09:05 (Hild 1) 06:14 19:40	09:06 (Hild 2) 05:25 21:21	05:11 21:52	05:11 21:53	06:25 21:13	07:14 20:59	08:04 18:59	09:07 (Hild 4) 07:57 16:28	08:33 16:22
25	08:15 17:03 26	07:21 17:58 07:19	06:20 (Hild 4) 06:20 18:46	09:06 (Hild 1) 06:12 19:41	09:07 (Hild 2) 05:24 21:22	05:11 21:53	05:11 21:54	06:27 21:14	07:16 20:59	08:05 18:59	09:11 (Hild 4) 07:58 16:27	08:34 16:23
26	08:13 17:05 27	07:19 18:00 07:17	06:18 (Hild 4) 06:18 18:50	09:08 (Hild 1) 06:10 19:42	09:09 (Hild 2) 05:23 21:23	05:11 21:54	05:11 21:55	06:28 21:15	07:17 20:59	08:07 18:59	09:12 (Hild 4) 07:59 16:26	08:35 16:24
27	08:12 17:06 28	07:17 18:02 07:15	06:15 (Hild 4) 06:15 18:51	09:10 (Hild 1) 06:08 19:43	09:11 (Hild 2) 05:22 21:24	05:12 21:55	05:12 21:56	06:30 21:16	07:19 20:59	08:09 18:59	09:13 (Hild 4) 08:00 16:25	08:36 16:25
28	08:11 17:08 29	07:15 18:04 07:13	06:13 (Hild 4) 06:13 18:53	09:12 (Hild 1) 06:06 19:44	09:13 (Hild 2) 05:21 21:25	05:12 21:56	05:12 21:57	06:31 21:17	07:20 20:59	08:11 18:59	09:14 (Hild 4) 08:01 16:24	08:37 16:26
29	08:09 17:10 30	07:13 18:07 07:11	06:11 (Hild 4) 06:11 18:51	09:14 (Hild 1) 06:04 19:45	09:15 (Hild 2) 05:20 21:26	05:13 21:57	05:13 21:58	06:32 21:18	07:21 20:59	08:12 18:59	09:15 (Hild 4) 08:02 16:23	08:38 16:27
30	08:08 17:12 31	07:11 18:09 07:09	06:09 (Hild 4) 06:09 18:53	09:16 (Hild 1) 06:03 19:46	09:17 (Hild 2) 05:19 21:27	05:14 21:58	05:14 21:59	06:33 21:19	07:22 20:59	08:13 18:59	09:16 (Hild 4) 08:03 16:22	08:39 16:28
31	08:07 17:13 astr.max.mögl.Beschattung	07:07 18:10 07:05	06:06 (Hild 4) 06:06 18:56	09:18 (Hild 1) 06:02 19:47	09:19 (Hild 2) 05:18 21:28	05:15 21:59	05:15 22:00	06:34 21:20	07:23 20:59	08:14 18:59	09:17 (Hild 4) 08:04 16:21	08:40 16:29
Red. Sonnenscheinwahrsch.	262	279	367	415	482	495	499	452	380	333	269	247
Reduktion Betriebsdauer		294		738					639		532	
Reduktion Windrichtung		0,26		0,33					0,37		0,30	
Gesamte Reduktion		0,98		0,98					0,98		0,98	
Met. wahrsch. Beschattung		0,64		0,64					0,64		0,64	
		0,17		0,21					0,23		0,19	
		49		153					148		99	

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	

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consruch-Straße 3
DE-34131 Kassel
-

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H08 - Hildfeld, Am Ufer 4

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601
Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 08:05		07:13	08:22 (Hild 4) 07:04	08:23 (Hild 2) 06:01	05:17	05:14	05:49	06:38	08:25 (Hild 2) 07:25	09:07 (Hild 4) 07:18	08:04 (Hild 3) 08:07
2	16:28 17:15		18:05	30 08:52 (Hild 4) 19:58	33 08:56 (Hild 2) 20:47	21:32	21:45	21:15	20:14	20 08:45 (Hild 2) 19:06	13 09:20 (Hild 4) 17:02	22 08:26 (Hild 3) 18:23
3	08:31 08:04		07:11	08:22 (Hild 4) 07:02	08:23 (Hild 2) 05:59	05:16	05:15	05:51	06:39	08:23 (Hild 2) 07:27	09:04 (Hild 4) 07:19	08:05 (Hild 3) 08:09
4	16:30 17:17		18:07	30 08:52 (Hild 4) 20:00	33 08:56 (Hild 2) 20:49	21:33	21:45	21:13	20:12	24 08:47 (Hild 2) 19:04	19 09:23 (Hild 4) 17:00	20 08:26 (Hild 3) 18:22
5	08:31 08:02		07:09	08:21 (Hild 4) 07:00	08:23 (Hild 2) 05:57	05:15	05:15	05:52	06:41	08:21 (Hild 2) 07:29	09:01 (Hild 4) 07:21	08:06 (Hild 3) 08:10
6	16:31 17:19		18:09	31 08:52 (Hild 4) 20:01	33 08:56 (Hild 2) 20:51	21:34	21:45	21:11	20:10	26 08:47 (Hild 2) 19:02	22 09:23 (Hild 4) 16:58	19 08:25 (Hild 3) 18:21
7	08:30 08:00		07:07	08:21 (Hild 4) 06:57	08:23 (Hild 2) 05:55	05:15	05:16	05:54	06:42	08:20 (Hild 2) 07:30	09:00 (Hild 4) 07:23	08:07 (Hild 3) 08:11
8	16:32 17:21		18:11	31 08:52 (Hild 4) 20:03	33 08:56 (Hild 2) 20:52	21:35	21:44	21:10	20:08	29 08:49 (Hild 2) 18:59	25 09:25 (Hild 4) 16:56	15 08:22 (Hild 3) 18:21
9	08:30 07:59	08:41 (Hild 3) 07:05	07:05	08:20 (Hild 4) 06:55	08:22 (Hild 2) 05:53	05:14	05:17	05:55	06:44	08:19 (Hild 2) 07:32	08:58 (Hild 4) 07:25	08:09 (Hild 3) 08:13
10	16:33 17:22	8 08:49 (Hild 3) 18:12	31 08:51 (Hild 4) 20:04	32 08:54 (Hild 2) 20:54	21:36	21:44	21:08	20:05	30 08:49 (Hild 2) 18:57	27 09:26 (Hild 4) 16:55	12 08:21 (Hild 3) 18:20	
11	08:30 07:57	08:39 (Hild 3) 07:02	08:21 (Hild 4) 06:53	08:22 (Hild 2) 05:52	05:13	05:18	05:57	06:46	08:19 (Hild 2) 07:33	08:57 (Hild 4) 07:26	08:12 (Hild 3) 08:14	
12	16:34 17:24	12 08:51 (Hild 3) 18:14	30 08:51 (Hild 4) 20:06	31 08:53 (Hild 2) 20:55	21:37	21:43	21:06	20:03	31 08:50 (Hild 2) 18:55	29 09:26 (Hild 4) 16:53	6 08:18 (Hild 3) 18:20	
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15	08:29 07:54	08:36 (Hild 3) 06:58	08:22 (Hild 4) 06:48	08:23 (Hild 2) 05:48	05:12	05:20	06:00	06:49	08:17 (Hild 2) 07:37	08:57 (Hild 4) 07:30	08:16	
16	16:37 17:28	19 08:55 (Hild 3) 18:18	28 08:50 (Hild 4) 20:09	29 08:52 (Hild 2) 20:59	21:39	21:42	21:03	19:59	33 08:50 (Hild 2) 18:51	30 09:27 (Hild 4) 16:50	16:19	
17	08:29 07:52	08:35 (Hild 3) 06:56	08:22 (Hild 4) 06:46	08:24 (Hild 2) 05:46	05:11	05:20	06:02	06:50	08:16 (Hild 2) 07:38	08:55 (Hild 4) 07:31	08:17	
18	16:38 17:30	21 08:56 (Hild 3) 18:19	26 08:48 (Hild 4) 20:11	26 08:50 (Hild 2) 21:00	21:39	21:42	21:01	19:56	33 08:49 (Hild 2) 18:48	31 09:26 (Hild 4) 16:48	16:19	
19	08:28 07:50	08:34 (Hild 3) 06:54	08:23 (Hild 4) 06:44	08:24 (Hild 2) 05:45	05:11	05:21	06:03	06:52	08:16 (Hild 2) 07:40	08:55 (Hild 4) 07:33	08:19	
20	16:39 17:31	23 08:57 (Hild 3) 18:21	23 08:46 (Hild 4) 20:13	24 08:48 (Hild 2) 21:02	21:40	21:43	20:59	19:54	33 08:49 (Hild 2) 18:46	32 09:26 (Hild 4) 16:46	16:19	
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25	08:26 07:45	08:33 (Hild 3) 06:47	08:29 (Hild 4) 06:37	08:31 (Hild 2) 05:40	05:10	05:25	06:08	06:57	08:17 (Hild 2) 07:45	08:55 (Hild 4) 07:38	08:22	
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32	16:48 17:42	24 08:57 (Hild 3) 18:31	19 07:58 (Hild 4) 20:23	21:11	21:44	21:36	20:48	19:40	25 08:43 (Hild 2) 18:33	25 09:22 (Hild 4) 16:38	16:19	
33	08:23 07:37	08:34 (Hild 3) 06:38	07:37 (Hild 4) 06:29	05:34	05:10	05:29	06:14	07:03	08:19 (Hild 2) 07:52	08:58 (Hild 4) 07:45	08:25	
34	16:50 17:44	22 08:56 (Hild 3) 18:33	21 07:58 (Hild 4) 20:24	21:12	21:44	21:35	20:46	19:38	23 08:42 (Hild 2) 18:31	23 09:21 (Hild 4) 16:36	16:19	
35	08:22 07:36	08:35 (Hild 3) 06:36	07:35 (Hild 4) 06:27	05:33	05:10	05:30	06:16	07:04	08:20 (Hild 2) 07:53	09:00 (Hild 4) 07:47	08:26	
36	16:51 17:46	20 08:55 (Hild 3) 18:35	23 07:59 (Hild 4) 20:26	21:14	21:45	21:34	20:44	19:36	23 08:43 (Hild 2) 18:29	19 09:19 (Hild 4) 16:35	16:19	
37	08:21 07:34	08:36 (Hild 3) 06:33	07:36 (Hild 4) 06:25	05:31	05:10	05:32	06:17	07:06	08:22 (Hild 2) 07:55	09:02 (Hild 4) 07:49	08:27	
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42	16:56 17:51	12 08:51 (Hild 3) 18:40	25 07:59 (Hild 4) 20:31	21:18	21:46	21:30	20:38	19:29	24 08:44 (Hild 2) 18:23	13 09:22 (Hild 4) 16:32	16:20	
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45	08:17 07:26	08:30 (Hild 3) 06:24	07:35 (Hild 4) 06:16	05:26	05:10	05:37	06:24	07:12	08:19 (Hild 2) 08:02	09:06 (Hild 4) 07:55	08:29	
46	16:59 17:55	16 08:46 (Hild 3) 18:43	23 07:58 (Hild 4) 20:34	21:21	21:46	21:28	20:34	19:24	24 08:43 (Hild 2) 18:19	19 09:25 (Hild 4) 16:29	16:21	
47	08:16 07:24	08:28 (Hild 3) 06:22	07:34 (Hild 4) 06:14	05:25	05:11	05:38	06:25	07:14	08:19 (Hild 2) 08:04	09:05 (Hild 4) 07:57	08:29	
48	17:01 17:57	20 08:46 (Hild 3) 18:45	23 07:57 (Hild 4) 20:36	21:22	21:46	21:26	20:31	19:22	24 08:43 (Hild 2) 18:17	21 09:24 (Hild 4) 16:28	16:22	
49	08:15 07:21	08:26 (Hild 3) 06:20	07:33 (Hild 4) 06:12	05:24	05:11	05:39	06:27	07:16	08:19 (Hild 2) 07:05	08:04 (Hild 3) 07:58	08:30	
50	17:03 17:58	24 08:50 (Hild 3) 18:46	23 07:56 (Hild 4) 20:37	21:23	21:46	21:25	20:29	19:20	23 08:42 (Hild 2) 17:15	23 08:27 (Hild 3) 16:27	16:22	
51	08:13 07:19	08:25 (Hild 3) 06:18	07:31 (Hild 4) 06:10	05:23	05:11	05:41	06:28	07:17	08:19 (Hild 2) 07:07	08:04 (Hild 3) 08:00	08:30	
52	17:05 18:00	26 08:51 (Hild 3) 18:48	23 07:54 (Hild 4) 20:39	21:25	21:46	21:24	20:27	19:18	22 08:41 (Hild 2) 17:13	23 08:27 (Hild 3) 16:26	16:23	
53	08:12 07:17	08:24 (Hild 3) 06:15	07:29 (Hild 4) 06:08	05:21	05:12	05:42	06:30	07:19	08:19 (Hild 2) 07:09	08:03 (Hild 3) 08:01	08:30	
54	17:06 18:02	28 08:52 (Hild 3) 18:50	26 07:55 (Hild 4) 20:41	21:26	21:46	21:22	20:25	19:15	20 08:39 (Hild 2) 17:11	24 08:27 (Hild 3) 16:26	16:24	
55	08:11 07:15	08:22 (Hild 3) 06:13	07:27 (Hild 4) 06:06	05:20	05:12	05:44	06:31	07:20	08:21 (Hild 2) 07:11	08:03 (Hild 3) 08:03	08:30	
56	17:08 18:04	30 08:52 (Hild 3) 18:51	28 07:55 (Hild 4) 20:42	21:27	21:46	21:21	20:23	19:13	17 08:38 (Hild 2) 17:09	24 08:27 (Hild 3) 16:25	16:25	
57	08:09	07:11	08:26 (Hild 2) 06:05	05:19	05:13	05:45	06:33	07:22	08:23 (Hild 2) 07:12	08:03 (Hild 3) 08:04	08:31	
58	17:10	19:53	08:56 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	13 08:36 (Hild 2) 17:07	24 08:27 (Hild 3) 16:24	16:25	
59	08:08	07:09	08:25 (Hild 2) 06:03	05:19	05:13	05:47	06:35	07:24	08:30 (Hild 2) 07:24	08:25 (Hild 3) 16:24	08:31	
60	17:12	19	08:56 (Hild 2) 20:46	21:29	21:46	21:18	20:19	19 08:30 (Hild 2) 07:24	19 08 7 08:32 (Hild 1) 17:05	24 08:27 (Hild 3) 16:26	16:26	
61	08:07	07:06	08:24 (Hild 2)	05:18	05:18	05:48	06:38	08:27 (Hild 2) 07:24	07:16	08:04 (Hild 3) 08:31	08:31	
62	17:16	19:56	08:56 (Hild 1) 32	08:56 (Hild 1)	415	482	495	499				

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H09 - Hildfeld, Am Ufer 5

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel
-

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H10 - Hildfeld, Am Ufer 6

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
538	347	302	494	560	497	650	937	1.350	1.257	937	732	8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H11 - Hildfeld, Am Ufer 8

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H12 - Hildfeld, Gerkenweg 1

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:31	08:05	07:13	08:28 (Hild 4) 07:04	08:41 (Hild 2) 06:01	05:17	05:14	05:49	06:38	07:25	08:24 (Hild 1) 07:18	08:07	
2	16:28	17:15	18:05	25 08:53 (Hild 4) 19:58	14 08:55 (Hild 2) 20:47	21:32	21:45	21:15	20:14	19:06	22 08:46 (Hild 1) 17:02	16:23	
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29	08:25	07:41	06:42	07:44 (Hild 1) 06:33	05:37	05:10	05:27	06:11	07:00	07:48	09:00 (Hild 4) 07:42	08:23	
30	16:47	17:40	18:29	22 08:06 (Hild 1) 20:21	21:09	21:43	21:37	20:50	19:43	26 08:53 (Hild 2) 18:35	28 09:28 (Hild 4) 16:39	16:19	
31	08:24	07:39	06:40	07:44 (Hild 1) 06:31	05:35	05:10	05:28	06:13	07:01	07:50	08:59 (Hild 4) 07:44	08:24	
32	16:48	17:42	18:31	22 08:06 (Hild 1) 20:23	21:11	21:44	21:36	20:48	19:40	28 08:53 (Hild 2) 18:33	28 09:27 (Hild 4) 16:38	16:19	
33	08:23	07:38	06:38	07:43 (Hild 2) 06:29	05:34	05:10	05:29	06:14	07:03	07:52	08:59 (Hild 4) 07:45	08:25	
34	16:50	17:44	18:33	22 08:05 (Hild 1) 20:24	21:12	21:44	21:35	20:46	19:38	28 08:53 (Hild 2) 18:31	28 09:27 (Hild 4) 16:36	16:19	
35	08:22	07:36	06:36	07:41 (Hild 2) 06:27	05:33	05:10	05:30	06:16	07:05	07:53	08:59 (Hild 4) 07:47	08:26	
36	16:51	17:46	20 08:52 (Hild 4) 18:35	24 08:05 (Hild 2) 20:26	21:14	21:45	21:34	20:44	19:36	30 08:53 (Hild 2) 18:29	28 09:27 (Hild 4) 16:35	16:19	
37	08:21	07:34	06:33	07:40 (Hild 2) 06:25	05:31	05:10	05:32	06:17	07:06	07:55	08:59 (Hild 4) 07:49	08:27	
38	16:53	17:48	22 08:53 (Hild 4) 18:36	26 08:06 (Hild 2) 20:28	21:15	21:45	21:33	20:42	19:34	30 08:53 (Hild 2) 18:27	28 09:27 (Hild 4) 16:34	16:19	
39	08:20	07:32	06:30 (Hild 4) 06:31	28 07:38 (Hild 2) 06:23	05:30	05:10	05:33	06:19	07:08	30 08:22 (Hild 2) 07:57	29 09:00 (Hild 4) 07:50	08:27	
40	16:54	17:49	24 08:54 (Hild 4) 18:38	28 08:06 (Hild 2) 20:29	21:17	21:45	21:31	20:40	19:31	30 08:52 (Hild 2) 18:25	27 09:27 (Hild 4) 16:33	16:20	
41	08:19	07:30	06:29 (Hild 4) 06:29	28 07:38 (Hild 2) 06:20	05:28	05:10	05:34	06:20	07:09	30 08:23 (Hild 2) 07:54	29 08:59 (Hild 4) 07:52	08:28	
42	16:56	17:51	26 08:55 (Hild 4) 18:40	28 08:06 (Hild 2) 20:31	21:18	21:46	21:30	20:38	19:29	29 08:52 (Hild 2) 18:23	26 09:25 (Hild 4) 16:32	16:20	
43	08:18	07:28	06:28 (Hild 4) 06:27	27 07:37 (Hild 2) 06:18	05:27	05:10	05:35	06:22	07:11	08:23 (Hild 2) 08:00	09:00 (Hild 4) 07:53	08:28	
44	16:58	17:53	27 08:55 (Hild 4) 18:41	30 08:07 (Hild 2) 20:33	21:19	21:46	21:29	20:36	19:27	29 08:52 (Hild 2) 18:21	24 09:24 (Hild 4) 16:30	16:21	
45	08:17	07:26	06:28 (Hild 4) 06:24	24 07:37 (Hild 2) 06:16	05:26	05:10	05:37	06:24	07:12	08:23 (Hild 2) 08:02	09:01 (Hild 4) 07:55	08:29	
46	16:59	17:55	28 08:56 (Hild 4) 18:43	30 08:07 (Hild 2) 20:34	21:21	21:46	21:29	20:34	19:24	28 08:51 (Hild 2) 18:19	22 09:23 (Hild 4) 16:29	16:21	
47	08:16	07:24	06:28 (Hild 4) 06:22	22 07:36 (Hild 2) 06:14	05:25	05:11	05:38	06:25	07:14	08:23 (Hild 2) 08:04	09:03 (Hild 4) 07:57	08:29	
48	17:01	17:57	28 08:56 (Hild 4) 18:45	30 08:06 (Hild 2) 20:36	21:22	21:46	21:26	20:31	19:22	27 08:50 (Hild 2) 18:17	19 09:22 (Hild 4) 16:28	16:22	
49	08:15	07:21	06:28 (Hild 4) 06:20	20 07:36 (Hild 2) 06:12	05:24	05:11	05:39	06:27	07:16	08:23 (Hild 2) 07:05	08:05 (Hild 4) 07:58	08:30	
50	17:03	17:58	28 08:56 (Hild 4) 18:46	29 08:05 (Hild 2) 20:37	21:23	21:46	21:25	20:29	19:20	25 08:48 (Hild 2) 17:15	15 08:20 (Hild 4) 16:27	16:22	
51	08:13	07:19	06:18	07:36 (Hild 2) 06:10	05:23	05:11	05:41	06:28	07:17	08:07	09:07 (Hild 4) 08:00	08:30	
52	17:05	18:00	28 08:56 (Hild 4) 18:48	29 08:05 (Hild 2) 20:39	21:25	21:46	21:24	20:27	19:18	22 08:47 (Hild 2) 17:13	11 08:18 (Hild 4) 16:26	16:23	
53	08:12	07:17	06:15	07:36 (Hild 2) 06:08	05:21	05:12	05:42	06:30	07:19	08:25 (Hild 1) 07:09	08:01	08:30	
54	17:06	18:02	28 08:56 (Hild 4) 18:50	28 08:04 (Hild 2) 20:41	21:26	21:46	21:22	20:25	19:15	22 08:47 (Hild 1) 17:11	16:26	16:24	
55	08:11	07:15	06:13	07:36 (Hild 2) 06:06	05:20	05:12	05:44	06:31	07:20	08:24 (Hild 1) 07:11	08:03	08:30	
56	17:08	18:04	27 08:54 (Hild 4) 18:51	28 08:03 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	23 08:47 (Hild 1) 07:11	16:25	16:25	
57	08:09		07:11	08:37 (Hild 2) 06:05	05:19	05:13	05:45	06:33	07:22	08:24 (Hild 1) 07:12	08:04	08:31	
58	17:10		19:53	25 09:02 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	23 08:47 (Hild 1) 07:07	16:24	16:25	
59	08:08		07:09	08:38 (Hild 2) 06:03	05:19	05:13	05:47	06:35	07:24	08:23 (Hild 1) 07:14	08:06	08:31	
60	17:12		19:55	22 09:00 (Hild 2) 20:46	21:29	21:46	21:18	20:19	19:08	23 08:46 (Hild 1) 07:05	16:23	16:26	
61	08:07		07:06	08:38 (Hild 2) 06:03	05:18		05:48	06:36		07:16		08:31	
62	17:13		19:56	20 08:58 (Hild 2) 20:47	21:31	21:46	21:16	20:16		17:03		16:27	
63	Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269	247
64	astr.max.mögl.Beschattung		314	678	21					507		530	
65	Red.Sonnenscheinwahrsch.		0,26	0,33	0,41					0,37		0,30	
66	Reduktion Betriebsdauer		0,98	0,98	0,98					0,98		0,98	
67	Reduktion Windrichtung		0,64	0,64	0,64					0,64		0,64	
68	Gesamte Reduktion		0,17	0,21	0,26					0,23		0,19	
69	Met.wahrsch.Beschattung		52	140	5					117		99	

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H13 - Hildfeld, Gerkenweg 2

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	08:32 (Hild 4) 07:04	08:44 (Hild 2) 06:01	05:17	05:14	05:49	06:38	07:25	08:25 (Hild 1) 07:18	08:07
2	16:28	17:15	18:05	08:56 (Hild 4) 19:58	08:57 (Hild 2) 13	20:47	21:32	21:45	21:15	19:06	08:48 (Hild 1) 17:02	16:23
3	08:31	08:04	07:11	08:33 (Hild 4) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	08:26 (Hild 1) 07:19	08:09
4	16:30	17:17	18:07	08:55 (Hild 4) 20:00	20:49	21:33	21:45	21:13	20:12	19:04	08:48 (Hild 1) 17:00	16:22
5	08:31	08:02	07:09	08:35 (Hild 4) 07:00	05:57	05:15	05:15	05:52	06:41	07:28	08:47 (Hild 1) 07:21	08:10
6	16:31	17:19	18:09	08:53 (Hild 4) 20:01	20:51	21:34	21:45	21:11	20:10	19:02	08:47 (Hild 1) 16:58	16:21
7	08:30	08:01	07:07	08:37 (Hild 4) 06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:27 (Hild 1) 07:23	08:11
8	16:32	17:21	18:11	08:51 (Hild 4) 20:03	20:52	21:35	21:44	21:10	20:08	18:59	08:46 (Hild 1) 16:56	16:21
9	08:30	07:59	07:05	08:40 (Hild 4) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:28 (Hild 1) 07:25	08:13
10	16:33	17:22	18:12	08:45 (Hild 4) 20:04	20:54	21:36	21:44	21:08	20:05	18:57	08:44 (Hild 1) 16:55	16:20
11	08:30	07:57	07:02	08:46 (Hild 4) 06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:29 (Hild 1) 07:26	08:14
12	16:34	17:24	18:14	08:54 (Hild 4) 20:06	20:55	21:37	21:43	21:06	20:03	18:55	08:41 (Hild 1) 16:53	16:20
13	08:30	07:56	07:00	08:47 (Hild 4) 06:54	05:50	05:13	05:14	05:59	06:47	07:35	08:32 (Hild 1) 07:28	08:15
14	16:35	17:26	18:16	08:54 (Hild 4) 20:08	20:57	21:38	21:43	21:05	20:01	18:53	08:38 (Hild 1) 16:51	16:19
15	08:29	07:54	06:58	07:49 (Hild 1) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	09:13 (Hild 4) 07:31	08:17
16	16:37	17:28	18:18	08:07 (Hild 1) 20:09	20:59	21:39	21:42	21:03	19:59	18:51	09:23 (Hild 4) 16:48	16:19
17	08:29	07:52	06:56	07:49 (Hild 1) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	09:13 (Hild 4) 07:31	08:17
18	16:38	17:30	18:19	08:07 (Hild 1) 20:11	21:00	21:39	21:42	21:01	19:56	18:48	09:23 (Hild 4) 16:48	16:19
19	08:28	07:50	06:54	07:48 (Hild 1) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	09:10 (Hild 4) 07:33	08:19
20	16:39	17:31	18:21	08:08 (Hild 1) 20:13	21:02	21:40	21:41	20:59	19:54	18:46	09:26 (Hild 4) 16:46	16:19
21	08:28	07:49	06:51	07:47 (Hild 1) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	09:08 (Hild 4) 07:35	08:20
22	16:41	17:33	18:23	08:09 (Hild 1) 20:14	21:03	21:41	21:40	20:57	19:52	18:44	09:28 (Hild 4) 16:45	16:19
23	08:27	07:47	06:49	07:47 (Hild 1) 06:40	05:42	05:11	05:24	06:06	06:55	07:43	09:06 (Hild 4) 07:37	08:21
24	16:42	17:35	18:24	08:09 (Hild 1) 20:16	21:05	21:42	21:39	20:56	19:50	18:42	09:28 (Hild 4) 16:43	16:18
25	08:26	07:45	06:47	07:45 (Hild 1) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	09:05 (Hild 4) 07:38	08:22
26	16:44	17:37	18:26	08:09 (Hild 1) 20:18	21:06	21:42	21:39	20:54	19:47	18:40	09:29 (Hild 4) 16:42	16:18
27	08:26	07:43	06:45	07:45 (Hild 1) 06:35	05:38	05:10	05:26	06:09	06:58	07:47	09:04 (Hild 4) 07:40	08:23
28	16:45	17:39	18:28	08:09 (Hild 1) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	09:30 (Hild 4) 16:40	16:18
29	08:25	07:41	06:42	07:46 (Hild 1) 06:33	05:37	05:10	05:27	06:11	07:00	07:48	09:03 (Hild 4) 07:42	08:23
30	16:47	17:40	18:29	08:08 (Hild 1) 20:21	21:09	21:43	21:37	20:50	19:43	18:35	09:31 (Hild 4) 16:39	16:19
31	08:24	07:39	06:40	07:46 (Hild 1) 06:31	05:35	05:10	05:28	06:13	07:01	07:50	09:02 (Hild 4) 07:44	08:24
32	16:48	17:42	18:31	08:08 (Hild 1) 20:23	21:11	21:44	21:36	20:48	19:40	18:33	09:30 (Hild 4) 16:38	16:19
33	08:23	07:38	06:38	07:44 (Hild 2) 06:29	05:34	05:10	05:29	06:14	07:03	07:52	09:02 (Hild 4) 07:45	08:25
34	16:50	17:44	18:33	08:07 (Hild 2) 20:24	21:12	21:44	21:35	20:46	19:38	18:31	09:31 (Hild 4) 16:36	16:19
35	08:22	07:36	06:36	07:43 (Hild 2) 06:27	05:33	05:10	05:30	06:16	07:04	07:53	09:02 (Hild 4) 07:47	08:26
36	16:51	17:46	18:35	08:09 (Hild 2) 20:26	21:14	21:45	21:34	20:44	19:36	18:29	09:31 (Hild 4) 16:35	16:19
37	08:21	07:34	06:33	07:42 (Hild 2) 06:25	05:31	05:10	05:32	06:17	07:06	07:55	09:02 (Hild 4) 07:49	08:27
38	16:53	17:48	18:36	08:09 (Hild 2) 20:28	21:15	21:45	21:33	20:42	19:34	18:27	09:31 (Hild 4) 16:34	16:19
39	08:20	07:32	06:31	07:40 (Hild 2) 06:23	05:30	05:10	05:33	06:19	07:08	07:57	09:02 (Hild 4) 07:50	08:27
40	16:54	17:49	18:38	08:09 (Hild 2) 20:29	21:17	21:45	21:31	20:40	19:31	18:25	09:31 (Hild 4) 16:33	16:20
41	08:19	07:30	06:29	07:40 (Hild 2) 06:20	05:28	05:10	05:34	06:20	07:09	07:58	09:02 (Hild 4) 07:52	08:28
42	16:56	17:51	18:40	08:09 (Hild 2) 20:31	21:18	21:46	21:30	20:38	19:29	18:23	09:29 (Hild 4) 16:32	16:20
43	08:18	07:28	06:27	07:39 (Hild 2) 06:18	05:27	05:10	05:35	06:22	07:11	08:00	09:03 (Hild 4) 07:53	08:28
44	16:58	17:53	18:41	08:10 (Hild 2) 20:33	21:19	21:46	21:29	20:36	19:27	18:21	09:29 (Hild 4) 16:30	16:21
45	08:17	07:26	06:24	07:39 (Hild 2) 06:16	05:26	05:10	05:37	06:24	07:12	08:02	09:03 (Hild 4) 07:55	08:29
46	16:59	17:55	18:43	08:10 (Hild 2) 20:34	21:21	21:46	21:29	20:34	19:24	18:19	09:28 (Hild 4) 16:29	16:21
47	08:16	07:24	06:22	07:38 (Hild 2) 06:14	05:25	05:11	05:38	06:25	07:14	08:04	09:04 (Hild 4) 07:57	08:29
48	17:01	17:57	18:45	08:09 (Hild 2) 20:36	21:22	21:46	21:26	20:31	19:22	18:17	09:27 (Hild 4) 16:28	16:22
49	08:15	07:21	06:20	07:38 (Hild 2) 06:12	05:24	05:11	05:39	06:27	07:16	08:06	09:06 (Hild 4) 07:58	08:30
50	17:03	17:58	18:46	08:08 (Hild 2) 20:37	21:23	21:46	21:25	20:29	19:20	18:15	09:26 (Hild 4) 16:27	16:22
51	08:13	07:19	06:18	07:39 (Hild 2) 06:10	05:23	05:11	05:41	06:28	07:17	08:07	09:08 (Hild 4) 08:00	08:30
52	17:05	18:00	18:48	08:08 (Hild 2) 20:39	21:25	21:46	21:24	20:27	19:18	18:13	09:24 (Hild 4) 16:26	16:23
53	08:12	07:17	06:15	07:39 (Hild 2) 06:08	05:21	05:12	05:42	06:30	07:19	08:09	09:09 (Hild 4) 08:01	08:30
54	17:06	18:02	18:50	08:07 (Hild 2) 20:41	21:26	21:46	21:22	20:25	19:15	18:10	09:21 (Hild 4) 16:26	16:24
55	08:11	07:15	06:13	07:39 (Hild 2) 06:06	05:20	05:12	05:44	06:31	07:20	08:10	09:10 (Hild 4) 08:02	08:31
56	17:08	18:04	18:51	08:05 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	18:08	09:22 (Hild 4) 16:25	16:25
57	08:09	07:11	06:05	08:40 (Hild 2) 06:05	05:19	05:13	05:45	06:33	07:22	08:12	09:12 (Hild 4) 08:04	08:31
58	17:10	07:13	18:53	09:04 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	18:06	09:23 (Hild 4) 16:24	16:25
59	08:08	07:09	06:03	08:41 (Hild 2) 06:03	05:19	05:13	05:47	06:35	07:24	08:14	09:14 (Hild 4) 08:06	08:31
60	17:12	07:12	18:55	09:02 (Hild 2) 20:46	21:29	21:46	21:18	20:19	19:08	18:03	09:24 (Hild 4) 16:23	16:26
61	08:07	07:06	06:00	08:42 (Hild 2) 06:00	05:18	05:12	05:48	06:36	07:25	08:15	09:15 (Hild 4) 08:07	08:31
62	17:13	07:13	18:56	09:00 (Hild 2) 20:47	21:31	21:46	21:16	20:16	19:03	17:53	09:25 (Hild 4) 16:23	16:27
63	Sonneneinstrahlung	262	279	367	482	495	499	452	380	333	269	247
64	astr.max.mögl.Beschattung	350	685	685	685	685	685	685	685	685	685	685
65	Red.Sonneneinstrahlung	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
66	Reduktion Betriebsdauer	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
67	Reduktion Windrichtung	0,63	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
68	Gesamte Reduktion	0,16	0,21	0,21	0,26	0,26	0,26	0,23	0,19	0,19	0,19	0,19
69	Met.wahrsch.Beschattung	58	142	142	142	142	142	118	104	104	104	104

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H14 - Hildfeld, Gerkenweg 3

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September		Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	07:04 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14		07:25 19:06	07:18 17:02	08:07 16:23
2	08:31 16:30	08:04 17:17	07:11 18:07	07:02 19:59	06:59 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12		07:27 19:04	07:19 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	07:00 19:59	06:57 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10		07:28 19:02	07:21 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21	07:07 18:11	06:57 19:59	06:55 20:52	05:15 21:35	05:16 21:44	05:54 21:10	06:42 20:08		07:30 18:59	07:23 16:56	08:11 16:21
5	08:30 16:33	08:01 17:22	07:05 18:12	06:55 19:59	06:55 20:52	05:14 21:36	05:17 21:44	05:55 21:08	06:44 20:05		07:32 18:57	07:25 16:55	08:13 16:20
6	08:30 16:34	08:01 17:24	07:02 18:14	06:53 19:59	06:53 20:55	05:13 21:37	05:18 21:43	05:57 21:06	06:46 20:03		07:33 18:55	07:26 16:53	08:14 16:20
7	08:30 16:35	08:01 17:26	07:00 18:16	06:51 19:59	06:51 20:57	05:13 21:38	05:19 21:43	05:59 21:05	06:47 20:01		07:35 18:53	07:28 16:51	08:15 16:19
8	08:29 16:37	07:54 17:28	06:58 18:18	06:48 19:59	06:48 20:59	05:12 21:39	05:20 21:42	06:00 21:03	06:49 19:59		07:37 18:51	07:30 16:50	08:16 16:19
9	08:29 16:38	07:52 17:30	06:56 18:19	06:46 19:59	06:46 20:59	05:12 21:39	05:20 21:42	06:02 21:01	06:50 19:56		07:38 18:48	07:32 16:48	08:17 16:19
10	08:28 16:39	07:50 17:31	06:54 18:21	06:44 19:59	06:44 20:59	05:11 21:40	05:21 21:41	06:03 20:59	06:52 19:54		07:40 18:46	07:33 16:46	08:19 16:19
11	08:28 16:41	07:49 17:33	06:51 18:23	06:42 19:59	06:42 20:59	05:11 21:40	05:22 21:41	06:05 20:57	06:53 19:52		07:42 18:44	07:35 16:45	08:20 16:19
12	08:27 16:42	07:47 17:35	06:49 18:24	06:41 19:59	06:41 20:59	05:10 21:42	05:24 21:43	06:06 20:56	06:55 19:50	08:41 (Hild 2)	07:43 18:42	07:37 16:43	08:21 16:18
13	08:26 16:44	07:45 17:37	06:47 18:26	06:37 19:59	06:37 20:59	05:10 21:42	05:25 21:43	06:08 20:54	06:57 19:47	4 08:45 (Hild 2)	07:45 18:40	07:38 16:42	08:22 16:18
14	08:26 16:45	07:43 17:39	06:45 18:28	06:35 19:59	06:35 20:59	05:10 21:43	05:26 21:43	06:09 20:52	06:58 19:45	14 08:50 (Hild 2)	07:47 18:37	07:40 16:40	08:23 16:18
15	08:25 16:47	07:41 17:40	06:42 18:29	06:33 19:59	06:33 20:59	05:10 21:43	05:27 21:43	06:11 20:50	07:00 19:43	18 08:51 (Hild 2)	07:48 18:35	07:42 16:39	08:23 16:19
16	08:24 16:48	07:39 17:42	06:40 18:31	06:31 19:59	06:31 20:59	05:10 21:44	05:28 21:44	06:13 20:48	07:01 19:40	22 08:53 (Hild 2)	07:50 18:33	07:44 16:38	08:24 16:19
17	08:23 16:50	07:38 17:44	06:38 18:33	06:29 19:59	06:29 20:59	05:10 21:44	05:29 21:45	06:14 20:46	07:03 19:38	24 08:54 (Hild 2)	07:52 18:31	07:45 16:36	08:25 16:19
18	08:22 16:51	07:36 17:46	06:36 18:35	06:27 19:59	06:27 20:59	05:10 21:45	05:30 21:46	06:16 20:44	07:05 19:36	26 08:55 (Hild 2)	07:53 18:29	07:47 16:35	08:26 16:19
19	08:21 16:53	07:34 17:48	06:33 18:36	06:26 19:59	06:26 20:59	05:10 21:45	05:32 21:46	06:17 20:42	07:06 19:34	27 08:56 (Hild 2)	07:55 18:27	07:49 16:34	08:27 16:19
20	08:20 16:54	07:32 17:49	06:31 18:38	06:23 19:59	06:23 20:59	05:10 21:46	05:33 21:47	06:19 20:40	07:08 19:31	29 08:57 (Hild 2)	07:57 18:25	07:50 16:33	08:28 16:20
21	08:19 16:56	07:30 17:51	06:29 18:40	06:20 19:59	06:20 20:59	05:10 21:46	05:34 21:47	06:20 20:38	07:09 19:29	30 08:58 (Hild 2)	07:58 18:23	07:52 16:32	08:29 16:20
22	08:18 16:58	07:28 17:53	06:27 18:41	06:18 19:59	06:18 20:59	05:10 21:47	05:35 21:48	06:22 20:36	07:11 19:27	30 08:59 (Hild 2)	08:00 18:21	07:53 16:30	08:30 16:21
23	08:17 16:59	07:26 17:55	06:24 18:43	06:16 19:59	06:16 20:59	05:10 21:48	05:37 21:49	06:24 20:34	07:12 19:24	30 09:00 (Hild 2)	08:02 18:19	07:55 16:29	08:31 16:21
24	08:16 17:01	07:24 17:57	06:22 18:45	06:14 19:59	06:14 20:59	05:11 21:49	05:38 21:50	06:25 20:31	07:14 19:22	30 09:01 (Hild 2)	08:04 18:17	07:57 16:28	08:32 16:22
25	08:15 17:03	07:21 17:58	06:20 18:46	06:12 19:59	06:12 20:59	05:11 21:50	05:39 21:51	06:27 20:29	07:16 19:20	28 09:02 (Hild 2)	08:06 18:15	07:58 16:27	08:33 16:22
26	08:13 17:05	07:19 18:00	06:18 18:48	06:10 19:59	06:10 20:59	05:11 21:51	05:41 21:52	06:28 20:27	07:17 19:18	28 09:03 (Hild 2)	08:07 18:13	07:59 16:26	08:34 16:23
27	08:12 17:06	07:17 18:02	06:15 18:50	06:08 19:59	06:08 20:59	05:12 21:52	05:42 21:53	06:30 20:25	07:19 19:15	24 09:04 (Hild 2)	08:09 18:11	08:01 16:26	08:35 16:24
28	08:11 17:08	07:15 18:04	06:13 18:51	06:06 19:59	06:06 20:59	05:12 21:53	05:44 21:54	06:31 20:23	07:20 19:13	24 09:05 (Hild 2)	08:11 18:09	08:03 16:25	08:36 16:25
29	08:09 17:10		07:11 19:53	06:05 20:44	06:05 21:28	05:13 21:46	05:45 21:47	06:33 20:21	07:22 19:11	21 09:06 (Hild 2)	08:13 18:07	08:04 16:26	08:37 16:26
30	08:08 17:12		07:09 19:55	06:03 20:46	06:03 21:29	05:13 21:47	05:47 21:48	06:35 20:19	07:24 19:08	18 09:07 (Hild 2)	08:15 18:05	08:06 16:27	08:38 16:26
31	08:07 17:13		07:06 19:56	06:02 20:45	06:02 21:28	05:12 21:48	05:48 21:49	06:36 20:16		13 09:08 (Hild 2)	08:17 18:03	08:08 16:28	08:39 16:27
Sonnenscheinstunden	262	279	367	415	482	495	452	380	441	333	419	269	247
astr.max.mögl.Beschattung		355	499						0,37		0,30		
Red.Sonnenscheinwahrsch.		0,26	0,33						0,96		0,98		
Reduktion Betriebsdauer		0,63	0,64						0,64		0,63		
Reduktion Windrichtung		0,16	0,21						0,23		0,19		
Gesamte Reduktion		0,16	0,21						0,23		0,19		
Met.wahrsch.Beschattung		59	103						102		78		

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H15 - Hildfeld, Gerkenweg 4

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

		Januar	Februar	März		April	Mai	Juni	Juli	August	September		Oktober		November	Dezember
1	08:31 16:28	08:05 17:15		07:13 18:05	20	08:35 (Hild 4) 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14		07:25 19:06	23	08:27 (Hild 1) 17:02	08:07 16:23
2	08:31 16:30	08:04 17:17		07:11 18:07	17	08:36 (Hild 4) 20:00	05:59 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12		07:27 19:04	23	08:27 (Hild 1) 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19		07:09 18:09	11	08:39 (Hild 4) 20:01	05:57 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 19:02		07:28 19:02	22	08:26 (Hild 1) 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21		07:07 18:11		08:50 (Hild 4) 20:03	05:55 20:52	05:15 21:35	05:16 21:44	05:54 21:10	06:42 20:08		07:30 18:59	21	08:27 (Hild 1) 16:56	08:11 16:21
5	08:30 16:33	07:59 17:22		07:05 18:12		06:55 (Hild 4) 20:04	05:53 20:54	05:14 21:36	05:17 21:44	05:55 21:08	06:44 20:05		07:32 18:57	21	08:28 (Hild 1) 16:55	08:13 16:20
6	08:30 16:34	07:57 17:24		07:02 18:14	11	07:55 (Hild 1) 20:06	05:53 20:55	05:13 21:37	05:18 21:43	05:57 21:06	06:46 20:03		07:33 18:55	19	08:28 (Hild 1) 16:53	08:14 16:20
7	08:30 16:35	07:56 17:26		07:00 18:16	15	07:53 (Hild 1) 20:08	05:50 20:57	05:13 21:38	05:19 21:43	05:59 21:05	06:47 20:01		07:35 18:53	17	08:45 (Hild 1) 16:51	08:15 16:19
8	08:29 16:37	07:54 17:28		06:58 18:18	19	07:51 (Hild 1) 20:09	05:48 20:59	05:12 21:39	05:20 21:42	06:00 21:03	06:49 19:59		07:37 18:51	13	08:33 (Hild 1) 16:50	08:16 16:19
9	08:29 16:38	07:52 17:30		06:56 18:19	21	07:49 (Hild 1) 20:11	05:46 21:00	05:12 21:39	05:20 21:42	06:50 21:01	06:58 19:56	7	07:38 18:48	7	08:40 (Hild 1) 16:48	08:17 16:19
10	08:28 16:39	07:50 17:31		06:54 18:21	21	07:49 (Hild 1) 20:13	05:45 21:02	05:11 21:40	05:21 21:41	06:03 20:59	06:52 19:54		07:40 18:46	6	09:16 (Hild 4) 16:46	08:19 16:19
11	08:28 16:41	07:49 17:33		06:51 18:23	23	07:48 (Hild 1) 20:14	05:43 21:03	05:11 21:41	05:22 21:40	06:05 20:57	06:53 19:52		07:42 18:44	14	09:12 (Hild 4) 16:45	08:20 16:19
12	08:27 16:42	07:47 17:35		06:49 18:24	23	07:48 (Hild 1) 20:16	05:42 21:05	05:11 21:42	05:24 21:39	06:06 20:56	06:55 19:50		07:43 18:42	18	09:09 (Hild 4) 16:43	08:21 16:18
13	08:26 16:44	07:45 17:37	7	08:43 (Hild 4) 18:26	23	07:47 (Hild 1) 20:18	05:40 21:06	05:10 21:42	05:25 21:39	06:08 20:54	06:57 19:47	13	07:45 18:40	22	09:27 (Hild 4) 16:42	08:22 16:18
14	08:26 16:45	07:43 17:39	14	08:39 (Hild 4) 18:28	23	07:47 (Hild 1) 20:19	05:38 21:08	05:10 21:43	05:26 21:38	06:09 20:52	06:58 19:45	13	07:47 18:37	22	09:29 (Hild 4) 16:40	08:23 16:18
15	08:25 16:47	07:41 17:40	18	08:53 (Hild 4) 18:29	22	08:37 (Hild 4) 20:21	05:37 21:09	05:10 21:43	05:27 21:37	06:11 20:50	07:00 19:43	22	07:48 18:35	26	09:30 (Hild 4) 16:39	08:24 16:19
16	08:24 16:48	07:39 17:42	21	08:55 (Hild 4) 18:31	25	08:36 (Hild 4) 20:23	05:35 21:11	05:10 21:44	05:28 21:36	06:13 20:48	07:01 19:40	24	07:50 18:33	27	09:31 (Hild 4) 16:38	08:25 16:19
17	08:23 16:50	07:38 17:44	23	08:35 (Hild 4) 18:33	27	08:35 (Hild 4) 20:24	05:34 21:12	05:10 21:44	05:29 21:35	06:14 20:46	07:03 19:38	24	07:52 18:31	27	09:04 (Hild 4) 16:36	08:26 16:19
18	08:22 16:51	07:36 17:46	25	08:58 (Hild 4) 18:35	28	08:34 (Hild 4) 20:26	05:33 21:14	05:10 21:45	05:30 21:34	06:16 20:44	07:05 19:36	26	07:53 18:29	28	09:03 (Hild 4) 16:35	08:27 16:19
19	08:21 16:53	07:34 17:48	26	08:33 (Hild 4) 18:36	29	08:33 (Hild 4) 20:28	05:31 21:15	05:10 21:45	05:32 21:33	06:17 20:42	07:06 19:34	27	07:55 18:27	29	09:03 (Hild 4) 16:34	08:27 16:19
20	08:20 16:54	07:32 17:49	28	08:32 (Hild 4) 18:38	30	08:32 (Hild 4) 20:29	05:30 21:17	05:10 21:45	05:33 21:31	06:19 20:40	07:08 19:31	28	07:57 18:25	29	09:03 (Hild 4) 16:33	08:27 16:20
21	08:19 16:56	07:30 17:51	28	08:32 (Hild 4) 18:40	30	08:32 (Hild 4) 20:31	05:28 21:18	05:10 21:46	05:33 21:30	06:20 20:38	07:09 19:29	30	07:58 18:23	28	09:03 (Hild 4) 16:32	08:28 16:20
22	08:18 16:58	07:28 17:53	28	08:32 (Hild 4) 18:41	30	08:32 (Hild 4) 20:33	05:27 21:19	05:10 21:46	05:35 21:29	06:22 20:36	07:11 19:27	30	08:00 18:21	27	09:03 (Hild 4) 16:30	08:28 16:21
23	08:17 16:59	07:26 17:55	28	08:32 (Hild 4) 18:43	30	08:32 (Hild 4) 20:34	05:26 21:21	05:10 21:46	05:37 21:28	06:24 20:34	07:12 19:24	30	08:02 18:19	26	09:04 (Hild 4) 16:29	08:29 16:21
24	08:16 17:01	07:24 17:57	28	08:32 (Hild 4) 18:45	29	08:32 (Hild 4) 20:36	05:25 21:22	05:11 21:46	05:38 21:26	06:25 20:31	07:14 19:22	30	08:04 18:17	25	09:04 (Hild 4) 16:28	08:29 16:22
25	08:15 17:03	07:21 17:58	28	08:32 (Hild 4) 18:46	28	08:32 (Hild 4) 20:37	05:24 21:23	05:11 21:46	05:39 21:25	06:27 20:29	07:16 19:20	30	08:05 18:15	23	09:05 (Hild 4) 16:27	08:30 16:22
26	08:13 17:05	07:19 18:00	26	08:33 (Hild 4) 18:48	26	08:33 (Hild 4) 20:39	05:23 21:25	05:11 21:46	06:28 21:24	07:07 20:27	07:17 19:18	27	08:28 (Hild 4) 18:13	20	09:07 (Hild 4) 16:26	08:31 16:23
27	08:12 17:06	07:17 18:02	24	08:34 (Hild 4) 18:50	24	08:34 (Hild 4) 20:41	05:22 21:26	05:12 21:46	06:30 21:22	07:19 20:25	07:09 19:15	28	08:27 (Hild 4) 18:11	18	09:07 (Hild 4) 16:26	08:32 16:24
28	08:11 17:08	07:15 18:04	23	08:33 (Hild 4) 18:51	22	08:33 (Hild 4) 20:42	05:20 21:27	05:12 21:46	06:31 21:21	07:20 20:23	07:11 19:13	23	08:28 (Hild 4) 18:09	12	09:08 (Hild 4) 16:25	08:33 16:25
29	08:09 17:10	07:13 18:06		08:32 (Hild 4) 18:53		08:34 (Hild 4) 20:05	05:19 21:28	05:13 21:46	06:33 21:19	07:22 20:21	07:22 19:11	22	08:29 (Hild 4) 18:07	4	09:09 (Hild 4) 16:24	08:34 16:25
30	08:08 17:12	07:11 18:07		08:31 (Hild 4) 18:54		08:35 (Hild 4) 20:06	05:19 21:29	05:13 21:46	06:35 21:18	07:24 20:19	07:24 19:08	23	08:30 (Hild 1) 18:05		08:35 (Hild 4) 16:23	08:35 16:26
31	08:07 17:13	07:10 18:08		08:30 (Hild 4) 18:55		08:36 (Hild 4) 20:07	05:18 21:31	05:10 21:46	06:36 21:16	07:25 20:16	07:25 19:07		08:31 (Hild 1) 18:06		08:36 (Hild 4) 16:22	08:36 16:27
Sonnenscheinstunden	262	279		367		415	482	495	499	452	380		456	333	269	247
astr.max.mögl.Beschattung		375		641									456	578		
Red.Sonnenscheinwahrsch.		0,26		0,33									0,37	0,30		
Reduktion Betriebsdauer		0,98		0,98									0,98	0,98		
Reduktion Windrichtung		0,63		0,64									0,64	0,64		
Gesamte Reduktion		0,16		0,21									0,23	0,19		
Met.wahrsch.Beschattung		62		133									106	107		

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H16 - Hildfeld, Gerkenweg 7

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	07:04 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	07:25 19:06	08:30 (Hild 2) 17:02	08:07 16:23
2	08:31 16:30	08:04 17:17	07:11 18:07	07:02 19:57	06:02 20:49	05:18 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:32 (Hild 2) 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	07:00 19:58	06:03 20:51	05:19 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:28 19:02	08:34 (Hild 2) 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21	07:07 18:11	07:01 19:57	06:04 20:52	05:20 21:35	05:16 21:44	05:54 21:10	06:42 20:08	07:30 18:59	08:35 (Hild 2) 16:56	08:11 16:21
5	08:30 16:33	08:01 17:22	07:05 18:12	07:01 19:58	06:04 20:52	05:20 21:35	05:16 21:44	05:54 21:10	06:42 20:08	07:30 18:59	08:35 (Hild 2) 16:56	08:11 16:21
6	08:30 16:34	08:01 17:23	07:05 18:13	07:01 19:59	06:04 20:53	05:20 21:36	05:16 21:45	05:54 21:11	06:42 20:09	07:30 18:59	08:35 (Hild 2) 16:56	08:11 16:21
7	08:30 16:35	08:01 17:24	07:05 18:14	07:01 19:59	06:04 20:53	05:20 21:36	05:16 21:45	05:54 21:11	06:42 20:09	07:30 18:59	08:35 (Hild 2) 16:56	08:11 16:21
8	08:29 16:36	07:54 17:25	06:58 18:15	06:48 19:59	05:48 20:57	05:12 21:38	05:20 21:43	06:00 21:05	06:49 20:01	07:37 18:53	08:36 (Hild 2) 16:51	08:12 16:19
9	08:29 16:37	07:52 17:26	06:56 18:16	06:46 19:59	05:46 20:58	05:12 21:39	05:20 21:42	06:02 21:03	06:50 19:59	07:38 18:51	08:37 (Hild 2) 16:50	08:13 16:19
10	08:28 16:38	07:50 17:27	06:54 18:17	06:44 19:59	05:45 20:59	05:11 21:39	05:21 21:42	06:03 21:01	06:52 19:56	07:40 18:48	08:38 (Hild 2) 16:48	08:14 16:19
11	08:28 16:39	07:49 17:28	06:51 18:18	06:42 19:59	05:43 20:59	05:11 21:40	05:22 21:41	06:05 21:03	06:53 19:54	07:42 18:46	08:39 (Hild 2) 16:46	08:15 16:19
12	08:27 16:40	07:47 17:29	06:48 18:19	06:39 19:59	05:40 20:59	05:10 21:40	05:21 21:41	06:06 21:04	06:55 19:55	07:43 18:47	08:40 (Hild 2) 16:45	08:16 16:19
13	08:26 16:41	07:45 17:30	06:47 18:20	06:37 19:59	05:39 20:59	05:09 21:40	05:20 21:41	06:08 21:05	06:57 19:54	07:42 18:46	08:41 (Hild 2) 16:44	08:17 16:19
14	08:26 16:42	07:43 17:31	06:46 18:21	06:36 19:59	05:38 20:59	05:08 21:40	05:19 21:41	06:09 21:06	06:58 19:54	07:41 18:47	08:42 (Hild 2) 16:43	08:18 16:19
15	08:25 16:43	07:41 17:32	06:45 18:22	06:35 19:59	05:37 20:59	05:07 21:40	05:18 21:41	06:10 21:07	06:59 19:53	07:40 18:47	08:43 (Hild 2) 16:42	08:19 16:19
16	08:24 16:44	07:39 17:33	06:44 18:23	06:34 19:59	05:36 20:59	05:06 21:40	05:17 21:41	06:11 21:08	06:58 19:52	07:39 18:46	08:44 (Hild 2) 16:41	08:20 16:19
17	08:23 16:45	07:38 17:34	06:43 18:24	06:33 19:59	05:35 20:59	05:05 21:40	05:16 21:41	06:12 21:09	06:57 19:51	07:38 18:45	08:45 (Hild 2) 16:40	08:21 16:19
18	08:22 16:46	07:36 17:35	06:42 18:25	06:32 19:59	05:34 20:59	05:04 21:40	05:15 21:41	06:13 21:10	06:56 19:50	07:37 18:44	08:46 (Hild 2) 16:39	08:22 16:19
19	08:21 16:47	07:34 17:36	06:41 18:26	06:31 19:59	05:33 20:59	05:03 21:40	05:14 21:41	06:14 21:11	06:55 19:49	07:36 18:43	08:47 (Hild 2) 16:38	08:23 16:19
20	08:20 16:48	07:32 17:37	06:40 18:27	06:30 19:59	05:32 20:59	05:02 21:40	05:13 21:41	06:15 21:12	06:54 19:48	07:35 18:42	08:48 (Hild 2) 16:37	08:24 16:19
21	08:19 16:49	07:30 17:38	06:39 18:28	06:29 19:59	05:31 20:59	05:01 21:40	05:12 21:41	06:16 21:13	06:53 19:47	07:34 18:41	08:49 (Hild 2) 16:36	08:25 16:19
22	08:18 16:50	07:28 17:39	06:38 18:29	06:28 19:59	05:30 20:59	05:00 21:40	05:11 21:41	06:17 21:14	06:52 19:46	07:33 18:40	08:50 (Hild 2) 16:35	08:26 16:19
23	08:17 16:51	07:26 17:40	06:37 18:30	06:27 19:59	05:29 20:59	04:59 21:40	05:10 21:41	06:18 21:15	06:51 19:45	07:32 18:39	08:51 (Hild 2) 16:34	08:27 16:19
24	08:16 16:52	07:24 17:41	06:36 18:31	06:26 19:59	05:28 20:59	04:58 21:40	05:09 21:41	06:19 21:16	06:50 19:44	07:31 18:38	08:52 (Hild 2) 16:33	08:28 16:19
25	08:15 16:53	07:22 17:42	06:35 18:32	06:25 19:59	05:27 20:59	04:57 21:40	05:08 21:41	06:20 21:17	06:49 19:43	07:30 18:37	08:53 (Hild 2) 16:32	08:29 16:19
26	08:13 17:05	07:19 18:00	06:33 18:33	06:23 19:59	05:25 20:59	04:55 21:40	05:06 21:41	06:21 21:18	06:48 19:42	07:29 18:36	08:54 (Hild 2) 16:31	08:30 16:19
27	08:12 17:06	07:17 18:02	06:32 18:34	06:22 19:59	05:24 20:59	04:54 21:40	05:05 21:41	06:22 21:19	06:47 19:41	07:28 18:35	08:55 (Hild 2) 16:30	08:31 16:19
28	08:11 17:08	07:15 18:04	06:31 18:35	06:21 19:59	05:23 20:59	04:53 21:40	05:04 21:41	06:23 21:20	06:46 19:40	07:27 18:34	08:56 (Hild 2) 16:29	08:32 16:19
29	08:09 17:10	07:13 18:06	06:30 18:36	06:20 19:59	05:22 20:59	04:52 21:40	05:03 21:41	06:24 21:21	06:45 19:39	07:26 18:33	08:57 (Hild 2) 16:28	08:33 16:19
30	08:08 17:12	07:11 18:07	06:29 18:37	06:19 19:59	05:21 20:59	04:51 21:40	05:02 21:41	06:25 21:22	06:44 19:38	07:25 18:32	08:58 (Hild 2) 16:27	08:34 16:19
31	08:07 17:13	07:10 18:08	06:28 18:38	06:18 19:59	05:20 20:59	04:50 21:40	05:01 21:41	06:26 21:23	06:43 19:37	07:24 18:31	08:59 (Hild 2) 16:26	08:35 16:19
Sonnenscheinstunden	262	279	367	415	482	495	452	380	377	333	269	247
astr.max.mögl.Beschattung		397	437						377	465		
Red.Sonnenscheinwahrsch.		0,26	0,33						0,37	0,30		
Reduktion Betriebsdauer		0,98	0,98						0,98	0,98		
Reduktion Windrichtung		0,63	0,64						0,64	0,63		
Gesamte Reduktion		0,16	0,21						0,23	0,18		
Met.wahrsch.Beschattung		65	91						88	86		

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H18 - Hildfeld, Hildfelder Str. 41

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:29	08:05 17:15	07:13 18:05	08:21 (Hild 4) 07:04 18:05 (Hild 4) 19:58	08:30 (Hild 2) 06:01 08:54 (Hild 2) 21:32	05:17 21:32	05:14 21:45	05:50 21:15	06:38 20:14	07:25 19:06	07:18 17:02	08:07 16:23
2	08:31 16:30	08:04 17:17	07:11 18:07	08:21 (Hild 4) 07:02 08:48 (Hild 4) 20:00	08:31 (Hild 2) 05:59 08:52 (Hild 2) 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	07:19 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	08:21 (Hild 4) 07:00 08:48 (Hild 4) 20:01	08:33 (Hild 2) 05:57 08:51 (Hild 2) 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:21 19:02	07:21 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21	07:07 18:11	08:22 (Hild 4) 06:57 08:47 (Hild 4) 20:03	08:35 (Hild 2) 05:55 08:48 (Hild 2) 20:52	05:15 21:35	05:16 21:44	05:54 21:10	06:42 20:08	07:30 18:59	07:23 16:56	08:11 16:21
5	08:30 16:33	07:59 17:22	07:05 18:12	08:22 (Hild 4) 06:55 08:45 (Hild 4) 20:04	08:39 (Hild 2) 05:53 08:42 (Hild 2) 20:54	05:14 21:36	05:17 21:44	05:55 21:08	06:44 20:05	07:32 18:57	07:25 16:55	08:13 16:20
6	08:30 16:34	07:57 17:24	07:02 18:14	08:23 (Hild 4) 06:53 08:43 (Hild 4) 20:06	08:41 (Hild 2) 05:52 08:43 (Hild 2) 21:37	05:13 21:43	05:18 21:45	05:57 21:06	06:46 20:03	07:33 18:55	07:26 16:53	08:14 16:20
7	08:30 16:35	07:56 17:26	07:00 18:16	08:42 (Hild 4) 06:51 08:28 (Hild 4) 20:08	08:44 (Hild 2) 05:50 08:42 (Hild 2) 20:57	05:13 21:38	05:14 21:43	05:59 21:05	06:47 20:01	07:35 18:53	07:28 16:51	08:15 16:19
8	08:29 16:37	07:54 17:28	06:58 18:18	08:28 (Hild 4) 06:48 08:39 (Hild 4) 20:09	08:45 (Hild 2) 05:48 08:42 (Hild 2) 21:39	05:12 21:42	05:20 21:03	06:00 19:59	06:49 18:51	07:37 18:51	07:30 16:50	08:16 16:19
9	08:29 16:38	07:52 17:30	06:56 18:19	08:39 (Hild 4) 06:46 08:40 (Hild 4) 20:11	08:46 (Hild 2) 05:46 08:43 (Hild 2) 21:42	05:12 21:40	05:20 21:03	06:00 19:56	06:49 18:51	07:37 18:51	07:30 16:50	08:16 16:19
10	08:28 16:39	07:50 17:31	06:54 18:21	08:40 (Hild 4) 06:44 08:41 (Hild 4) 20:13	08:47 (Hild 2) 05:45 08:44 (Hild 2) 21:42	05:11 21:40	05:21 21:03	06:03 19:54	06:52 18:46	07:38 18:46	07:32 16:48	08:19 16:19
11	08:28 16:41	07:49 17:33	06:51 18:23	08:42 (Hild 4) 06:42 08:42 (Hild 4) 20:14	08:48 (Hild 2) 05:43 08:43 (Hild 2) 21:41	05:11 21:41	05:22 21:03	06:05 19:52	06:53 18:44	07:39 18:44	07:35 16:45	08:20 16:19
12	08:27 16:42	07:47 17:35	06:49 18:24	08:43 (Hild 4) 06:40 08:43 (Hild 4) 20:16	08:49 (Hild 2) 05:42 08:44 (Hild 2) 21:42	05:11 21:42	05:24 21:03	06:06 19:50	06:55 18:42	07:40 18:42	07:37 16:43	08:21 16:18
13	08:26 16:44	07:45 17:37	06:47 18:26	08:44 (Hild 4) 06:37 08:44 (Hild 4) 20:18	08:50 (Hild 2) 05:40 08:45 (Hild 2) 21:42	05:10 21:42	05:25 21:03	06:08 19:47	06:57 18:40	07:41 18:40	07:38 16:42	08:22 16:18
14	08:26 16:45	07:43 17:39	06:45 18:28	08:45 (Hild 4) 06:35 08:45 (Hild 4) 20:19	08:51 (Hild 2) 05:38 08:46 (Hild 2) 21:43	05:10 21:43	05:26 21:03	06:09 19:45	06:58 18:37	07:42 18:37	07:40 16:40	08:23 16:18
15	08:25 16:47	07:41 17:40	06:42 18:29	08:46 (Hild 4) 06:33 08:46 (Hild 4) 20:21	08:52 (Hild 2) 05:37 08:47 (Hild 2) 21:43	05:10 21:43	05:27 21:03	06:11 19:43	07:00 18:35	07:43 18:35	07:42 16:39	08:24 16:19
16	08:24 16:48	07:39 17:42	06:40 18:31	08:47 (Hild 4) 06:31 08:47 (Hild 4) 20:23	08:53 (Hild 2) 05:35 08:48 (Hild 2) 21:44	05:10 21:44	05:28 21:03	06:13 19:40	07:01 18:30	07:44 18:30	07:44 16:38	08:25 16:19
17	08:23 16:50	07:38 17:44	06:38 18:33	08:48 (Hild 4) 06:29 08:48 (Hild 4) 20:24	08:54 (Hild 2) 05:34 08:49 (Hild 2) 21:45	05:09 21:45	05:29 21:03	06:14 19:38	07:03 18:30	07:45 18:31	07:45 16:36	08:26 16:19
18	08:22 16:51	07:36 17:46	06:36 18:35	08:49 (Hild 4) 06:27 07:53 (Hild 2) 20:26	08:55 (Hild 2) 05:33 07:54 (Hild 2) 21:46	05:09 21:46	05:30 21:03	06:15 19:36	07:05 18:29	07:47 18:29	07:47 16:35	08:27 16:19
19	08:21 16:53	07:34 17:48	06:33 18:36	08:50 (Hild 4) 06:25 07:56 (Hild 2) 20:28	08:56 (Hild 2) 05:31 07:57 (Hild 2) 21:47	05:08 21:47	05:32 21:03	06:17 19:34	07:56 18:27	07:55 18:27	07:49 16:34	08:28 16:19
20	08:20 16:54	07:32 17:49	06:31 18:38	08:51 (Hild 4) 06:23 07:58 (Hild 2) 20:29	08:57 (Hild 2) 05:30 07:59 (Hild 2) 21:48	05:07 21:48	05:33 21:03	06:19 19:31	07:57 18:25	07:56 18:25	07:50 16:33	08:29 16:20
21	08:19 16:56	07:30 17:51	06:29 18:40	08:52 (Hild 4) 06:20 07:59 (Hild 2) 20:31	08:58 (Hild 2) 05:28 07:59 (Hild 2) 21:49	05:06 21:49	05:34 21:03	06:20 19:28	07:58 18:23	07:58 18:23	07:52 16:32	08:30 16:20
22	08:18 16:58	07:28 17:53	06:27 18:41	08:53 (Hild 4) 06:18 07:59 (Hild 2) 20:33	08:59 (Hild 2) 05:27 07:59 (Hild 2) 21:50	05:05 21:50	05:35 21:03	06:22 19:27	07:11 18:27	07:11 18:27	07:53 16:30	08:31 16:21
23	08:17 16:59	07:26 17:55	06:24 18:43	08:54 (Hild 4) 06:16 07:59 (Hild 2) 20:34	09:00 (Hild 2) 05:26 07:59 (Hild 2) 21:51	05:04 21:51	05:36 21:03	06:24 19:24	07:12 18:24	07:12 18:24	07:55 16:29	08:32 16:21
24	08:16 17:01	07:24 17:57	06:22 18:45	08:55 (Hild 4) 06:14 07:59 (Hild 2) 20:36	09:01 (Hild 2) 05:25 07:59 (Hild 2) 21:52	05:03 21:52	05:37 21:03	06:25 19:22	07:14 18:22	07:14 18:22	07:57 16:28	08:33 16:22
25	08:15 17:03	07:21 17:58	06:20 18:46	08:56 (Hild 4) 06:12 07:59 (Hild 2) 20:37	09:02 (Hild 2) 05:24 07:59 (Hild 2) 21:53	05:02 21:53	05:38 21:03	06:27 19:20	07:16 18:20	07:16 18:20	07:58 16:27	08:34 16:25
26	08:13 17:05	07:19 18:00	06:18 18:48	08:57 (Hild 4) 06:10 07:59 (Hild 2) 20:39	09:03 (Hild 2) 05:23 07:59 (Hild 2) 21:54	05:01 21:54	05:39 21:03	06:28 19:18	07:17 18:18	07:17 18:18	08:00 16:26	08:35 16:23
27	08:12 17:06	07:17 18:02	06:15 18:50	08:58 (Hild 4) 06:08 07:59 (Hild 2) 20:41	09:04 (Hild 2) 05:21 07:59 (Hild 2) 21:55	05:00 21:55	05:40 21:03	06:30 19:15	07:19 18:15	07:19 18:15	08:01 16:25	08:36 16:24
28	08:11 17:08	07:15 18:04	06:13 18:51	08:59 (Hild 4) 06:06 07:59 (Hild 2) 20:42	09:05 (Hild 2) 05:20 07:59 (Hild 2) 21:56	04:59 21:56	05:41 21:03	06:31 19:13	07:20 18:13	07:20 18:13	08:03 16:25	08:37 16:25
29	08:09 17:10	18:04	06:11 18:53	09:00 (Hild 4) 06:05 08:29 (Hild 2) 20:44	09:06 (Hild 2) 05:19 08:29 (Hild 2) 21:57	04:58 21:57	05:42 21:03	06:33 19:11	07:22 18:11	07:22 18:11	08:04 16:26	08:38 16:25
30	08:08 17:12		06:09 18:55	09:01 (Hild 4) 06:03 08:29 (Hild 2) 20:46	09:07 (Hild 2) 05:18 08:29 (Hild 2) 21:58	04:57 21:58	05:43 21:03	06:35 19:10	07:24 18:10	07:24 18:10	08:06 16:27	08:39 16:26
31	08:07 17:13		06:07 19:56	09:02 (Hild 4) 06:01 08:55 (Hild 2) 20:48	09:08 (Hild 2) 05:17 08:55 (Hild 2) 21:59	04:56 21:59	05:44 21:03	06:36 19:08	07:25 18:09	07:25 18:09	08:07 16:28	08:40 16:27
Sonnenscheinstunden												
astr.max.mögl.Beschattung												
Red.Sonnenscheinwahrsch.												
Reduktion Betriebsdauer												
Reduktion Windrichtung												
Gesamte Reduktion												
Met.wahrsch.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)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
	Minuten mit Schatten	

Annahmen für Schattenwurfberechnung

1,58	2,64	3,90	5,63	6,26	6,50	6,48	6,13	4,67	3,19	1,70	1,23
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N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
538	347	302	494	560	497	650	937	1.350	1.257	937	732	8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	Schattenanfang (WEA mit erstem Schatten)	Schattenende (WEA mit letztem Schatten)
1							
2							
3							
4							
5							
6							
7							
8							
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10							
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24							
25							
26							
27							
28							
29							
30							
31							

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H21 - Hildfeld, Hildfelder Str. 44

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	08:28 (Hild 4)	07:04	08:34 (Hild 2)	06:01	05:17	05:14	05:49	06:38	
2	16:28	17:15	18:05	08:56 (Hild 4)	19:58	26	09:00 (Hild 2)	06:47	21:32	21:45	20:14	
3	08:31	08:04	07:11	08:28 (Hild 4)	07:02	08:35 (Hild 2)	05:59	05:16	05:15	05:51	06:39	
4	16:30	17:17	18:07	08:55 (Hild 4)	20:00	24	08:59 (Hild 2)	20:49	21:33	21:45	20:12	
5	08:31	08:02	07:09	08:29 (Hild 4)	07:00	08:37 (Hild 2)	05:57	05:15	05:15	05:52	06:41	
6	16:31	17:19	18:09	08:55 (Hild 4)	20:01	20	08:57 (Hild 2)	20:51	21:34	21:45	20:10	
7	08:30	08:00	07:07	08:30 (Hild 4)	06:57	08:39 (Hild 2)	05:55	05:15	05:16	05:54	06:42	
8	16:32	17:21	18:11	08:54 (Hild 4)	20:03	16	08:55 (Hild 2)	20:52	21:35	21:44	20:09	
9	08:30	07:59	07:05	08:30 (Hild 4)	06:55	08:41 (Hild 2)	05:53	05:14	05:17	05:55	06:44	
10	16:33	17:22	18:12	21	08:51 (Hild 4)	20:04	9	08:50 (Hild 2)	20:54	21:36	21:44	
11	08:30	07:57	07:02	08:32 (Hild 4)	06:53		05:52	05:13	05:18	05:57	06:46	
12	16:34	17:24	18:14	17	08:49 (Hild 4)	20:06	20:55	21:37	21:43	21:06	20:03	
13	08:30	07:56	07:00	08:35 (Hild 4)	06:51		05:50	05:13	05:19	05:59	06:47	
14	16:35	17:25	18:16	11	08:46 (Hild 4)	20:08	20:57	21:40	21:38	21:05	20:03	
15	08:29	07:54	06:58		06:48		05:48	05:12	05:20	06:00	06:49	
16	16:37	17:28	18:18		20:09		20:59	21:39	21:42	21:03	19:59	
17	08:29	07:52	06:56		07:51 (Hild 1)	06:46	05:46	05:12	05:20	06:02	06:50	
18	16:38	17:30	18:19	9	08:00 (Hild 1)	20:11	21:00	21:39	21:42	21:01	19:56	
19	08:28	07:50	06:54		07:42 (Hild 1)	06:44	05:45	05:11	05:19	06:03	06:52	
20	16:39	17:31	18:21	15	06:03 (Hild 1)	20:13	21:02	21:40	21:41	21:09	19:54	
21	08:28	07:49	06:51		07:47 (Hild 1)	20:12	05:43	05:11	05:22	06:05	06:53	
22	16:41	17:33	18:23	18	08:05 (Hild 1)	20:14	21:03	21:41	21:40	21:09	19:52	
23	08:27	07:47	06:49		07:45 (Hild 1)	20:10	05:42	05:11	05:24	06:06	06:55	
24	16:42	17:35	18:24	21	08:06 (Hild 1)	20:16	21:06	21:42	21:39	21:05	19:50	
25	08:26	07:45	06:47		07:44 (Hild 1)	20:13	05:40	05:10	05:25	06:08	06:57	
26	16:44	17:37	18:26	22	08:06 (Hild 1)	20:18	21:06	21:42	21:39	21:04	19:47	
27	08:26	07:43	06:45		07:43 (Hild 1)	20:15	05:38	05:10	05:26	06:09	06:58	
28	16:45	17:39	18:28	23	08:06 (Hild 1)	20:19	21:08	21:43	21:38	21:02	19:45	
29	08:25	07:41	06:42		07:43 (Hild 1)	20:13	05:37	05:10	05:27	06:11	07:00	
30	16:47	17:40	18:29	23	08:06 (Hild 1)	20:21	21:09	21:43	21:37	21:00	19:43	
31	08:24	07:39	06:40		07:43 (Hild 1)	20:13	05:35	05:10	05:28	06:13	07:01	
1	16:48	17:42	18:31	23	08:06 (Hild 1)	20:21	21:11	21:44	21:36	21:08	19:40	
2	08:23	07:38	06:38		07:42 (Hild 1)	20:29	21:34	05:10	05:29	06:14	07:03	
3	16:50	17:44	18:33	23	08:05 (Hild 1)	20:24	21:12	21:44	21:35	21:06	19:38	
4	08:22	07:36	06:36		07:42 (Hild 1)	20:27	05:33	05:10	05:28	06:13	07:04	
5	16:51	17:46	18:35	23	08:05 (Hild 1)	20:25	21:14	21:45	21:34	21:04	19:36	
6	08:21	07:34	06:33		07:42 (Hild 1)	20:26	05:31	05:10	05:32	06:17	07:06	
7	16:53	17:48	18:36	22	08:04 (Hild 1)	20:28	21:15	21:45	21:33	21:02	19:34	
8	08:20	07:32	06:31		07:40 (Hild 1)	20:23	05:30	05:10	05:33	06:19	07:08	
9	16:54	17:49	18:38	23	08:05 (Hild 1)	20:29	21:17	21:46	21:31	21:03	19:35	
10	08:19	07:30	06:29		07:38 (Hild 1)	20:20	05:28	05:10	05:34	06:20	07:09	
11	16:56	17:51	18:40	26	08:04 (Hild 1)	20:31	21:18	21:46	21:30	21:08	19:29	
12	08:18	07:28	06:27		07:37 (Hild 1)	20:18	05:27	05:10	05:35	06:22	07:11	
13	16:58	17:53	18:41	28	08:05 (Hild 1)	20:33	21:19	21:46	21:29	21:06	19:27	
14	08:17	07:26	06:24		07:37 (Hild 1)	20:16	05:26	05:10	05:37	06:24	07:12	
15	16:59	17:55	18:43	29	08:05 (Hild 1)	20:34	21:21	21:46	21:38	21:09	19:24	
16	08:16	07:24	06:22		07:35 (Hild 1)	20:14	05:25	05:11	05:38	06:25	07:14	
17	17:01	17:57	18:45	30	08:05 (Hild 1)	20:36	21:22	21:46	21:26	21:01	19:22	
18	16:57	17:51	18:40		07:35 (Hild 1)	20:12	05:24	05:11	05:39	06:27	07:16	
19	08:13	07:19	06:18		08:06 (Hild 1)	20:37	21:23	21:46	21:25	21:09	19:20	
20	17:05	18:00	18:48	32	08:06 (Hild 1)	20:39	21:25	21:46	21:24	21:07	19:17	
21	08:12	07:17	06:15		07:34 (Hild 1)	20:08	05:21	05:12	05:42	06:30	07:19	
22	17:06	18:02	18:50	31	08:05 (Hild 1)	20:41	21:26	21:46	21:22	21:05	19:15	
23	08:11	07:15	06:13		07:33 (Hild 1)	20:06	05:20	05:12	05:44	06:31	07:20	
24	17:08	18:04	18:51	31	08:05 (Hild 1)	20:45	21:27	21:46	21:23	21:06	19:13	
25	08:09		07:11		08:34 (Hild 2)	06:05	05:19	05:13	05:45	06:33	07:22	
26	17:10		19:53		30	09:04 (Hild 2)	20:44	21:28	21:46	21:19	20:21	
27	08:08		07:09		08:34 (Hild 2)	20:03	05:19	05:13	05:47	06:35	07:24	
28	17:12		19:55		29	09:03 (Hild 2)	20:46	21:29	21:46	21:18	20:19	
29	08:07		07:06		08:34 (Hild 2)	20:01	05:19	05:13	05:48	06:36	07:25	
30	17:13		19:56		27	09:01 (Hild 2)	20:16	21:31	21:46	21:16	20:16	
Sonnenscheinstunden	262	279	367			415	482	495	499	452	380	
astr.max.mögl.Beschattung		300	723		95						604	
Red.Sonnenscheinwahrsch.		0.26	0.93		0.41						0.37	
Reduktion Betriebsdauer		0.98	0.98		0.98						0.98	
Reduktion Windrichtung		0.64	0.64		0.64						0.64	
Gesamte Reduktion		0.17	0.21		0.26						0.23	
Met.wahrsch.Beschattung		50	150		24						199	

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H22 - Hildfeld, Hildfelder Str. 45

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSS WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	08:27 (Hild 4)	07:04	08:37 (Hild 2)	06:01	05:17	05:14	05:49	06:38	07:25
2	16:28	17:15	18:05	27 08:54 (Hild 4)	19:58	21 08:58 (Hild 2)	06:47	21:32	21:45	21:15	20:14	19:06
3	08:31	08:04	07:11	08:28 (Hild 4)	07:02	08:38 (Hild 2)	05:59	05:16	05:15	05:51	06:39	07:27
4	16:30	17:17	18:07	25 08:53 (Hild 4)	20:00	18 08:56 (Hild 2)	06:49	21:33	21:45	21:13	20:12	19:04
5	08:31	08:02	07:09	08:29 (Hild 4)	07:00	08:41 (Hild 2)	05:57	05:15	05:15	05:52	06:41	07:28
6	16:31	17:19	18:09	23 08:52 (Hild 4)	20:01	12 08:53 (Hild 2)	06:51	21:34	21:45	21:11	20:10	19:02
7	08:30	08:01	07:07	08:30 (Hild 4)	06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:19
8	16:32	17:21	18:11	21 08:51 (Hild 4)	20:03	20:52	05:16	21:35	21:44	21:12	20:11	19:03
9	08:30	07:59	07:05	08:31 (Hild 4)	06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:13
10	16:33	17:22	18:12	17 08:48 (Hild 4)	20:04	20:54	21:36	21:44	21:08	20:05	18:57	18:11
11	08:30	07:57	07:02	08:34 (Hild 4)	06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:14
12	16:34	17:24	18:14	12 08:46 (Hild 4)	20:06	20:55	21:37	21:43	21:06	20:03	18:55	16:53
13	08:30	07:56	07:00	06:51		05:50	05:13	05:19	05:59	06:47	07:35	08:15
14	16:35	17:25	18:16	20:08		20:57	21:40	21:43	21:03	20:03	18:53	16:54
15	08:29	07:54	06:58	07:53 (Hild 1)	20:48	05:48	05:12	05:20	06:00	06:49	07:37	08:16
16	16:37	17:28	18:18	7 08:00 (Hild 1)	20:09	20:59	21:39	21:42	21:03	20:59	18:51	16:59
17	08:29	07:52	06:56	07:49 (Hild 1)	20:46	05:46	05:12	05:20	06:02	06:50	08:34 (Hild 2)	07:31
18	16:38	17:30	18:19	13 08:02 (Hild 1)	20:11	21:00	21:39	21:42	21:01	20:56	18:52 (Hild 2)	16:48
19	08:28	07:50	06:54	07:42 (Hild 1)	20:44	05:45	05:11	05:20	06:03	06:52	08:35 (Hild 2)	16:49
20	16:39	17:31	18:21	17 08:04 (Hild 1)	20:13	21:02	21:40	21:41	21:00	20:59	18:54	17:21
21	08:28	07:49	06:51	07:46 (Hild 1)	20:42	05:43	05:11	05:22	06:05	06:53	08:30 (Hild 2)	16:46
22	16:41	17:33	18:23	19 08:05 (Hild 1)	20:14	21:03	21:41	21:40	21:00	20:57	19:52	16:50
23	08:27	07:47	06:49	07:45 (Hild 1)	20:40	05:42	05:11	05:24	06:06	06:55	08:28 (Hild 2)	16:43
24	16:42	17:35	18:24	21 08:06 (Hild 1)	20:16	21:06	21:42	21:39	21:05	20:55	19:54	16:51
25	08:26	07:45	06:47	07:43 (Hild 1)	20:37	05:40	05:10	05:25	06:08	06:57	08:27 (Hild 2)	16:42
26	16:44	17:37	18:26	23 08:06 (Hild 1)	20:18	21:06	21:42	21:39	21:04	20:54	19:47	16:50
27	08:26	07:43	06:45	07:43 (Hild 1)	20:35	05:38	05:10	05:26	06:09	06:58	08:25 (Hild 2)	16:40
28	16:45	17:39	18:28	23 08:06 (Hild 1)	20:19	21:08	21:43	21:38	21:04	20:52	19:45	16:48
29	08:25	07:41	06:42	07:43 (Hild 1)	20:33	05:37	05:10	05:27	06:11	07:00	08:25 (Hild 2)	16:42
30	16:47	17:40	18:29	23 08:06 (Hild 1)	20:21	21:09	21:43	21:37	21:00	20:50	19:43	16:49
31	08:24	07:39	06:40	07:43 (Hild 1)	20:31	05:35	05:10	05:28	06:13	07:01	08:23 (Hild 2)	16:44
1	16:48	17:42	18:31	23 08:06 (Hild 1)	20:23	21:11	21:44	21:36	21:00	20:48	19:40	16:48
2	08:23	07:38	06:38	07:42 (Hild 1)	20:29	21:04	21:38	21:30	21:02	20:46	19:38	16:47
3	16:50	17:44	18:33	23 08:05 (Hild 1)	20:24	21:12	21:44	21:35	21:00	20:46	19:38	16:46
4	08:22	07:36	06:36	07:42 (Hild 1)	20:27	21:03	21:36	21:28	21:00	20:43	19:30	16:45
5	16:51	17:46	18:35	22 08:04 (Hild 1)	20:26	21:14	21:45	21:34	21:04	20:44	19:36	16:44
6	08:21	07:34	06:33	07:41 (Hild 1)	20:25	21:03	21:36	21:28	21:00	20:43	19:28	16:43
7	16:53	17:48	18:36	23 08:04 (Hild 1)	20:28	21:15	21:46	21:33	21:02	20:42	19:34	16:42
8	08:20	07:32	06:31	07:38 (Hild 2)	20:23	21:05	21:40	21:30	21:00	20:43	19:28	16:41
9	16:54	17:49	18:38	26 08:04 (Hild 2)	20:29	21:17	21:48	21:31	21:03	20:48	19:37	16:40
10	08:19	07:30	06:29	07:37 (Hild 2)	20:20	21:06	21:41	21:30	21:00	20:43	19:29	16:39
11	16:56	17:51	18:40	28 08:05 (Hild 2)	20:31	21:18	21:46	21:30	21:02	20:46	19:35	16:38
12	08:18	07:28	06:27	07:37 (Hild 2)	20:18	21:07	21:40	21:30	21:00	20:43	19:28	16:37
13	16:58	17:53	18:41	29 08:06 (Hild 2)	20:33	21:19	21:46	21:29	21:00	20:46	19:34	16:36
14	08:17	07:26	06:24	07:36 (Hild 2)	20:14	21:06	21:40	21:30	21:00	20:43	19:27	16:35
15	16:59	17:55	18:43	30 08:06 (Hild 2)	20:34	21:21	21:46	21:30	21:00	20:46	19:34	16:34
16	08:16	07:24	06:22	07:35 (Hild 2)	20:16	21:05	21:40	21:30	21:00	20:43	19:26	16:33
17	17:01	17:57	18:45	30 08:05 (Hild 2)	20:36	21:22	21:46	21:26	21:00	20:43	19:22	16:32
18	08:15	07:21	06:20	07:35 (Hild 2)	20:12	21:04	21:41	21:30	21:00	20:43	19:21	16:31
19	17:03	17:58	18:46	30 08:05 (Hild 2)	20:37	21:23	21:46	21:25	21:00	20:43	19:20	16:30
20	08:13	07:19	06:18	07:35 (Hild 2)	20:08	21:01	21:41	21:30	21:00	20:43	19:17	16:29
21	17:05	18:00	18:48	30 08:05 (Hild 2)	20:39	21:25	21:46	21:24	21:00	20:43	19:18	16:28
22	08:12	07:17	06:15	07:35 (Hild 2)	20:08	21:01	21:42	21:30	21:00	20:43	19:17	16:27
23	17:06	18:02	18:50	30 08:05 (Hild 2)	20:41	21:26	21:46	21:22	21:00	20:43	19:15	16:26
24	08:11	07:15	06:13	07:34 (Hild 2)	20:06	21:00	21:46	21:30	21:00	20:43	19:14	16:25
25	17:08	18:04	18:51	29 08:05 (Hild 2)	20:45	21:27	21:46	21:21	21:00	20:43	19:13	16:24
26	08:09		06:11	07:35 (Hild 2)	20:05	21:03	21:45	21:30	21:00	20:43	19:12	16:23
27	17:10		19:53	27 09:02 (Hild 2)	20:44	21:28	21:46	21:19	21:00	20:43	19:11	16:22
28	08:08		07:09	08:35 (Hild 2)	20:03	21:09	21:43	21:30	21:00	20:43	19:10	16:21
29	17:12		19:55	27 09:02 (Hild 2)	20:46	21:29	21:46	21:18	21:00	20:43	19:08	16:20
30	08:07		07:06	08:35 (Hild 2)	20:04	21:05	21:46	21:30	21:00	20:43	19:07	16:19
31	17:13		19:56	24 08:59 (Hild 2)	20:07	21:31	21:46	21:16	21:00	20:43	19:06	16:18
Sonneneinstrahlung	262	279	367	702	415	482	495	499	452	380	333	269
astr.mögl.Beschattung		304		51						550	524	247
Red.Sonneneinstrahlung		0.26		0.41						0.37	0.30	
Reduktion Betriebsdauer		0.98		0.98						0.98	0.98	
Reduktion Wertschöpfung		0.64		0.64						0.64	0.64	
Gesamte Reduktion		0.17		0.26						0.23	0.19	
Met.wahrsch.Beschattung		50		13						123	97	

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consruch-Straße 3
DE-34131 Kassel

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H23 - Hildfeld, Hildfelder Str. 46

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	[Januar	[Februar	[März	[April	[Mai	[Juni	[Juli	[August	[September	[Oktober	[November	[Dezember	
1 08:31	08:05	08:45 (Hild 3)	07:13	08:31 (Hild 4)	07:04	08:35 (Hild 2)	06:01	05:17	05:14	05:49	06:38	08:10 (Hild 3)	08:07
2 16:28	17:15	12 08:57 (Hild 3)	18:05	29 09:00 (Hild 4)	19:58	28 09:03 (Hild 2)	20:47	21:32	21:45	21:15	20:14	08:34 (Hild 3)	16:22
3 08:31	08:04	08:43 (Hild 3)	07:11	08:04 (Hild 4)	07:02	08:36 (Hild 2)	05:59	05:16	05:15	05:51	06:39	08:10 (Hild 3)	08:09
4 16:30	17:17	16 08:59 (Hild 3)	18:07	28 08:59 (Hild 4)	20:00	26 09:02 (Hild 2)	20:49	21:33	21:45	21:13	20:12	08:34 (Hild 3)	16:22
5 08:31	08:02	08:42 (Hild 3)	07:09	08:32 (Hild 4)	07:00	08:37 (Hild 2)	05:57	05:15	05:15	05:52	06:41	08:10 (Hild 3)	08:10
6 16:31	17:19	18 09:00 (Hild 3)	18:09	26 08:58 (Hild 4)	20:01	24 09:01 (Hild 2)	20:51	21:34	21:45	21:11	20:10	08:34 (Hild 3)	16:21
7 08:30	08:00	08:42 (Hild 3)	07:07	08:33 (Hild 4)	06:57	08:38 (Hild 2)	05:55	05:15	05:16	05:54	06:42	08:29 (Hild 3)	08:11
8 16:32	17:21	20 09:02 (Hild 3)	19:11	24 08:57 (Hild 4)	20:03	21 08:59 (Hild 2)	20:52	21:35	21:44	21:10	20:08	08:33 (Hild 3)	16:21
9 08:30	07:59	08:41 (Hild 3)	07:05	08:34 (Hild 4)	06:55	08:39 (Hild 2)	05:53	05:14	05:17	05:55	06:44	08:33 (Hild 3)	08:13
10 16:33	17:22	21 09:02 (Hild 3)	18:12	21 08:55 (Hild 4)	20:04	17 08:56 (Hild 2)	20:54	21:36	21:44	21:08	20:05	08:32 (Hild 3)	16:20
11 08:30	07:57	08:40 (Hild 3)	07:02	08:36 (Hild 4)	06:53	08:43 (Hild 2)	05:52	05:13	05:18	05:57	06:46	08:31 (Hild 3)	08:14
12 16:34	17:24	23 09:03 (Hild 3)	18:14	16 08:52 (Hild 4)	20:06	9 08:52 (Hild 2)	20:55	21:37	21:43	21:06	20:03	08:32 (Hild 3)	16:20
13 08:30	07:56	08:40 (Hild 3)	07:00	08:39 (Hild 4)	06:51	9 08:52 (Hild 2)	20:55	21:37	21:43	21:06	20:03	08:32 (Hild 3)	16:20
14 16:35	17:26	23 09:03 (Hild 3)	18:16	10 08:49 (Hild 4)	20:08	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
15 08:29	07:54	08:40 (Hild 3)	06:58	08:48	06:48	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
16 16:37	17:28	24 09:04 (Hild 3)	18:19	12 09:09	20:09	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
17 08:29	07:52	08:40 (Hild 3)	06:56	07:52 (Hild 1)	06:46	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
18 16:38	17:30	24 09:04 (Hild 3)	18:19	10 08:02 (Hild 1)	20:11	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
19 08:28	07:50	08:40 (Hild 3)	06:54	07:50 (Hild 1)	06:44	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
20 16:39	17:31	24 09:04 (Hild 3)	18:21	15 08:05 (Hild 1)	20:13	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
21 08:28	07:49	08:40 (Hild 3)	06:51	07:48 (Hild 1)	06:42	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
22 16:41	17:33	24 09:04 (Hild 3)	18:23	18 08:06 (Hild 1)	20:14	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
23 08:27	07:47	08:41 (Hild 3)	06:49	07:47 (Hild 1)	06:40	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
24 16:42	17:35	22 09:03 (Hild 3)	18:24	20 08:07 (Hild 1)	20:16	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
25 08:26	07:45	08:41 (Hild 3)	06:47	07:45 (Hild 1)	06:37	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
26 16:44	17:37	21 09:02 (Hild 3)	18:26	22 08:07 (Hild 1)	20:18	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
27 08:26	07:43	08:42 (Hild 3)	06:45	07:44 (Hild 1)	06:35	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
28 16:45	17:39	20 09:02 (Hild 3)	18:28	24 08:08 (Hild 1)	20:19	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
29 08:25	07:41	08:43 (Hild 3)	06:42	07:44 (Hild 1)	06:33	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
30 16:47	17:40	21 09:03 (Hild 3)	18:29	24 08:09 (Hild 1)	20:21	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
31 08:24	07:39	08:42 (Hild 3)	06:40	07:44 (Hild 1)	06:31	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
32 16:48	17:42	17 08:59 (Hild 3)	18:31	24 08:08 (Hild 1)	20:23	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
33 08:23	07:38	08:39 (Hild 4)	06:38	07:43 (Hild 1)	06:29	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
34 16:50	17:44	17 08:56 (Hild 3)	18:33	24 08:07 (Hild 1)	20:24	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
35 08:22	07:36	08:37 (Hild 4)	06:36	07:43 (Hild 1)	06:27	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
36 16:51	17:46	20 08:57 (Hild 3)	18:35	24 08:07 (Hild 1)	20:26	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
37 08:21	07:34	08:35 (Hild 4)	06:33	07:44 (Hild 1)	06:25	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
38 16:53	17:48	23 08:58 (Hild 4)	18:36	22 08:06 (Hild 1)	20:28	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
39 08:20	07:32	08:34 (Hild 4)	06:31	07:42 (Hild 1)	06:23	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
40 16:54	17:49	25 08:59 (Hild 4)	18:38	23 08:05 (Hild 1)	20:29	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
41 08:19	07:30	08:33 (Hild 4)	06:29	07:40 (Hild 1)	06:20	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
42 16:56	17:51	27 09:00 (Hild 4)	18:40	26 08:06 (Hild 1)	20:31	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
43 08:18	07:28	08:32 (Hild 4)	06:27	07:39 (Hild 1)	06:18	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
44 16:58	17:53	29 09:01 (Hild 4)	18:41	28 08:07 (Hild 1)	20:33	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
45 08:17	07:26	08:32 (Hild 4)	06:24	07:38 (Hild 1)	06:16	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
46 16:59	17:55	29 09:01 (Hild 4)	18:43	30 08:08 (Hild 1)	20:34	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
47 08:16	07:24	08:31 (Hild 4)	06:22	07:37 (Hild 1)	06:14	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
48 17:01	17:57	31 09:02 (Hild 4)	18:45	31 08:08 (Hild 1)	20:36	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
49 08:15	07:21	08:31 (Hild 4)	06:20	07:36 (Hild 1)	06:12	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
50 17:03	17:58	31 09:02 (Hild 4)	18:46	32 08:08 (Hild 1)	20:37	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
51 08:13	07:19	08:31 (Hild 4)	06:18	07:36 (Hild 1)	06:10	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
52 17:05	18:00	31 09:02 (Hild 4)	18:48	32 08:08 (Hild 1)	20:39	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
53 08:12	07:17	08:31 (Hild 4)	06:15	07:36 (Hild 1)	06:08	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
54 17:06	18:02	31 09:02 (Hild 4)	18:50	32 08:08 (Hild 1)	20:41	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
55 08:11	07:15	08:30 (Hild 4)	06:13	07:35 (Hild 1)	06:06	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
56 17:08	18:04	30 09:00 (Hild 4)	18:51	32 08:07 (Hild 1)	20:42	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
57 08:09			07:11	08:35 (Hild 2)	06:04	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
58 17:10			07:53	09:07 (Hild 2)	20:44	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
59 08:08			07:09	08:35 (Hild 2)	06:03	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
60 17:12			07:15	08:39 (Hild 2)	20:46	10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
61 08:07			07:06	08:34 (Hild 2)		10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
62 17:13	7 08:54 (Hild 3)		19:56	30 09:04 (Hild 2)		10 08:49 (Hild 4)	20:08	20:57	21:38	21:43	21:05	08:31 (Hild 3)	16:19
Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269	247	
astr. max. mögl. Beschattung	7	650	740	125					650	682	209		
Red. Sonnenscheinwahrsch.	0,19	0,26	0,33	0,41					0,37	0,30	0,19		
Reduktion Betriebsdauer	0,98	0,98	0,98	0,98					0,98	0,98	0,98		
Reduktion Windrichtung	0,62	0,63	0,64	0,64					0,64	0,63	0,62		
Gesamte Reduktion	0,11	0,16	0,21	0,26					0,23	0,18	0,12		
Met. wahrsch. Beschattung	1	106	153	32					151	126	24		

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H24 - Hildfeld, Hildfelder Str. 47

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSS WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember			
1	08:31	08:05	07:13	08:39 (Hild 4)	07:04	08:48 (Hild 2)	06:01	05:17	05:14	05:49	06:38	07:25	08:28 (Hild 1)	07:18	08:07
2	16:28	17:15	18:05	22 09:01 (Hild 4)	19:58	14 09:02 (Hild 2)	20:47	21:32	21:45	21:15	20:14	19:06	24 08:52 (Hild 1)	17:02	16:22
3	08:31	08:04	07:11	08:40 (Hild 4)	07:02	08:53 (Hild 2)	05:59	05:16	05:15	05:51	06:39	07:27	08:28 (Hild 1)	07:19	08:09
4	16:30	17:17	18:07	19 08:59 (Hild 4)	20:00	3 08:56 (Hild 2)	20:49	21:33	21:45	21:13	20:12	19:04	24 08:52 (Hild 1)	17:00	16:22
5	08:31	08:02	07:09	08:43 (Hild 4)	07:00		05:57	05:15	05:15	05:52	06:41	07:28	08:28 (Hild 1)	07:21	08:10
6	16:31	17:19	18:09	14 08:57 (Hild 4)	20:01		20:51	21:34	21:45	21:11	20:10	19:02	23 08:51 (Hild 1)	16:58	16:21
7	08:30	08:00	07:07	08:47 (Hild 4)	06:57		05:55	05:15	05:16	05:54	06:42	07:30	08:29 (Hild 1)	07:23	08:11
8	16:32	17:21	18:11	15 08:52 (Hild 4)	20:03		20:52	21:35	21:46	21:12	20:11	19:03	24 08:50 (Hild 1)	16:56	16:21
9	08:30	07:59	07:05	08:51 (Hild 4)	06:55		05:53	05:14	05:17	05:55	06:44	07:32	08:30 (Hild 1)	07:25	08:13
10	16:33	17:22	18:12		20:04		20:54	21:36	21:44	21:08	20:05	18:57	08:49 (Hild 1)	16:55	16:20
11	08:30	07:57	07:02	07:58 (Hild 1)	06:53		05:52	05:13	05:18	05:57	06:46	07:33	08:30 (Hild 1)	07:26	08:14
12	16:34	17:24	18:14	9 08:07 (Hild 1)	20:06		20:55	21:37	21:43	21:06	20:03	18:55	17 08:47 (Hild 1)	16:53	16:20
13	08:30	07:56	07:00	07:55 (Hild 1)	06:51		05:50	05:13	05:19	05:59	06:47	07:35	08:32 (Hild 1)	07:28	08:15
14	16:35	17:25	18:16	10 08:10 (Hild 1)	20:08		20:57	21:39	21:43	21:08	20:03	18:56	12 08:44 (Hild 1)	16:54	16:19
15	08:29	07:54	06:58	07:53 (Hild 1)	06:48		05:48	05:12	05:20	06:00	06:49	07:37	08:37 (Hild 1)	07:30	08:16
16	16:37	17:28	18:18	18 08:11 (Hild 1)	20:09		20:59	21:39	21:42	21:03	19:59	18:51	3 08:40 (Hild 1)	16:50	16:19
17	08:29	07:52	06:56	07:51 (Hild 1)	06:46		05:46	05:12	05:20	06:02	06:50	07:38		07:31	08:17
18	16:38	17:30	18:19	21 08:12 (Hild 1)	20:11		21:00	21:39	21:42	21:01	19:56	18:48		16:48	16:19
19	08:28	07:50	06:54	07:50 (Hild 1)	06:44		05:45	05:10	05:21	06:03	06:52	07:39	09:19 (Hild 4)	16:46	16:19
20	16:39	17:31	18:21	22 08:12 (Hild 1)	20:13		21:02	21:40	21:41	21:09	19:54	18:46	10 09:29 (Hild 4)	16:46	16:19
21	08:28	07:49	06:51	07:50 (Hild 1)	06:42		05:43	05:11	05:22	06:05	06:53	07:42	09:16 (Hild 4)	16:45	16:20
22	16:41	17:33	18:23	23 08:13 (Hild 1)	20:14		21:03	21:41	21:40	21:07	19:52	13 08:54 (Hild 2)	16 09:32 (Hild 4)	16:45	16:19
23	08:27	07:47	06:49	07:49 (Hild 1)	06:40		05:42	05:11	05:23	06:06	06:55	07:43	09:13 (Hild 4)	16:43	16:18
24	16:42	17:35	2 08:52 (Hild 4)	07:48 (Hild 1)	20:16		05:40	05:12	05:25	06:08	06:57	07:45	09:11 (Hild 4)	16:43	16:18
25	08:26	07:45	06:47	07:48 (Hild 1)	06:37		05:40	05:10	05:25	06:08	06:57	07:45	09:11 (Hild 4)	16:43	16:18
26	16:44	17:37	13 08:58 (Hild 4)	07:48 (Hild 1)	20:18		21:06	21:42	21:39	21:04	19:47	22 08:58 (Hild 2)	16 09:34 (Hild 4)	16:42	16:18
27	08:26	07:43	06:45	07:48 (Hild 1)	06:35		05:38	05:10	05:26	06:09	06:58	07:47	09:10 (Hild 4)	16:40	16:18
28	16:45	17:39	17 09:00 (Hild 4)	07:48 (Hild 1)	20:18		21:08	21:43	21:38	21:02	19:45	25 08:59 (Hild 2)	16 09:36 (Hild 4)	16:40	16:18
29	08:25	07:41	06:42	07:49 (Hild 1)	06:33		05:37	05:10	05:27	06:11	07:00	07:48	09:10 (Hild 4)	16:42	16:23
30	16:47	17:40	21 09:02 (Hild 4)	07:49 (Hild 1)	20:21		21:09	21:43	21:37	21:00	19:43	27 09:37 (Hild 4)	16 09:37 (Hild 4)	16:39	16:18
31	08:24	07:39	06:39	07:49 (Hild 1)	06:31		05:35	05:10	05:28	06:12	07:01	07:49	09:08 (Hild 4)	16:39	16:18
1	16:48	17:42	24 09:03 (Hild 4)	07:49 (Hild 1)	20:23		21:11	21:44	21:36	21:08	19:40	29 09:00 (Hild 2)	16 09:36 (Hild 4)	16:38	16:24
2	08:23	07:38	06:38	07:47 (Hild 2)	06:29		05:34	05:10	05:29	06:14	07:03	07:49	09:08 (Hild 4)	16:38	16:25
3	16:50	17:44	26 09:04 (Hild 4)	07:47 (Hild 2)	20:24		21:12	21:44	21:35	21:06	19:38	30 09:01 (Hild 2)	16 09:37 (Hild 4)	16:36	16:19
4	08:22	07:36	06:36	07:46 (Hild 2)	06:27		05:33	05:10	05:29	06:14	07:04	07:49	09:07 (Hild 4)	16:37	16:20
5	16:51	17:46	27 09:05 (Hild 4)	07:46 (Hild 2)	20:25		21:14	21:45	21:34	21:04	19:36	31 09:01 (Hild 2)	16 09:37 (Hild 4)	16:35	16:19
6	08:21	07:34	06:33	07:45 (Hild 2)	06:26		05:31	05:10	05:32	06:17	07:06	07:49	09:07 (Hild 4)	16:35	16:19
7	16:53	17:48	28 09:05 (Hild 4)	07:45 (Hild 2)	20:28		21:15	21:45	21:33	21:02	19:34	32 09:01 (Hild 2)	16 09:37 (Hild 4)	16:34	16:19
8	08:20	07:32	06:36	07:44 (Hild 2)	06:23		05:30	05:10	05:33	06:19	07:08	07:49	09:07 (Hild 4)	16:34	16:19
9	16:54	17:49	30 09:06 (Hild 4)	07:44 (Hild 2)	20:29		21:17	21:46	21:31	21:04	19:31	32 09:00 (Hild 2)	16 09:37 (Hild 4)	16:33	16:20
10	08:19	07:30	06:36	07:43 (Hild 2)	06:29		05:28	05:10	05:34	06:20	07:09	07:49	09:07 (Hild 4)	16:33	16:20
11	16:56	17:51	30 09:06 (Hild 4)	07:43 (Hild 2)	20:30		21:18	21:46	21:30	21:03	19:29	32 09:00 (Hild 2)	16 09:36 (Hild 4)	16:32	16:20
12	08:18	07:28	06:36	07:43 (Hild 2)	06:27		05:27	05:10	05:35	06:22	07:11	07:49	09:07 (Hild 4)	16:32	16:20
13	16:58	17:53	30 09:06 (Hild 4)	07:43 (Hild 2)	20:31		21:19	21:46	21:29	21:03	19:27	31 09:00 (Hild 2)	16 09:36 (Hild 4)	16:30	16:21
14	08:17	07:26	06:36	07:43 (Hild 2)	06:24		05:26	05:10	05:37	06:24	07:12	07:49	09:08 (Hild 4)	16:31	16:21
15	16:59	17:55	31 09:06 (Hild 4)	07:43 (Hild 2)	20:34		21:21	21:46	21:30	21:04	19:24	31 09:00 (Hild 2)	16 09:36 (Hild 4)	16:29	16:21
16	08:16	07:24	06:36	07:42 (Hild 2)	06:16		05:25	05:11	05:38	06:25	07:14	07:49	09:08 (Hild 4)	16:29	16:21
17	17:01	17:57	30 09:06 (Hild 4)	07:42 (Hild 2)	20:36		21:22	21:46	21:26	21:01	19:23	30 08:59 (Hild 2)	16 09:35 (Hild 4)	16:28	16:22
18	08:15	07:21	06:36	07:42 (Hild 2)	06:13		05:24	05:11	05:39	06:27	07:16	07:49	09:09 (Hild 4)	16:28	16:22
19	17:03	17:58	29 09:05 (Hild 4)	07:42 (Hild 2)	20:37		21:23	21:46	21:25	21:00	19:20	29 08:57 (Hild 2)	16 09:34 (Hild 4)	16:27	16:22
20	08:13	07:19	06:36	07:42 (Hild 2)	06:10		05:23	05:11	05:37	06:27	07:17	07:49	09:09 (Hild 4)	16:27	16:22
21	17:05	18:00	28 09:05 (Hild 4)	07:42 (Hild 2)	20:39		21:25	21:46	21:24	21:00	19:18	27 08:56 (Hild 2)	16 09:33 (Hild 4)	16:26	16:23
22	08:12	07:17	06:38	07:43 (Hild 2)	06:08		05:21	05:12	05:42	06:30	07:19	07:49	09:11 (Hild 4)	16:26	16:23
23	17:06	18:02	26 09:04 (Hild 4)	07:43 (Hild 2)	20:41		21:26	21:46	21:22	21:00	19:15	24 08:54 (Hild 2)	16 09:33 (Hild 4)	16:26	16:24
24	08:11	07:15	06:37	07:43 (Hild 2)	06:06		05:20	05:12	05:45	06:33	07:20	07:49	09:13 (Hild 4)	16:25	16:25
25	17:08	18:04	25 09:02 (Hild 4)	07:43 (Hild 2)	20:42		21:27	21:46	21:23	21:01	19:13	24 08:53 (Hild 2)	16 09:33 (Hild 4)	16:25	16:25
26	08:09		07:11	08:43 (Hild 2)	06:04		05:19	05:13	05:44	06:33	07:22	07:49	09:11 (Hild 4)	16:24	16:25
27	17:10		19:53	26 09:09 (Hild 2)	20:44		21:28	21:46	21:19	21:01	19:11	24 08:53 (Hild 1)	16 09:33 (Hild 4)	16:24	16:25
28	08:08		07:09	08:45 (Hild 2)	06:03		05:19	05:13	05:47	06:35	07:24	07:49	09:11 (Hild 4)	16:24	16:25
29	17:12		19:55	22 09:07 (Hild 2)	20:46		21:29	21:46	21:18	21:00	19:08	24 08:52 (Hild 1)	16 09:33 (Hild 4)	16:24	16:26
30	08:07		07:06	08:45 (Hild 2)	06:01		05:18	05:12	05:48	06:36	07:25	07:49	09:11 (Hild 4)	16:23	16:26
31	17:13		19:56	19 09:04 (Hild 2)			21:31	21:46	21:16	21:06	19:06	24 08:52 (Hild 1)	16 09:33 (Hild 4)	16:23	16:27
Sonnenscheinstunden	262	279		367		415	482	495	499	452	380		333		247
astr. max. mögl. Beschattung		416		714		17					535		620		
Red. Sonnenscheinwachs.		0,26		0,33		0,41					0,37		0,90		
Reduktion Betriebswachs.		0,98		0,98		0,98					0,98		0,98		
Reduktion Windrichtung		0,63		0,64		0,64					0,64		0,63		
Gesamte Reduktion		0,16		0,21		0,26					0,23		0,15		
Met. wach. Beschattung				148		4					124		118		

Projekt:	Beschreibung:	Lizenzierter Anwender:
24-1-3219-001	Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW	Ramboll Deutschland GmbH Elisabeth-Consbruch-Straße 3 DE-34131 Kassel - H. Ristow / hri@ramboll.com Berechnet: 21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H25 - Hildfeld, Hildfelder Str. 49

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,58	2,64	3,90	5,63	6,26	6,50	6,48	6,13	4,67	3,19	1,70	1,23

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
538	347	302	494	560	497	650	937	1.350	1.257	937	732	8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1 08:31	08:05	08:48 (Hild 3) 07:13	08:47 (Hild 4) 07:04	06:01	05:17	05:14	05:49	06:38	07:25	08:32 (Hild 1) 07:18	08:20 (Hild 3) 08:07	
2 16:28	17:15	09:11 (Hild 3) 18:05	09:03 (Hild 4) 19:58	20:47	21:32	21:45	21:15	20:14	19:06	08:56 (Hild 1) 17:02	08:39 (Hild 3) 16:22	
3 16:30	08:04	08:47 (Hild 3) 07:11	08:51 (Hild 4) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	08:32 (Hild 1) 07:19	08:19 (Hild 3) 08:09	
4 08:31	17:17	09:11 (Hild 3) 18:07	08:59 (Hild 4) 20:00	20:49	21:33	21:45	21:13	20:12	19:04	08:56 (Hild 1) 17:00	08:40 (Hild 3) 16:22	
5 08:31	08:02	08:47 (Hild 3) 07:09	07:00	05:57	05:15	05:15	05:52	06:41	07:28	08:31 (Hild 1) 07:21	08:19 (Hild 3) 08:10	
6 16:31	17:19	09:11 (Hild 3) 18:09	20:01	20:51	21:34	21:45	21:11	20:10	19:02	08:55 (Hild 1) 16:58	08:41 (Hild 3) 16:21	
7 08:30	08:00	08:48 (Hild 3) 07:07	06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:31 (Hild 1) 07:23	08:17 (Hild 3) 08:11	
8 16:32	17:21	09:12 (Hild 3) 18:11	20:03	20:52	21:35	21:44	21:10	20:08	18:59	08:55 (Hild 1) 16:56	22 08:40 (Hild 3) 16:21	
9 08:30	07:59	08:48 (Hild 3) 07:05	08:00 (Hild 1) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:32 (Hild 1) 07:25	08:17 (Hild 3) 08:13	
10 16:33	17:22	09:11 (Hild 3) 18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	08:54 (Hild 1) 16:55	24 08:41 (Hild 3) 16:20	
11 08:30	07:57	08:48 (Hild 3) 07:02	07:58 (Hild 1) 06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:32 (Hild 1) 07:24	08:17 (Hild 3) 08:14	
12 16:34	17:24	09:11 (Hild 3) 18:14	20:06	20:55	21:37	21:43	21:06	20:03	18:55	20 08:52 (Hild 1) 16:53	24 08:41 (Hild 3) 16:20	
13 08:30	07:56	08:48 (Hild 3) 07:00	07:56 (Hild 1) 06:51	05:50	05:13	05:19	05:59	06:47	07:35	08:33 (Hild 1) 07:28	08:18 (Hild 3) 08:15	
14 16:35	17:26	09:11 (Hild 3) 18:16	20:08	20:57	21:38	21:43	21:05	20:01	18:53	08:51 (Hild 1) 16:51	23 08:41 (Hild 3) 16:19	
15 08:29	07:54	08:49 (Hild 3) 06:58	07:55 (Hild 1) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:35 (Hild 1) 07:30	08:18 (Hild 3) 08:16	
16 16:37	17:28	09:11 (Hild 3) 18:18	20:09	20:59	21:39	21:42	21:03	19:59	18:51	14 08:49 (Hild 1) 16:50	24 08:42 (Hild 3) 16:19	
17 08:29	07:52	08:50 (Hild 3) 06:56	07:54 (Hild 1) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	08:37 (Hild 1) 07:31	08:18 (Hild 3) 08:17	
18 16:38	17:30	09:10 (Hild 3) 18:19	20:11	21:00	21:39	21:42	21:01	19:56	18:48	8 08:45 (Hild 1) 16:48	23 08:41 (Hild 3) 16:19	
19 08:28	07:50	08:51 (Hild 3) 06:54	07:53 (Hild 1) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	08:36 (Hild 1) 07:33	08:19 (Hild 3) 08:19	
20 16:39	17:31	09:09 (Hild 3) 18:21	20:13	21:02	21:40	21:41	20:59	19:54	18:46	16:46	22 08:41 (Hild 3) 16:19	
21 08:28	07:49	08:50 (Hild 4) 06:51	07:53 (Hild 1) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	07:35	20 08:20 (Hild 3) 08:20	
22 16:41	17:33	09:08 (Hild 3) 18:23	20:14	21:03	21:41	21:40	20:57	19:52	18:44	16:45	21 08:41 (Hild 3) 16:19	
23 08:27	07:47	08:48 (Hild 4) 06:49	07:53 (Hild 1) 06:40	05:42	05:11	05:23	06:06	06:55	07:43	09:22 (Hild 4) 07:37	08:21 (Hild 3) 08:21	
24 16:42	17:35	09:07 (Hild 4) 18:24	20:16	21:05	21:42	21:39	20:55	19:50	18:42	12 09:34 (Hild 4) 16:43	20 08:41 (Hild 3) 16:18	
25 08:26	07:45	08:46 (Hild 4) 06:47	07:52 (Hild 1) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	09:20 (Hild 4) 07:38	08:21 (Hild 3) 08:22	
26 16:44	17:37	09:08 (Hild 4) 18:26	20:18	21:06	21:42	21:39	20:54	19:47	18 09:01 (Hild 2) 18:40	17 09:37 (Hild 4) 16:42	18 08:39 (Hild 3) 16:18	
27 08:26	07:43	08:45 (Hild 4) 06:45	07:52 (Hild 1) 06:35	05:38	05:10	05:26	06:09	06:58	07:47	09:18 (Hild 4) 07:40	08:22 (Hild 3) 08:23	
28 16:45	17:39	09:09 (Hild 4) 18:28	20:19	21:08	21:43	21:38	20:52	19:45	22 09:02 (Hild 2) 18:37	21 09:39 (Hild 4) 16:40	16 08:38 (Hild 3) 16:18	
29 08:25	07:41	08:44 (Hild 4) 06:42	07:53 (Hild 2) 06:33	05:37	05:10	05:27	06:11	07:00	08:39 (Hild 2) 07:48	09:17 (Hild 4) 07:42	08:24 (Hild 3) 08:23	
30 16:47	17:40	09:10 (Hild 4) 18:29	20:21	21:09	21:43	21:37	20:50	19:43	25 09:04 (Hild 2) 18:35	24 09:41 (Hild 4) 16:39	13 08:37 (Hild 3) 16:18	
31 08:24	07:39	08:43 (Hild 4) 06:40	07:52 (Hild 2) 06:31	05:35	05:10	05:28	06:12	07:01	08:37 (Hild 2) 07:50	09:15 (Hild 4) 07:44	08:26 (Hild 3) 08:24	
1 16:48	17:42	09:11 (Hild 4) 18:31	20:23	21:11	21:44	21:36	20:48	19:40	27 09:04 (Hild 2) 18:33	26 09:41 (Hild 4) 16:38	10 08:36 (Hild 3) 16:19	
2 08:23	07:37	08:42 (Hild 4) 06:38	07:50 (Hild 2) 06:29	05:34	05:10	05:29	06:14	07:03	08:36 (Hild 2) 07:52	09:14 (Hild 4) 07:45	08:31 (Hild 3) 08:25	
3 16:50	17:44	09:11 (Hild 4) 18:33	20:24	21:12	21:44	21:35	20:46	19:38	29 09:05 (Hild 2) 18:31	28 09:42 (Hild 4) 16:36	1 08:32 (Hild 3) 16:19	
4 08:22	07:36	08:42 (Hild 4) 06:36	07:50 (Hild 2) 06:27	05:33	05:10	05:30	06:16	07:04	08:35 (Hild 2) 07:53	09:13 (Hild 4) 07:47	08:26	
5 16:51	17:46	09:12 (Hild 4) 18:35	20:26	21:14	21:45	21:34	20:44	19:36	30 09:05 (Hild 2) 18:29	29 09:42 (Hild 4) 16:35	16:19	
6 08:21	07:34	08:42 (Hild 4) 06:33	07:49 (Hild 2) 06:25	05:31	05:10	05:32	06:17	07:06	08:34 (Hild 2) 07:55	09:13 (Hild 4) 07:49	08:27	
7 16:53	17:48	09:12 (Hild 4) 18:36	20:28	21:15	21:45	21:33	20:42	19:34	32 09:06 (Hild 2) 18:27	30 09:43 (Hild 4) 16:34	16:19	
8 08:20	07:32	08:41 (Hild 4) 06:31	07:48 (Hild 2) 06:23	05:30	05:10	05:33	06:19	07:08	08:33 (Hild 2) 07:57	09:13 (Hild 4) 07:50	08:27	
9 16:54	17:49	09:12 (Hild 4) 18:38	20:29	21:17	21:45	21:31	20:40	19:31	32 09:05 (Hild 2) 18:25	30 09:43 (Hild 4) 16:33	16:20	
10 08:19	07:30	08:41 (Hild 4) 06:29	07:47 (Hild 2) 06:20	05:28	05:10	05:34	06:20	07:09	08:33 (Hild 2) 07:58	09:12 (Hild 4) 07:52	08:28	
11 16:56	17:51	09:12 (Hild 4) 18:40	20:31	21:18	21:46	21:30	20:38	19:29	33 09:06 (Hild 2) 18:23	30 09:42 (Hild 4) 16:32	16:20	
12 08:18	07:28	08:42 (Hild 4) 06:27	07:47 (Hild 2) 06:18	05:27	05:10	05:35	06:22	07:11	08:33 (Hild 2) 08:00	09:12 (Hild 4) 07:53	08:28	
13 16:58	17:53	09:12 (Hild 4) 18:41	20:33	21:19	21:46	21:29	20:36	19:27	33 09:06 (Hild 2) 18:21	30 09:42 (Hild 4) 16:30	16:21	
14 08:17	07:26	08:42 (Hild 4) 06:24	07:47 (Hild 2) 06:16	05:26	05:10	05:37	06:24	07:12	08:32 (Hild 2) 08:02	09:12 (Hild 4) 07:55	08:29	
15 16:59	17:55	09:11 (Hild 4) 18:43	20:34	21:21	21:46	21:28	20:34	19:24	33 09:05 (Hild 2) 18:19	30 09:42 (Hild 4) 16:29	16:21	
16 08:16	07:24	08:42 (Hild 4) 06:22	07:47 (Hild 2) 06:14	05:25	05:11	05:38	06:25	07:14	08:32 (Hild 2) 08:04	09:12 (Hild 4) 07:57	08:29	
17 17:01	17:57	09:11 (Hild 4) 18:45	20:36	21:22	21:46	21:26	20:31	19:22	33 09:05 (Hild 2) 18:17	30 09:42 (Hild 4) 16:28	16:22	
18 08:15	07:21	08:43 (Hild 4) 06:20	07:47 (Hild 2) 06:12	05:24	05:11	05:39	06:27	07:16	08:32 (Hild 2) 07:05	09:13 (Hild 4) 07:58	08:30	
19 17:03	2 08:58 (Hild 3) 17:58	27 09:10 (Hild 4) 18:46	31 08:18 (Hild 2) 20:37	21:23	21:46	21:25	20:29	19:20	31 09:03 (Hild 2) 17:15	29 09:42 (Hild 4) 16:27	16:22	
20 08:13	08:53 (Hild 3) 07:19	28 08:44 (Hild 4) 06:18	30 07:48 (Hild 2) 20:28	21:15	21:45	21:23	20:42	19:34	32 09:06 (Hild 2) 18:27	30 09:43 (Hild 4) 16:34	16:19	
21 17:05	10 09:03 (Hild 3) 18:00	25 09:09 (Hild 4) 18:48	29 08:17 (Hild 2) 20:39	21:25	21:46	21:24	20:27	19:18	30 09:03 (Hild 2) 17:13	27 09:41 (Hild 4) 16:26	16:23	
22 08:12	08:51 (Hild 3) 07:17	28 08:45 (Hild 4) 06:15	30 07:48 (Hild 2) 20:38	21:24	21:45	21:22	20:42	19:19	30 09:03 (Hild 2) 17:09	27 09:41 (Hild 4) 16:26	16:23	
23 17:06	13 09:04 (Hild 3) 18:02	23 09:08 (Hild 4) 18:50	28 08:16 (Hild 2) 20:41	21:26	21:46	21:22	20:25	19:15	28 09:01 (Hild 2) 17:11	26 09:39 (Hild 4) 16:26	16:24	
24 08:11	08:50 (Hild 3) 07:15	28 08:45 (Hild 4) 06:13	30 07:48 (Hild 2) 20:41	21:26	21:46	21:22	20:25	19:15	28 09:01 (Hild 2) 17:11	26 09:39 (Hild 4) 16:26	16:24	
25 17:08	16 09:06 (Hild 3) 18:04	20 09:05 (Hild 4) 18:51	26 08:14 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	26 09:00 (Hild 2) 17:09	25 09:39 (Hild 4) 16:25	16:25	
26 08:09	08:50 (Hild 3) 07:11	29 08:46 (Hild 4) 06:14	30 07:48 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	26 09:00 (Hild 2) 17:09	25 09:39 (Hild 4) 16:25	16:25	
27 17:10	18 09:08 (Hild 3) 19:03	22 09:12 (Hild 4) 19:03	29 08:12 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	26 09:00 (Hild 2) 17:07	21 09:37 (Hild 4) 16:24	16:25	
28 08:08	08:49 (Hild 3) 07:09	29 08:46 (Hild 4) 06:14	30 07:48 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	26 09:00 (Hild 2) 17:09	25 09:39 (Hild 4) 16:25	16:25	
29 17:12	20 09:09 (Hild 3) 19:55	22 09:12 (Hild 4) 19:03	29 08:12 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	26 09:00 (Hild 2) 17:07	21 09:37 (Hild 4) 16:24	16:25	
30 08:07	08:48 (Hild 3) 07:06	29 08:46 (Hild 4) 06:14	30 07:48 (Hild 2) 20:42	21:27	21:46	21:21	20:23	19:13	26 09:00 (Hild 2) 17:09	25 09:39 (Hild 4) 16:25	16:25	
31 17:13	21 09:09 (Hild 3) 20:02	22 09:12 (Hild 4) 19:03	29 08:12 (Hild 2) 20:44	21:28	21:46	21:19	20:21	19:11	26 09:00 (Hild 2) 17:07	21 09:37 (Hild 4) 16:24	16:25	
Sonnenscheinstunden												
262		279	367	415	482	495	416	452	380	333	269	247
astr. max. mögl. Beschattung												
Red. Sonnenscheinwahrsch.	100	695	714	714	714	714	714	714	714	68		

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H26 - Hildfeld, Hügelsweg 1

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15		07:13 18:05		08:05 (Hild 1) 17:04	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	
2	08:31 16:30	08:04 17:17		07:11 18:07	12	08:17 (Hild 1) 17:08	05:47 20:47	05:16 21:32	05:15 21:45	05:51 21:13	06:39 20:12	
3	08:31 16:31	08:02 17:19		07:09 18:09	16	08:19 (Hild 1) 17:00	05:49 20:57	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10	
4	08:30 16:32	08:01 17:21		07:07 18:11	19	08:20 (Hild 1) 16:57	05:51 20:55	05:15 21:34	05:16 21:45	05:54 21:11	06:42 20:10	
5	08:30 16:33	07:59 17:22		07:05 18:12	22	08:21 (Hild 1) 16:54	05:52 20:54	05:14 21:33	05:17 21:46	05:55 21:10	06:44 20:08	
6	08:30 16:34	07:57 17:24	8	08:54 (Hild 4) 09:02 (Hild 4)		07:58 (Hild 1) 16:53	05:52 20:55	05:13 21:37	05:18 21:43	05:57 21:06	06:46 20:03	
7	08:30 16:35	07:56 17:25	14	08:51 (Hild 4) 09:05 (Hild 4)		07:58 (Hild 1) 16:51	05:50 20:53	05:13 21:38	05:19 21:43	05:59 21:05	06:47 20:05	
8	08:29 16:37	07:54 17:28	18	08:50 (Hild 4) 09:08 (Hild 4)		07:58 (Hild 1) 16:48	05:58 20:49	05:12 21:39	05:20 21:42	06:00 21:03	06:49 20:05	
9	08:29 16:38	07:52 17:30	21	08:48 (Hild 4) 09:09 (Hild 4)		07:57 (Hild 1) 16:46	05:56 21:00	05:12 21:39	05:20 21:42	06:02 21:01	06:50 20:06	
10	08:28 16:39	07:50 17:31	23	08:47 (Hild 4) 09:10 (Hild 4)		07:58 (Hild 1) 16:44	05:54 21:01	05:11 21:40	05:21 21:41	06:03 21:05	06:52 20:04	
11	08:28 16:41	07:49 17:33	25	08:46 (Hild 4) 09:11 (Hild 4)		08:23 (Hild 2) 16:41	05:58 21:03	05:11 21:41	05:22 21:40	06:05 21:05	06:53 20:05	
12	08:27 16:42	07:47 17:35	26	08:45 (Hild 4) 09:12 (Hild 4)		08:26 (Hild 2) 16:42	05:56 21:04	05:11 21:43	05:23 21:42	06:06 21:06	06:55 20:05	
13	08:26 16:44	07:45 17:37	27	08:45 (Hild 4) 09:12 (Hild 4)		07:56 (Hild 2) 16:47	05:50 21:06	05:10 21:42	05:25 21:39	06:08 21:04	06:57 20:06	
14	08:26 16:45	07:43 17:39	28	08:44 (Hild 4) 09:12 (Hild 4)		07:56 (Hild 2) 16:45	05:58 21:08	05:10 21:43	05:26 21:38	06:09 21:05	06:58 20:05	
15	08:25 16:47	07:41 17:40	28	08:44 (Hild 4) 09:12 (Hild 4)		07:56 (Hild 2) 16:42	05:57 21:09	05:10 21:43	05:27 21:37	06:11 21:00	07:00 20:05	
16	08:24 16:48	07:39 17:42	28	08:44 (Hild 4) 09:12 (Hild 4)		07:56 (Hild 2) 16:40	05:56 21:11	05:10 21:44	05:28 21:36	06:12 21:01	07:01 20:06	
17	08:23 16:50	07:38 17:44	28	08:44 (Hild 4) 09:12 (Hild 4)		08:26 (Hild 2) 16:38	05:55 21:12	05:10 21:44	05:29 21:35	06:14 21:04	07:03 20:05	
18	08:22 16:51	07:36 17:46	28	08:44 (Hild 4) 09:12 (Hild 4)		07:55 (Hild 2) 16:36	05:54 21:14	05:10 21:45	05:30 21:34	06:16 21:04	07:04 20:06	
19	08:21 16:53	07:34 17:48	28	08:44 (Hild 4) 09:12 (Hild 4)		07:56 (Hild 2) 16:33	05:53 21:15	05:10 21:46	05:32 21:33	06:17 21:04	07:06 20:07	
20	08:20 16:54	07:32 17:49	26	08:45 (Hild 4) 09:13 (Hild 4)		08:23 (Hild 2) 16:32	05:52 21:16	05:10 21:45	05:33 21:32	06:19 21:03	07:08 20:08	
21	08:19 16:56	07:30 17:51	24	08:46 (Hild 4) 09:10 (Hild 4)		08:24 (Hild 2) 16:30	05:58 21:18	05:10 21:46	05:34 21:30	06:20 21:03	07:09 20:09	
22	08:18 16:58	07:28 17:53	22	08:47 (Hild 4) 09:09 (Hild 4)		07:58 (Hild 2) 16:28	05:57 21:19	05:10 21:46	05:35 21:29	06:22 21:02	07:11 20:10	
23	08:17 16:59	07:26 17:55	20	08:48 (Hild 4) 09:08 (Hild 4)		08:00 (Hild 2) 16:16	05:56 21:20	05:10 21:46	05:37 21:24	06:24 21:02	07:12 20:11	
24	08:16 17:01	07:24 17:57	16	08:50 (Hild 4) 09:06 (Hild 4)		08:02 (Hild 2) 16:14	05:55 21:22	05:11 21:46	05:38 21:26	06:25 21:04	07:14 20:12	
25	08:15 17:03	07:21 17:58	11	08:52 (Hild 4) 09:03 (Hild 4)		08:12 (Hild 2) 16:12	05:54 21:23	05:11 21:46	05:39 21:25	06:27 21:03	07:16 20:13	
26	08:13 17:05	07:19 18:00		08:51 (Hild 4) 18:48		08:10 (Hild 2) 16:10	05:53 21:24	05:11 21:46	05:41 21:24	06:28 21:04	07:17 20:14	
27	08:12 17:06	07:17 18:02		08:10 (Hild 2) 18:50		08:08 (Hild 2) 16:08	05:52 21:26	05:12 21:46	05:42 21:22	06:30 21:05	07:19 20:16	
28	08:11 17:08	07:15 18:04	3	08:09 (Hild 1) 08:12 (Hild 1)		08:06 (Hild 2) 16:06	05:50 21:27	05:12 21:46	05:43 21:23	06:31 21:04	07:20 20:17	
29	08:09 17:10			07:11 19:53		08:04 (Hild 2) 16:04	05:49 21:28	05:13 21:46	05:44 21:21	06:33 21:05	07:22 20:18	
30	08:08 17:12			07:09 19:55		08:03 (Hild 2) 16:03	05:48 21:29	05:13 21:46	05:47 21:19	06:35 21:06	07:24 20:19	
31	08:07 17:13			07:06 19:56		08:02 (Hild 2) 16:02	05:48 21:31	05:13 21:46	05:48 21:16	06:36 21:07	07:25 20:20	
Sonnenscheinstunden	262	279		367			415	482	495	452	380	
astr. max. mögl. Beschattung		452		574					499		300	
Red. Sonnenscheinwahrsch.		0,26		0,33							0,30	
Reduktion Betriebsdauer		0,98		0,98							0,98	
Reduktion Windrichtung		0,62		0,64							0,63	
Gesamte Reduktion		0,16		0,21							0,18	
Met. wahrsch. Beschattung		73		119							9	

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H27 - Hildfeld, Hügelweg 14

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H28 - Hildfeld, Hügelpweg 6

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 08:05 16:28 17:15		07:13 18:05	08:06 (Hild 1) 07:04 08:26 (Hild 1) 19:58	06:01 20:47 21:32 21:45	05:17 05:14 21:45 21:15	05:14 05:49 21:15 20:14	05:38 06:38 21:15 20:14		07:25 19:06 30 08:42 (Hild 2) 07:18	28 08:48 (Hild 4) 16:22	08:07 16:22
2	08:31 08:04 16:30 17:17	8 09:08 (Hild 4) 18:07	22 08:27 (Hild 1) 20:00	20:49 21:33 05:15 05:15	20:51 21:34 21:45 21:11	20:10 20:10 05:15 05:16	05:54 06:42 21:10 20:08	06:47 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	
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17	08:23 07:38 16:50 17:44	26 09:17 (Hild 4) 18:33	24 08:28 (Hild 2) 20:24	21:12 21:44 05:10 05:29	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
18	08:22 07:36 16:51 17:46	24 09:16 (Hild 4) 18:35	22 08:27 (Hild 2) 20:26	21:14 21:45 05:10 05:32	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
19	08:21 07:34 16:53 17:48	22 09:15 (Hild 4) 18:36	19 08:25 (Hild 2) 20:28	21:15 21:45 05:10 05:33	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
20	08:20 07:32 16:54 17:49	18 09:13 (Hild 4) 18:38	14 08:22 (Hild 2) 20:29	21:17 21:46 05:10 05:34	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
21	08:19 07:30 16:56 17:51	14 09:11 (Hild 4) 18:40	3 08:16 (Hild 2) 20:31	21:18 21:46 05:10 05:35	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
22	08:18 07:28 16:58 17:53	7 09:07 (Hild 4) 18:41		20:33 21:19 05:10 05:37	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
23	08:17 07:26 16:59 17:55		06:24 18:43	20:34 21:21 05:11 05:38	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
24	08:16 07:24 17:01 17:57		06:22 18:45	20:36 21:22 05:11 05:39	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
25	08:15 07:21 17:03 17:58		06:20 18:46	20:37 21:23 05:11 05:39	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
26	08:13 07:19 17:05 18:00	11 08:11 (Hild 1) 16:18		20:39 21:25 05:11 05:38	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
27	08:12 07:17 17:06 18:02	16 08:09 (Hild 1) 16:15		20:41 21:26 05:12 05:42	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
28	08:11 07:15 17:08 18:04	18 08:07 (Hild 1) 16:13		20:46 21:30 05:12 05:44	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
29	08:09 07:13 17:10 18:08		07:11 19:56	20:44 21:28 05:13 05:45	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
30	08:08 07:10 17:12 18:06		07:09 19:55	20:46 21:29 05:13 05:47	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
31	08:07 07:09 17:13 18:07		07:06 19:56	20:48 21:31 05:14 05:48	20:00 20:49 21:39 21:42	21:03 21:03 05:21 06:03	06:52 18:59 30 09:11 (Hild 2) 16:56	24 08:46 (Hild 4) 16:21	27 08:48 (Hild 4) 16:22	08:10 16:21	08:11 16:21	
Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269	247
astr.max.mögl.Beschattung		510	526						187	677	184	
Red.Sonnenscheinwahrsch.		0,26	0,33						0,37	0,30	0,19	
Reduktion Betriebsdauer		0,98	0,98						0,98	0,98	0,98	
Reduktion Windrichtung		0,62	0,64						0,64	0,63	0,62	
Gesamte Reduktion		0,16	0,21						0,23	0,18	0,12	
Met.wahrsch.Beschattung		82	109						43	125	21	

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

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

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H30 - Hildfeld, Steinertstr. 2

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	08:44 (Hild 4) 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	07:25 19:06	08:30 (Hild 1) 17:02	08:07 16:22
2	08:31 16:30	08:04 17:17	07:11 18:07	08:57 (Hild 4) 20:00	06:01 20:49	05:17 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:30 (Hild 1) 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	08:57 (Hild 4) 20:01	06:01 20:51	05:17 21:34	05:15 21:45	05:51 21:11	06:39 20:10	07:27 19:02	08:30 (Hild 1) 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21	07:07 18:11	08:02 (Hild 1) 20:03	06:57 20:52	05:15 21:35	05:15 21:44	05:54 21:10	06:42 20:08	07:30 18:59	08:30 (Hild 1) 16:56	08:11 16:21
5	08:30 16:33	08:01 17:22	07:05 18:12	07:58 (Hild 1) 20:04	06:55 20:54	05:14 21:36	05:17 21:44	05:55 21:08	06:44 20:05	07:32 18:57	08:30 (Hild 1) 16:55	08:13 16:20
6	08:30 16:34	08:01 17:24	07:02 18:14	07:56 (Hild 1) 20:06	06:53 20:55	05:13 21:37	05:18 21:43	05:57 21:06	06:46 20:03	07:33 18:55	08:30 (Hild 1) 16:53	08:14 16:20
7	08:30 16:35	08:01 17:26	07:00 18:20	07:55 (Hild 1) 20:08	06:51 20:57	05:13 21:38	05:19 21:43	05:59 21:05	06:47 20:01	07:35 18:53	08:31 (Hild 1) 16:51	08:15 16:19
8	08:29 16:37	08:01 17:28	07:04 18:18	07:54 (Hild 1) 20:09	06:48 20:59	05:12 21:39	05:20 21:42	06:00 21:03	06:49 19:59	07:37 18:51	08:31 (Hild 1) 16:50	08:16 16:19
9	08:29 16:38	08:01 17:30	07:04 18:19	07:52 (Hild 1) 20:11	06:46 21:00	05:12 21:39	05:20 21:42	06:02 21:01	06:50 19:56	07:38 18:48	08:31 (Hild 1) 16:48	08:17 16:19
10	08:28 16:39	08:01 17:31	07:04 18:21	07:52 (Hild 1) 20:13	06:44 21:02	05:11 21:40	05:21 21:41	06:03 20:59	06:52 19:54	07:40 18:46	08:31 (Hild 1) 16:46	08:19 16:19
11	08:28 16:41	08:01 17:33	07:04 18:23	08:15 (Hild 1) 20:14	06:42 21:03	05:11 21:41	05:22 21:40	06:05 20:57	06:53 19:52	07:42 18:44	08:31 (Hild 1) 16:45	08:20 16:19
12	08:27 16:42	08:01 17:35	07:04 18:24	08:44 (Hild 4) 20:16	06:42 21:05	05:11 21:42	05:23 21:39	06:06 20:55	06:55 19:50	07:43 18:42	08:31 (Hild 1) 16:43	08:21 16:18
13	08:26 16:44	08:01 17:37	07:04 18:26	08:15 (Hild 1) 20:18	06:42 21:06	05:11 21:42	05:25 21:39	06:08 20:54	06:57 19:47	07:45 18:40	08:31 (Hild 1) 16:42	08:22 16:18
14	08:26 16:45	08:01 17:39	07:04 18:28	08:15 (Hild 1) 20:19	06:42 21:08	05:11 21:43	05:26 21:38	06:09 20:52	06:58 19:45	07:47 18:37	08:31 (Hild 1) 16:40	08:23 16:18
15	08:25 16:47	08:01 17:40	07:04 18:29	08:16 (Hild 1) 20:21	06:42 21:09	05:11 21:43	05:27 21:37	06:11 20:50	06:58 19:43	07:48 18:35	08:31 (Hild 1) 16:39	08:23 16:18
16	08:24 16:48	08:01 17:42	07:04 18:31	08:17 (Hild 1) 20:23	06:42 21:11	05:11 21:44	05:28 21:36	06:12 20:48	06:58 19:40	07:49 18:33	08:31 (Hild 1) 16:38	08:24 16:19
17	08:23 16:50	08:01 17:44	07:04 18:33	08:18 (Hild 1) 20:24	06:42 21:12	05:11 21:44	05:29 21:35	06:14 20:46	06:58 19:38	07:50 18:31	08:31 (Hild 1) 16:36	08:25 16:19
18	08:22 16:51	08:01 17:46	07:04 18:35	08:18 (Hild 1) 20:26	06:42 21:14	05:11 21:45	05:30 21:34	06:16 20:44	06:58 19:36	07:53 18:29	08:31 (Hild 1) 16:35	08:26 16:19
19	08:21 16:53	08:01 17:48	07:04 18:36	08:19 (Hild 1) 20:28	06:42 21:15	05:11 21:45	05:32 21:33	06:17 20:42	06:58 19:34	07:55 18:27	08:31 (Hild 1) 16:34	08:27 16:19
20	08:20 16:54	08:01 17:49	07:04 18:38	08:20 (Hild 1) 20:29	06:42 21:17	05:11 21:45	05:33 21:31	06:19 20:40	06:58 19:31	07:57 18:25	08:31 (Hild 1) 16:33	08:28 16:20
21	08:19 16:56	08:01 17:51	07:04 18:40	08:21 (Hild 1) 20:31	06:42 21:18	05:11 21:46	05:34 21:30	06:20 20:38	06:58 19:29	07:58 18:23	08:31 (Hild 1) 16:32	08:29 16:20
22	08:18 16:58	08:01 17:53	07:04 18:41	08:22 (Hild 1) 20:33	06:42 21:19	05:11 21:46	05:35 21:29	06:22 20:36	06:58 19:27	07:59 18:21	08:31 (Hild 1) 16:30	08:30 16:21
23	08:17 16:59	08:01 17:55	07:04 18:43	08:23 (Hild 1) 20:34	06:42 21:21	05:11 21:46	05:36 21:28	06:24 20:34	06:58 19:24	07:59 18:19	08:31 (Hild 1) 16:29	08:31 16:21
24	08:16 17:01	08:01 17:57	07:04 18:45	08:24 (Hild 1) 20:36	06:42 21:22	05:11 21:46	05:38 21:26	06:25 20:31	06:58 19:22	07:59 18:17	08:31 (Hild 1) 16:28	08:32 16:22
25	08:15 17:03	08:01 17:58	07:04 18:46	08:25 (Hild 1) 20:37	06:42 21:23	05:11 21:46	05:39 21:25	06:27 20:29	06:58 19:20	07:59 18:15	08:31 (Hild 1) 16:27	08:33 16:22
26	08:13 17:05	08:01 18:00	07:04 18:48	08:26 (Hild 1) 20:39	06:42 21:25	05:11 21:46	05:41 21:24	06:28 20:27	06:58 19:18	07:59 18:13	08:31 (Hild 1) 16:26	08:34 16:23
27	08:12 17:06	08:01 18:02	07:04 18:50	08:27 (Hild 1) 20:41	06:42 21:26	05:11 21:46	05:42 21:22	06:30 20:25	06:58 19:15	07:59 18:11	08:31 (Hild 1) 16:25	08:35 16:24
28	08:11 17:08	08:01 18:04	07:04 18:51	08:28 (Hild 1) 20:42	06:42 21:27	05:11 21:46	05:43 21:21	06:31 20:23	06:58 19:13	07:59 18:08	08:31 (Hild 1) 16:24	08:36 16:25
29	08:09 17:10	08:01 18:05	07:04 18:53	08:29 (Hild 1) 20:44	06:42 21:28	05:11 21:46	05:44 21:19	06:32 20:21	06:58 19:11	07:59 18:07	08:31 (Hild 1) 16:23	08:37 16:26
30	08:08 17:12	08:01 18:06	07:04 18:54	08:30 (Hild 1) 20:46	06:42 21:29	05:11 21:46	05:45 21:18	06:33 20:19	06:58 19:08	07:59 18:05	08:31 (Hild 1) 16:22	08:38 16:27
31	08:07 17:13	08:01 18:07	07:04 18:55	08:31 (Hild 1) 20:47	06:42 21:30	05:11 21:46	05:46 21:16	06:34 20:16	06:58 19:06	07:59 18:04	08:31 (Hild 1) 16:21	08:39 16:28
Sonnenscheinstunden	262	279	367	415	482	495	452	380	443	333	269	247
astr.max.mögl.Beschattung		436	631						443	642		
Red.Sonnenscheinwahrsch.		0,26	0,33						0,37	0,30		
Reduktion Betriebsdauer		0,98	0,98						0,98	0,98		
Reduktion Windrichtung		0,63	0,64						0,64	0,63		
Gesamte Reduktion		0,16	0,21						0,23	0,18		
Met.wahrsch.Beschattung		71	131						103	119		

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

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

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H31 - Hildfeld, Steinertstr. 3

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	06:40 (Hild 4) 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	07:25 19:06	08:29 (Hild 1) 17:02	08:07 16:22
2	08:31 16:30	08:04 17:17	07:11 18:07	06:43 (Hild 4) 19:58	06:09 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:29 (Hild 1) 17:00	08:09 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	06:52 (Hild 4) 19:58	06:15 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:28 19:02	08:28 (Hild 1) 16:58	08:10 16:21
4	08:30 16:32	08:01 17:21	07:07 18:11	06:57 19:58	06:15 20:52	05:15 21:35	05:15 21:44	05:54 21:10	06:42 20:08	07:30 18:59	08:29 (Hild 1) 16:56	08:11 16:21
5	08:30 16:33	07:59 17:22	07:05 18:12	07:57 (Hild 1) 19:58	06:55 20:54	05:53 21:36	05:14 21:44	05:55 21:08	06:44 20:05	07:32 18:57	08:29 (Hild 1) 16:55	08:13 16:20
6	08:30 16:34	07:57 17:24	07:02 18:14	07:55 (Hild 1) 19:58	06:53 20:56	05:52 21:37	05:13 21:43	05:57 21:06	06:46 20:03	07:33 18:55	08:29 (Hild 1) 16:53	08:14 16:20
7	08:30 16:35	07:56 17:26	07:00 18:20	07:54 (Hild 1) 19:58	06:51 20:57	05:50 21:38	05:13 21:43	05:59 21:05	06:47 20:01	07:35 18:53	08:30 (Hild 1) 16:51	08:15 16:19
8	08:29 16:37	07:54 17:28	06:58 18:18	07:53 (Hild 1) 19:58	06:48 20:59	05:48 21:39	05:12 21:42	06:00 21:03	06:49 19:59	07:37 18:51	08:32 (Hild 1) 16:50	08:16 16:19
9	08:29 16:38	07:52 17:30	06:56 18:19	07:51 (Hild 1) 19:58	06:46 21:00	05:46 21:39	05:12 21:42	06:02 21:01	06:50 19:56	07:38 18:48	08:34 (Hild 1) 16:48	08:17 16:19
10	08:28 16:39	07:50 17:31	06:54 18:21	07:50 (Hild 1) 19:58	06:44 21:02	05:45 21:40	05:11 21:41	06:03 20:59	06:52 19:54	07:40 18:46	08:42 (Hild 1) 16:46	08:19 16:19
11	08:28 16:41	07:49 17:33	06:51 18:23	07:50 (Hild 1) 19:58	06:42 21:03	05:43 21:41	05:11 21:40	06:05 20:57	06:53 19:52	07:42 18:44	09:15 (Hild 4) 16:45	08:20 16:19
12	08:27 16:42	07:47 17:35	06:44 (Hild 4) 18:24	07:50 (Hild 1) 19:58	06:40 21:05	05:42 21:42	05:11 21:39	06:06 20:56	06:55 19:50	07:43 18:42	09:15 (Hild 4) 16:43	08:21 16:18
13	08:26 16:44	07:45 17:37	06:41 (Hild 4) 18:26	07:49 (Hild 1) 19:58	06:37 21:06	05:40 21:42	05:10 21:39	06:08 20:54	06:57 19:47	07:45 18:40	09:15 (Hild 4) 16:42	08:22 16:18
14	08:26 16:45	07:43 17:39	06:40 (Hild 4) 18:28	07:50 (Hild 1) 19:58	06:35 21:08	05:38 21:43	05:10 21:38	06:09 20:52	06:58 19:45	07:47 18:37	09:15 (Hild 4) 16:40	08:23 16:18
15	08:25 16:47	07:41 17:40	06:38 (Hild 4) 18:29	07:49 (Hild 1) 19:58	06:33 21:09	05:37 21:43	05:10 21:37	06:11 20:50	06:58 19:43	07:48 18:35	09:15 (Hild 4) 16:39	08:23 16:19
16	08:24 16:48	07:39 17:42	06:37 (Hild 4) 18:31	07:48 (Hild 1) 19:58	06:31 21:11	05:35 21:44	05:10 21:36	06:13 20:48	06:58 19:40	07:50 18:33	09:15 (Hild 4) 16:38	08:24 16:19
17	08:23 16:50	07:38 17:44	06:36 (Hild 4) 18:33	07:46 (Hild 1) 19:58	06:29 21:12	05:34 21:44	05:10 21:35	06:14 20:46	06:57 19:38	07:52 18:31	09:15 (Hild 4) 16:36	08:25 16:19
18	08:22 16:51	07:36 17:46	06:36 (Hild 4) 18:35	07:46 (Hild 1) 19:58	06:27 21:14	05:33 21:45	05:10 21:34	06:16 20:44	06:58 19:36	07:53 18:29	09:15 (Hild 4) 16:35	08:26 16:19
19	08:21 16:53	07:34 17:48	06:35 (Hild 4) 18:36	07:45 (Hild 1) 19:58	06:25 21:15	05:31 21:45	05:10 21:33	06:17 20:42	06:58 19:34	07:55 18:27	09:15 (Hild 4) 16:34	08:27 16:19
20	08:20 16:54	07:32 17:49	06:35 (Hild 4) 18:36	07:44 (Hild 1) 19:58	06:23 21:17	05:30 21:45	05:10 21:31	06:19 20:40	06:58 19:31	07:57 18:25	09:15 (Hild 4) 16:33	08:27 16:20
21	08:19 16:56	07:30 17:51	06:35 (Hild 4) 18:40	07:44 (Hild 1) 19:58	06:20 21:18	05:28 21:46	05:10 21:30	06:20 20:38	06:58 19:29	07:58 18:23	09:15 (Hild 4) 16:32	08:28 16:20
22	08:18 16:58	07:28 17:53	06:35 (Hild 4) 18:41	07:44 (Hild 1) 19:58	06:18 21:19	05:27 21:46	05:10 21:32	06:22 20:36	06:58 19:27	07:59 18:21	09:15 (Hild 4) 16:30	08:28 16:21
23	08:17 16:59	07:26 17:55	06:35 (Hild 4) 18:43	07:45 (Hild 1) 19:58	06:16 21:21	05:26 21:46	05:10 21:34	06:24 20:34	06:58 19:24	07:59 18:19	09:15 (Hild 4) 16:29	08:29 16:21
24	08:16 17:01	07:24 17:57	06:36 (Hild 4) 18:45	07:44 (Hild 1) 19:58	06:14 21:22	05:25 21:46	05:11 21:38	06:25 20:31	06:58 19:22	07:59 18:17	09:15 (Hild 4) 16:28	08:29 16:22
25	08:15 17:03	07:21 17:58	06:36 (Hild 4) 18:46	07:45 (Hild 1) 19:58	06:12 21:23	05:24 21:46	05:11 21:39	06:27 20:29	06:58 19:20	07:59 18:15	09:15 (Hild 4) 16:27	08:30 16:22
26	08:13 17:05	07:19 18:00	06:37 (Hild 4) 18:48	07:46 (Hild 1) 19:58	06:10 21:25	05:23 21:46	05:11 21:42	06:28 20:27	06:58 19:18	07:59 18:13	09:15 (Hild 4) 16:26	08:30 16:23
27	08:12 17:06	07:17 18:02	06:38 (Hild 4) 18:50	07:47 (Hild 1) 19:58	06:08 21:26	05:22 21:46	05:12 21:42	06:30 20:25	06:58 19:15	07:59 18:11	09:15 (Hild 4) 16:26	08:30 16:24
28	08:11 17:08	07:15 18:04	06:38 (Hild 4) 18:51	07:48 (Hild 1) 19:58	06:06 21:27	05:20 21:46	05:12 21:42	06:31 20:23	06:58 19:13	07:59 18:09	09:15 (Hild 4) 16:25	08:30 16:25
29	08:09 17:10	07:13 18:08	06:39 (Hild 4) 19:01	07:49 (Hild 1) 19:58	06:04 21:28	05:19 21:46	05:13 21:42	06:33 20:21	06:58 19:11	07:59 18:07	09:15 (Hild 4) 16:24	08:31 16:25
30	08:08 17:12	07:11 18:10	06:40 (Hild 4) 19:02	07:50 (Hild 1) 19:58	06:03 21:29	05:18 21:46	05:12 21:42	06:35 20:19	06:58 19:08	07:59 18:05	09:15 (Hild 4) 16:23	08:31 16:26
31	08:07 17:13	07:10 18:11	06:41 (Hild 4) 19:03	07:51 (Hild 1) 19:58	06:02 21:30	05:17 21:46	05:11 21:42	06:36 20:16	06:58 19:06	07:59 18:03	09:15 (Hild 4) 16:22	08:31 16:27
Sonnenscheinstunden	262	279	367	415	482	495	452	380	433	333	269	247
astr.max.mögl.Beschattung		411	617						433	610		
Red.Sonnenscheinwahrsch.		0,26	0,33						0,37	0,30		
Reduktion Betriebsdauer		0,98	0,98						0,98	0,98		
Reduktion Windrichtung		0,63	0,64						0,64	0,63		
Gesamte Reduktion		0,16	0,21						0,23	0,19		
Met.wahrsch.Beschattung		67	128						101	113		

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	

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H32 - Hildfeld, Steinertstr. 4

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28 08:01 16:30 08:03 16:31 08:30 16:32 08:30 16:35 08:29 16:37 08:29 16:38 08:28 16:39 08:22 16:51 08:21 16:53 08:20 16:54 08:19 16:56 08:18 16:58 08:17 16:59 08:16 17:01 08:15 17:03 08:13 17:05 08:11 17:08 08:09 17:10 08:08 17:12 08:07 17:13	08:05 17:15 08:04 17:17 08:02 17:19 08:01 17:21 07:59 17:22 07:57 17:24 07:56 17:26 07:54 17:28 07:52 17:30 07:50 17:31 07:49 17:33 07:47 17:35 07:45 17:37 07:43 17:39 07:41 17:40 07:39 17:42 07:38 17:44 07:36 17:46 07:34 17:48 07:32 17:49 07:30 17:51 07:28 17:53 07:26 17:59 08:16 07:24 17:01 08:15 17:03 08:13 17:05 18:00 07:17 18:02 07:15 18:04 07:10 08:08 17:12 08:07 17:13	07:13 18:05 07:11 18:07 07:09 18:09 07:07 18:11 07:05 18:12 07:02 18:14 07:00 18:16 06:58 18:18 06:56 18:19 06:54 18:21 06:51 18:23 06:49 18:24 06:47 18:26 06:45 18:28 06:43 18:31 06:38 18:33 06:36 18:38 06:34 18:41 06:33 18:43 06:30 18:45 06:28 18:48 06:27 18:53 06:24 18:59 06:22 19:01 06:20 19:03 06:18 19:04 06:16 19:06 06:14 19:08 06:12 19:10 06:10 19:12 06:09 19:14 06:08 19:16 06:07 19:18 06:06 19:20 06:05 19:22 06:04 19:24 06:03 19:26 06:02 19:28 06:01 19:30 06:00 19:32 05:59 19:34 05:57 19:36 05:56 19:38 05:55 19:40 05:54 19:42 05:53 19:44 05:52 19:46 05:51 19:48 05:50 19:50 05:49 19:52 05:48 19:54 05:47 19:56 05:46 19:58 05:45 19:59 05:44 19:59 05:43 19:59 05:42 19:59 05:41 19:59 05:40 19:59 05:39 19:59 05:38 19:59 05:37 19:59 05:36 19:59 05:35 19:59 05:34 19:59 05:33 19:59 05:32 19:59 05:31 19:59 05:30 19:59 05:29 19:59 05:28 19:59 05:27 19:59 05:26 19:59 05:25 19:59 05:24 19:59 05:23 19:59 05:22 19:59 05:21 19:59 05:20 19:59 05:19 19:59 05:18 19:59 05:17 19:59 05:16 19:59 05:15 19:59 05:14 19:59 05:13 19:59 05:12 19:59 05:11 19:59 05:10 19:59 05:09 19:59 05:08 19:59 05:07 19:59 05:06 19:59 05:05 19:59 05:04 19:59 05:03 19:59 05:02 19:59 05:01 19:59 05:00 19:59 04:59 19:59 04:58 19:59 04:57 19:59 04:56 19:59 04:55 19:59 04:54 19:59 04:53 19:59 04:52 19:59 04:51 19:59 04:50 19:59 04:49 19:59 04:48 19:59 04:47 19:59 04:46 19:59 04:45 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19:59 03:21 19:59 03:20 19:59 03:19 19:59 03:18 19:59 03:17 19:59 03:16 19:59 03:15 19:59 03:14 19:59 03:13 19:59 03:12 19:59 03:11 19:59 03:10 19:59 03:09 19:59 03:08 19:59 03:07 19:59 03:06 19:59 03:05 19:59 03:04 19:59 03:03 19:59 03:02 19:59 03:01 19:59 03:00 19:59 02:59 19:59 02:58 19:59 02:57 19:59 02:56 19:59 02:55 19:59 02:54 19:59 02:53 19:59 02:52 19:59 02:51 19:59 02:50 19:59 02:49 19:59 02:48 19:59 02:47 19:59 02:46 19:59 02:45 19:59 02:44 19:59 02:43 19:59 02:42 19:59 02:41 19:59 02:40 19:59 02:39 19:59 02:38 19:59 02:37 19:59 02:36 19:59 02:35 19:59 02:34 19:59 02:33 19:59 02:32 19:59 02:31 19:59 02:30 19:59 02:29 19:59 02:28 19:59 02:27 19:59 02:26 19:59 02:25 19:59 02:24 19:59 02:23 19:59 02:22 19:59 02:21 19:59 02:20 19:59 02:19 19:59 02:18 19:59 02:17 19:59 02:16 19:59 02:15 19:59 02:14 19:59 02:13 19:59 02:12 19:59 02:11 19:59 02:10 19:59 02:09 19:59 02:08 19:59 02:07 19:59 02:06 19:59 02:05 19:59 02:04 19:59 02:03 19:59 02:02 19:59 02:01 19:59 02:00 19:59 01:59 19:59 01:58 19:59 01:57 19:59 01:56 19:59 01:55 19:59 01:54 19:59 01:53 19:59 01:52 19:59 01:51 19:59 01:50 19:59 01:49 19:59 01:48 19:59 01:47 19:59 01:46 19:59 01:45 19:59 01:44 19:59 01:43 19:59 01:42 19:59 01:41 19:59 01:40 19:59 01:39 19:59 01:38 19:59 01:37 19:59 01:36 19:59 01:35 19:59 01:34 19:59 01:33 19:59 01:32 19:59 01:31 19:59 01:30 19:59 01:29 19:59 01:28 19:59 01:27 19:59 01:26 19:59 01:25 19:59 01:24 19:59 01:23 19:59 01:22 19:59 01:21 19:59 01:20 19:59 01:19 19:59 01:18 19:59 01:17 19:59 01:16 19:59 01:15 19:59 01:14 19:59 01:13 19:59 01:12 19:59 01:11 19:59 01:10 19:59 01:09 19:59 01:08 19:59 01:07 19:59 01:06 19:59 01:05 19:59 01:04 19:59 01:03 19:59 01:02 19:59 01:01 19:59 01:00 19:59 00:59 19:59 00:58 19:59 00:57 19:59 00:56 19:59 00:55 19:59 00:54 19:59 00:53 19:59 00:52 19:59 00:51 19:59 00:50 19:59 00:49 19:59 00:48 19:59 00:47 19:59 00:46 19:59 00:45 19:59 00:44 19:59 00:43 19:59 00:42 19:59 00:41 19:59 00:40 19:59 00:39 19:59 00:38 19:59 00:37 19:59 00:36 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24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H33 - Hildfeld, Steinertstr. 5

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

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07:13 18:01 07:12 18:02 07:11 18:03 07:10 18:04 07:09 18:05 07:08 18:06 07:07 18:07 07:06 18:08 07:05 18:09 07:04 18:10 07:03 18:11 07:02 18:12 07:01 18:13 07:00 18:14 06:59 18:15 06:58 18:16 06:57 18:17 06:56 18:18 06:55 18:19 06:54 18:20 06:53 18:21 06:52 18:22 06:51 18:23 06:50 18:24 06:49 18:25 06:48 18:26 06:47 18:27 06:46 18:28 06:45 18:29 06:44 18:30 06:43 18:31 06:42 18:32 06:41 18:33 06:40 18:34 06:39 18:35 06:38 18:36 06:37 18:37 06:36 18:38 06:35 18:39 06:34 18:40 06:33 18:41 06:32 18:42 06:31 18:43 06:30 18:44 06:29 18:45 06:28 18:46 06:27 18:47 06:26 18:48 06:25 18:49 06:24 18:50 06:23 18:51 06:22 18:52 06:21 18:53 06:20 18:54 06:19 18:55 06:18 18:56 06:17 18:57 06:16 18:58 06:15 18:59 06:14 19:00 06:13 19:01 06:12 19:02 06:11 19:03 06:10 19:04 06:09 19:05 06:08 19:06 06:07 19:07 06:06 19:08 06:05 19:09 06:04 19:10 06:03 19:11 06:02 19:12 06:01 19:13 06:00 19:14 05:59 19:15 05:58 19:16 05:57 19:17 05:56 19:18 05:55 19:19 05:54 19:20 05:53 19:21 05:52 19:22 05:51 19:23 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Sonnenscheinstunden	262	279	367		415	482	495	499	452	380		
astr.max.mögl.Beschattung		425	572						379	631		
Red.Sonnenscheinwahrsch.		0.26	0.33						0.37	0.30		
Reduktion Betriebsdauer		0.98	0.98						0.98	0.98		
Reduktion Windrichtung		0.63	0.64						0.64	0.63		
Gesamte Reduktion		0.16	0.21						0.23	0.19		
Met.wahrsch.Beschattung		70	119						88	117		

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H34 - Hildfeld, Steinertstr. 8

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
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Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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3	08:31	08:04	07:11	07:02	19:58	05:16	05:15	05:51	06:39	07:27	28	08:34 (Hild 2)
4	16:30	17:17	18:07	20:00	20:49	21:33	21:45	21:13	20:12	19:04	25	08:59 (Hild 2)
5	08:31	08:02	07:09	07:00	19:57	05:15	05:15	05:52	06:41	07:28	26	08:34 (Hild 2)
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7	08:30	08:01	07:07	06:57	19:55	05:15	05:16	05:54	06:38	07:30	23	08:35 (Hild 2)
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9	08:30	07:59	07:05	06:55	19:53	05:14	05:17	05:55	06:44	07:32	20	08:37 (Hild 2)
10	16:33	17:22	18:12	20:04	20:54	21:36	21:44	21:08	20:05	18:57	17	08:54 (Hild 2)
11	08:30	07:57	07:02	06:53	19:52	05:13	05:18	05:57	06:46	07:33	16	08:38 (Hild 2)
12	16:34	17:24	18:14	20:06	20:55	21:37	21:43	21:06	20:03	18:55	13	08:51 (Hild 2)
13	08:30	07:56	07:00	06:51	19:50	05:13	05:19	05:59	06:47	07:35	12	08:40 (Hild 2)
14	16:35	17:25	18:16	20:08	20:57	21:38	21:43	21:05	20:02	18:53	11	08:41 (Hild 2)
15	08:29	07:54	06:58	06:48	19:58	05:12	05:20	06:00	06:49	07:37	10	07:30
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30	16:47	17:40	18:29	20:21	21:09	21:43	21:37	20:50	19:43	18:35	7	09:21 (Hild 4)
31	08:24	07:39	06:40	06:31	19:55	05:10	05:28	06:13	07:01	07:50	6	09:17 (Hild 4)
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2	08:23	07:38	06:38	06:29	19:54	05:10	05:29	06:14	07:03	07:52	13	09:15 (Hild 4)
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4	08:22	07:37	06:36	06:27	19:53	05:10	05:30	06:15	07:02	07:53	17	09:16 (Hild 4)
5	16:51	17:46	18:35	20:26	21:14	21:45	21:34	20:44	19:36	18:32	22	09:35 (Hild 4)
6	08:21	07:34	06:33	06:25	19:51	05:10	05:32	06:17	07:06	07:55	21	09:12 (Hild 4)
7	16:53	17:48	18:36	20:28	21:15	21:45	21:33	20:42	19:34	18:37	24	09:36 (Hild 4)
8	08:20	07:32	06:31	06:23	19:50	05:10	05:33	06:19	07:08	07:57	25	09:12 (Hild 4)
9	16:54	17:49	18:38	20:29	21:16	21:46	21:35	20:43	19:35	18:38	26	09:37 (Hild 4)
10	08:19	07:30	06:29	06:20	19:52	05:10	05:34	06:20	07:09	07:58	28	09:10 (Hild 4)
11	16:56	17:51	18:40	20:31	21:18	21:46	21:30	20:38	19:29	18:30	21	09:39 (Hild 4)
12	08:18	07:28	06:27	06:18	19:57	05:10	05:35	06:22	07:11	08:00	20	09:10 (Hild 4)
13	16:58	17:53	18:41	20:32	21:19	21:46	21:29	20:36	19:27	18:32	24	09:32 (Hild 4)
14	08:17	07:26	06:24	06:16	19:56	05:10	05:37	06:24	07:12	08:02	25	09:10 (Hild 4)
15	16:59	17:55	18:43	20:34	21:19	21:46	21:28	20:34	19:24	18:33	27	09:37 (Hild 4)
16	08:16	07:24	06:22	06:14	19:55	05:11	05:38	06:25	07:14	08:04	28	09:10 (Hild 4)
17	17:01	17:57	18:45	20:36	21:22	21:46	21:26	20:31	19:22	18:33	27	09:37 (Hild 4)
18	08:15	07:21	06:20	06:12	19:54	05:11	05:39	06:27	07:16	08:04	27	09:10 (Hild 4)
19	17:03	17:58	18:46	20:37	21:23	21:46	21:25	20:29	19:28	18:34	25	09:37 (Hild 4)
20	08:13	07:19	06:18	06:10	19:51	05:11	05:41	06:28	07:17	08:07	26	09:10 (Hild 4)
21	17:05	18:00	18:48	20:39	21:25	21:46	21:24	20:27	19:18	18:30	23	08:37 (Hild 4)
22	08:12	07:17	06:15	06:08	19:51	05:12	05:42	06:30	07:19	08:12	24	08:39 (Hild 4)
23	17:06	18:02	18:50	20:41	21:26	21:46	21:22	20:25	19:15	18:30	27	08:36 (Hild 4)
24	08:11	07:15	06:13	06:06	19:50	05:12	05:44	06:31	07:20	08:13	26	08:40 (Hild 4)
25	17:08	18:04	18:51	20:42	21:27	21:46	21:21	20:23	19:13	18:33	30	09:02 (Hild 2)
26	08:09		07:11	06:04	19:50	05:13	05:45	06:33	07:22	08:14	29	08:11 (Hild 4)
27	17:10		19:53	20:44	21:28	21:46	21:19	20:21	19:11	18:32	24	08:15 (Hild 4)
28	08:08		07:09	06:03	19:50	05:13	05:47	06:35	07:24	08:16	23	08:12 (Hild 4)
29	17:12		19:55	20:46	21:29	21:46	21:18	20:19	19:08	18:33	22	08:13 (Hild 4)
30	08:07		07:06	06:02	19:58		05:48	06:36		07:16	20	08:14 (Hild 4)
31	17:13		19:56		21:31		21:16	20:16		07:17	22	08:15 (Hild 4)
Sonnenscheinstunden	262	279	367		415	482	495	452	380	311	333	269
astr. max. mögl. Beschattung		422	436							517		38
Red. Sonnenscheinwahrsch.		0,26	0,33							0,37		0,19
Reduktion Betriebsdauer		0,98	0,98							0,98		0,98
Reduktion Windrichtung		0,63	0,64							0,64		0,63
Gesamte Reduktion		0,16	0,21							0,23		0,12
Met. wahrsch. Beschattung		69	91							95		4

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H35 - Hildfeld, Zum Grund 13

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	08:58 (Hild 4) 07:13	08:14 (Hild 2) 07:04	06:01	05:17	05:14	05:49	06:38	07:25	08:52 (Hild 2) 07:18	08:25 (Hild 4) 08:07
2	16:26	17:15	21 09:19 (Hild 4) 18:05	26 08:40 (Hild 2) 19:58	20:47	21:32	21:45	21:15	20:14	19:06	22 09:14 (Hild 2) 17:02	27 08:52 (Hild 4) 16:22
3	08:31	08:04	08:57 (Hild 4) 07:11	08:14 (Hild 2) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	08:51 (Hild 2) 07:19	08:25 (Hild 4) 08:09
4	16:30	17:17	23 09:20 (Hild 4) 18:07	26 08:40 (Hild 2) 20:00	20:49	21:33	21:45	21:13	20:12	19:04	25 09:16 (Hild 2) 17:00	28 08:53 (Hild 4) 16:22
5	08:31	08:02	08:56 (Hild 4) 07:09	08:13 (Hild 2) 07:00	05:57	05:15	05:15	05:52	06:41	07:28	08:49 (Hild 2) 07:21	08:25 (Hild 4) 08:10
6	16:31	17:19	24 09:20 (Hild 4) 18:09	28 08:41 (Hild 2) 20:01	20:51	21:34	21:45	21:11	20:10	19:02	27 09:16 (Hild 2) 16:58	28 08:53 (Hild 4) 16:21
7	08:30	08:01	08:56 (Hild 4) 07:07	29 08:12 (Hild 2) 06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:49 (Hild 2) 07:23	08:25 (Hild 4) 08:11
8	16:32	17:21	26 09:22 (Hild 4) 18:11	29 08:41 (Hild 2) 20:03	20:52	21:35	21:44	21:10	20:08	18:59	27 09:16 (Hild 2) 16:56	27 08:52 (Hild 4) 16:21
9	08:30	07:59	08:56 (Hild 4) 07:05	30 08:11 (Hild 2) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:48 (Hild 2) 07:25	08:25 (Hild 4) 08:13
10	16:33	17:22	26 09:22 (Hild 4) 18:12	30 08:41 (Hild 2) 20:04	20:54	21:36	21:44	21:08	20:05	18:57	29 09:17 (Hild 2) 16:55	27 08:52 (Hild 4) 16:20
11	08:30	07:57	08:55 (Hild 4) 06:58	08:11 (Hild 2) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:47 (Hild 2) 07:30	08:25 (Hild 4) 08:16
12	16:34	17:24	27 09:22 (Hild 4) 18:14	30 08:41 (Hild 2) 20:06	20:55	21:37	21:43	21:06	20:03	18:55	29 09:16 (Hild 2) 16:53	27 08:52 (Hild 4) 16:20
13	08:30	07:56	08:56 (Hild 4) 07:00	08:11 (Hild 2) 06:51	05:50	05:13	05:19	05:59	06:47	07:35	08:47 (Hild 2) 07:28	08:26 (Hild 4) 08:15
14	16:35	17:26	27 09:23 (Hild 4) 18:16	30 08:41 (Hild 2) 20:08	20:57	21:38	21:43	21:05	20:01	18:53	30 09:17 (Hild 2) 16:51	26 08:52 (Hild 4) 16:19
15	08:29	07:54	08:56 (Hild 4) 06:58	08:11 (Hild 2) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:47 (Hild 2) 07:30	08:25 (Hild 4) 08:16
16	16:37	17:28	27 09:23 (Hild 4) 18:18	29 08:40 (Hild 2) 20:09	20:59	21:39	21:42	21:03	19:59	18:51	30 09:17 (Hild 2) 16:50	24 08:51 (Hild 4) 16:19
17	08:29	07:52	08:56 (Hild 4) 06:56	29 08:11 (Hild 2) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	08:46 (Hild 2) 07:32	08:28 (Hild 4) 08:17
18	16:38	17:30	27 09:23 (Hild 4) 18:19	28 08:39 (Hild 2) 20:11	21:00	21:39	21:42	21:01	19:56	18:48	30 09:16 (Hild 2) 16:48	23 08:51 (Hild 4) 16:19
19	08:28	07:50	08:56 (Hild 4) 06:54	08:11 (Hild 2) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	08:47 (Hild 2) 07:32	08:29 (Hild 4) 08:19
20	16:39	17:31	27 09:23 (Hild 4) 18:21	27 08:38 (Hild 2) 20:13	21:02	21:40	21:41	20:59	19:54	18:46	28 09:15 (Hild 2) 16:46	21 08:50 (Hild 4) 16:19
21	08:28	07:49	08:56 (Hild 4) 06:51	08:12 (Hild 2) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	08:47 (Hild 2) 07:35	08:30 (Hild 4) 08:20
22	16:41	17:33	26 09:22 (Hild 4) 18:23	25 08:37 (Hild 2) 20:14	21:03	21:41	21:40	20:57	19:52	18:44	28 09:15 (Hild 2) 16:45	19 08:49 (Hild 4) 16:19
23	08:27	07:47	08:56 (Hild 4) 06:49	08:13 (Hild 2) 06:40	05:42	05:11	05:23	06:06	06:55	07:43	08:47 (Hild 2) 07:37	08:32 (Hild 4) 08:21
24	16:42	17:35	26 09:23 (Hild 4) 18:24	23 08:36 (Hild 2) 20:16	21:05	21:42	21:39	20:56	19:50	18:42	26 09:13 (Hild 2) 16:43	16 08:48 (Hild 4) 16:18
25	08:26	07:45	08:57 (Hild 4) 06:47	23 08:14 (Hild 2) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	08:48 (Hild 2) 07:38	08:33 (Hild 4) 08:22
26	16:44	17:37	24 09:21 (Hild 4) 18:26	20 08:34 (Hild 2) 20:18	21:06	21:42	21:39	20:54	19:47	18:40	24 09:12 (Hild 2) 16:42	12 08:45 (Hild 4) 16:18
27	08:26	07:43	08:58 (Hild 4) 06:45	08:16 (Hild 2) 06:35	05:38	05:10	05:26	06:09	06:58	07:47	08:49 (Hild 2) 07:40	08:36 (Hild 4) 08:23
28	16:45	17:39	22 09:20 (Hild 4) 18:28	15 08:31 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	22 09:11 (Hild 2) 16:40	7 08:43 (Hild 4) 08:23
29	08:25	07:41	08:59 (Hild 4) 06:42	08:19 (Hild 2) 06:33	05:37	05:10	05:27	06:11	07:00	07:48	08:51 (Hild 2) 07:42	08:23
30	16:47	17:40	19 09:18 (Hild 4) 18:29	9 08:28 (Hild 2) 20:21	21:09	21:43	21:37	20:50	19:43	18:35	18 09:09 (Hild 2) 16:39	16:18
31	08:24	07:39	09:01 (Hild 4) 06:40	06:31	05:35	05:10	05:28	06:12	07:01	07:50	08:52 (Hild 2) 07:44	08:24
32	16:48	17:42	16 09:17 (Hild 4) 18:31	20:23	21:11	21:44	21:36	20:48	19:40	18:33	14 09:06 (Hild 2) 16:38	16:19
33	08:23	07:38	09:03 (Hild 4) 06:38	06:29	05:34	05:10	05:29	06:14	07:03	07:52	08:57 (Hild 2) 07:45	08:25
34	16:50	17:44	11 09:14 (Hild 4) 18:33	20:24	21:12	21:44	21:35	20:46	19:38	18:31	5 09:02 (Hild 2) 16:36	16:19
35	08:22	07:36	06:36	06:27	05:33	05:10	05:30	06:16	07:04	07:53	08:57 (Hild 2) 07:47	08:26
36	16:51	17:46	18:35	20:26	21:14	21:45	21:34	20:44	19:36	18:29	08:52 (Hild 2) 16:35	16:19
37	08:21	07:34	06:33	06:25	05:31	05:10	05:32	06:17	07:06	07:55	08:57 (Hild 2) 07:49	08:27
38	16:53	17:48	18:36	20:28	21:15	21:45	21:33	20:42	19:34	18:27	08:52 (Hild 2) 16:34	16:19
39	08:20	07:32	06:31	06:23	05:30	05:10	05:33	06:19	07:08	07:57	08:52 (Hild 2) 16:33	08:27
40	16:54	17:49	18:38	20:29	21:17	21:45	21:31	20:40	19:31	18:25	08:52 (Hild 2) 16:33	16:20
41	08:19	07:30	06:29	06:20	05:28	05:10	05:34	06:20	07:09	07:58	08:52 (Hild 2) 16:32	16:20
42	16:56	17:51	18:40	20:31	21:18	21:46	21:30	20:38	19:29	18:23	08:51 (Hild 2) 16:32	16:20
43	08:18	07:28	06:27	06:18	05:27	05:10	05:35	06:22	07:11	08:00	08:52 (Hild 2) 16:31	16:20
44	16:58	17:53	18:41	20:33	21:19	21:46	21:29	20:36	19:27	18:21	08:52 (Hild 2) 16:30	16:21
45	08:17	07:26	06:24	06:16	05:26	05:10	05:37	06:24	07:12	08:02	08:52 (Hild 2) 16:29	16:21
46	16:59	17:55	18:43	20:34	21:21	21:46	21:28	20:34	19:24	18:19	08:52 (Hild 2) 16:29	16:21
47	08:16	07:24	06:22	06:14	05:25	05:11	05:38	06:25	07:14	08:04	09:37 (Hild 4) 07:57	08:29
48	17:01	17:57	18:45	20:36	21:22	21:46	21:26	20:31	19:22	18:17	4 09:41 (Hild 4) 16:28	16:22
49	08:15	07:21	06:20	06:12	05:24	05:11	05:39	06:27	07:16	08:05	08:53 (Hild 4) 07:58	08:30
50	17:03	17:58	18:46	20:38	21:23	21:46	21:25	20:29	19:20	17:15	12 08:45 (Hild 4) 16:27	16:22
51	08:13	07:19	06:18	06:10	05:23	05:11	05:41	06:28	07:17	08:07	08:31 (Hild 4) 08:00	08:30
52	17:05	18:00	16 08:36 (Hild 2) 18:48	20:39	21:25	21:46	21:24	20:27	19:18	17:13	17 08:48 (Hild 4) 16:26	16:23
53	08:12	07:17	06:15	06:08	05:21	05:12	05:42	06:30	07:19	08:09	08:28 (Hild 4) 08:01	08:30
54	17:06	18:02	20 08:38 (Hild 2) 18:50	20:41	21:26	21:46	21:22	20:25	19:15	17:11	20 08:48 (Hild 4) 16:26	16:24
55	08:11	07:15	06:13	06:06	05:20	05:12	05:44	06:31	07:20	08:10	08:27 (Hild 2) 07:11	08:30
56	17:08	18:04	22 08:38 (Hild 2) 18:51	20:42	21:27	21:46	21:21	20:23	19:13	4 09:06 (Hild 2) 17:09	23 08:50 (Hild 4) 16:25	16:25
57	08:09	07:11	06:11	06:04	05:19	05:13	05:45	06:33	07:22	08:12	08:57 (Hild 2) 07:12	08:31
58	17:10	18:05	19:53	20:44	21:28	21:46	21:19	20:21	19:11	14 09:11 (Hild 2) 17:07	25 08:51 (Hild 4) 16:24	16:25
59	08:08	07:09	06:09	06:03	05:19	05:13	05:47	06:35	07:24	08:14	08:54 (Hild 2) 07:14	08:31
60	17:12	18:07	19:55	20:46	21:29	21:46	21:18	20:19	19:08	19 09:13 (Hild 2) 17:05	25 08:51 (Hild 4) 16:23	16:26
61	08:07	07:06	06:06	06:01	05:18	05:12	05:48	06:36	07:25	08:15	08:54 (Hild 2) 07:13	08:31
62	17:13	18:08	19:56	20:47	21:31	21:46	21:16	20:16	19:05	18 09:12 (Hild 2) 17:04	26 08:52 (Hild 4) 16:22	16:27
63	Sonnenscheinstunden	262	279	367	415	482	495	452	380	333	269	247
64	astr.max.mögl.Beschattung	55	467	375					37	566	312	
65	Red. Sonnenscheinwahrsch.	0,19	0,26	0,33					0,37	0,30	0,19	
66	Reduktion Betriebsdauer	0,98	0,98	0,98					0,98	0,98	0,98	
67	Reduktion Windrichtung	0,61	0,62	0,64					0,64	0,63	0,61	
68	Gesamte Reduktion	0,11	0,16	0,21					0,23	0,19	0,11	
69	Met. wahrsch. Beschattung	6	75	78					9	105	36	

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	

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H36 - Hildfeld, Zum Grund 15

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H37 - Hildfeld, Zum Grund 17

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	08:59 (Hild 4)	07:13	08:10 (Hild 1)	07:04	06:01	05:17	05:14	05:49	06:38	07:18
2	16:25	17:15	09:22 (Hild 4)	18:05	08:41 (Hild 2)	19:58	20:47	21:32	21:45	21:15	20:14	19:06
3	08:31	08:04	08:58 (Hild 4)	07:11	08:11 (Hild 1)	07:02	05:59	05:16	05:15	05:51	06:39	07:27
4	16:30	17:17	09:23 (Hild 4)	18:07	08:42 (Hild 2)	20:00	20:49	21:33	21:45	21:13	20:12	19:04
5	08:31	08:02	08:58 (Hild 4)	07:09	08:11 (Hild 1)	07:00	05:57	05:15	05:15	05:52	06:41	07:28
6	16:31	17:19	09:23 (Hild 4)	18:09	08:43 (Hild 2)	20:01	20:51	21:34	21:45	21:11	20:10	19:02
7	08:30	08:01	08:58 (Hild 4)	07:07	08:12 (Hild 1)	06:57	05:55	05:15	05:16	05:54	06:42	07:30
8	16:32	17:21	09:24 (Hild 4)	18:11	08:43 (Hild 2)	20:03	20:52	21:35	21:44	21:10	20:08	18:59
9	08:30	07:59	08:57 (Hild 4)	07:05	08:12 (Hild 2)	06:55	05:53	05:14	05:17	05:55	06:44	07:32
10	16:33	17:22	09:25 (Hild 4)	18:12	08:43 (Hild 2)	20:06	20:56	21:36	21:44	21:08	20:05	18:57
11	08:29	07:57	08:57 (Hild 4)	07:02	08:12 (Hild 2)	06:53	05:52	05:13	05:18	05:57	06:46	07:33
12	16:34	17:24	09:25 (Hild 4)	18:14	08:43 (Hild 2)	20:06	20:55	21:37	21:43	21:06	20:03	18:55
13	08:30	07:56	08:57 (Hild 4)	07:00	08:12 (Hild 2)	06:51	05:50	05:13	05:19	05:59	06:47	07:35
14	16:35	17:25	09:25 (Hild 4)	18:16	08:42 (Hild 2)	20:08	20:57	21:38	21:43	21:05	20:01	18:53
15	08:29	07:54	08:58 (Hild 4)	06:58	08:13 (Hild 2)	06:48	05:48	05:12	05:20	06:00	06:49	07:37
16	16:37	17:28	09:25 (Hild 4)	18:18	08:42 (Hild 2)	20:09	20:59	21:39	21:42	21:03	19:59	18:51
17	08:29	07:52	08:58 (Hild 4)	06:56	08:12 (Hild 2)	06:46	05:46	05:12	05:20	06:02	06:50	07:38
18	16:38	17:30	09:25 (Hild 4)	18:19	08:41 (Hild 2)	20:11	21:00	21:39	21:42	21:01	19:56	18:48
19	08:28	07:50	08:58 (Hild 4)	06:54	08:13 (Hild 2)	06:44	05:45	05:11	05:21	06:03	06:52	07:40
20	16:39	17:31	09:25 (Hild 4)	18:21	08:40 (Hild 2)	20:13	21:02	21:40	21:41	20:59	19:54	18:46
21	08:28	07:49	08:58 (Hild 4)	06:51	08:13 (Hild 2)	06:42	05:43	05:11	05:22	06:05	06:53	07:42
22	16:41	17:33	09:24 (Hild 4)	18:23	08:39 (Hild 2)	20:14	21:03	21:41	21:40	20:57	19:52	18:44
23	08:27	07:47	08:59 (Hild 4)	06:49	08:14 (Hild 2)	06:40	05:42	05:11	05:23	06:06	06:55	07:43
24	16:42	17:35	09:24 (Hild 4)	18:24	08:38 (Hild 2)	20:16	21:05	21:42	21:39	20:56	19:50	18:42
25	08:26	07:45	08:59 (Hild 4)	06:47	08:15 (Hild 2)	06:37	05:40	05:10	05:25	06:08	06:57	07:45
26	16:44	17:37	09:23 (Hild 4)	18:26	08:35 (Hild 2)	20:18	21:06	21:42	21:39	20:54	19:47	18:40
27	08:26	07:43	09:00 (Hild 4)	06:45	08:17 (Hild 2)	06:35	05:38	05:10	05:26	06:09	06:58	07:47
28	16:45	17:39	09:22 (Hild 4)	18:28	08:33 (Hild 2)	20:19	21:08	21:43	21:38	20:52	19:45	18:37
29	08:25	07:41	09:01 (Hild 4)	06:42	08:20 (Hild 2)	06:33	05:37	05:10	05:27	06:11	07:00	07:48
30	16:47	17:40	09:20 (Hild 4)	18:29	08:30 (Hild 2)	20:21	21:09	21:43	21:37	20:50	19:43	18:35
31	08:24	07:39	09:03 (Hild 4)	06:40	08:31	05:35	05:10	05:28	06:12	07:01	07:50	08:44
1	16:48	17:42	09:18 (Hild 4)	18:31	08:29	21:11	21:44	21:36	20:48	19:40	18:33	17:25
2	08:23	07:38	09:06 (Hild 4)	06:38	08:29	05:34	05:10	05:29	06:14	07:03	07:52	08:46
3	16:50	17:44	9 09:15 (Hild 4)	18:33	08:28	21:12	21:44	21:35	20:46	19:38	18:31	17:23
4	08:22	07:36		06:36	08:27	05:33	05:10	05:30	06:16	07:04	07:53	08:46
5	16:51	17:46		18:35	08:26	21:14	21:45	21:34	20:44	19:36	18:29	17:21
6	08:21	07:34		06:33	08:25	05:31	05:10	05:32	06:17	07:06	07:55	08:47
7	16:53	17:48		18:36	08:24	21:15	21:45	21:33	20:42	19:34	18:27	17:19
8	08:20	07:32		06:31	08:23	05:30	05:10	05:33	06:19	07:08	07:57	08:49
9	16:54	17:49		18:38	08:22	21:17	21:45	21:31	20:40	19:31	18:25	17:17
10	08:19	07:30	08:21 (Hild 1)	06:29	08:20	05:28	05:10	05:34	06:20	07:09	07:58	08:50
11	16:56	17:51	4 08:25 (Hild 1)	18:40	08:21	21:18	21:46	21:30	20:38	19:29	18:23	17:15
12	08:18	07:28	08:17 (Hild 1)	06:27	08:18	05:27	05:10	05:35	06:22	07:11	08:00	08:52
13	16:58	17:53	12 08:29 (Hild 1)	18:41	08:14	21:19	21:46	21:29	20:36	19:27	18:21	17:13
14	08:17	07:26	08:15 (Hild 1)	06:24	08:16	05:26	05:10	05:37	06:24	07:12	08:02	08:54
15	16:59	17:55	16 08:31 (Hild 1)	18:43	08:14	21:24	21:21	21:46	21:28	20:34	19:24	18:19
16	08:16	07:24	08:14 (Hild 1)	06:22	08:14	05:25	05:11	05:38	06:25	07:14	08:04	08:56
17	17:01	17:57	18 08:32 (Hild 1)	18:45	08:13	21:26	21:46	21:26	20:31	19:22	18:17	17:09
18	08:15	07:21	08:13 (Hild 1)	06:20	08:12	05:24	05:11	05:39	06:27	07:16	08:05	08:57
19	17:03	17:58	22 08:35 (Hild 2)	18:46	08:12	21:23	21:46	21:25	20:29	19:20	18:15	17:07
20	08:13	07:19	08:12 (Hild 1)	06:18	08:10	05:23	05:11	05:41	06:28	07:17	08:07	08:59
21	17:05	18:00	08:38 (Hild 2)	18:48	08:09	21:25	21:46	21:24	20:27	19:18	18:13	17:05
22	08:12	07:17	09:08 (Hild 4)	07:17	08:12 (Hild 1)	06:15	06:08	05:21	05:12	05:42	06:30	07:19
23	17:06	18:02	09:12 (Hild 4)	18:02	08:40 (Hild 2)	18:50	08:07	21:26	21:46	21:22	20:25	19:15
24	08:11	07:14	09:04 (Hild 4)	07:15	08:11 (Hild 1)	06:13	06:06	05:20	05:12	05:44	06:31	07:20
25	17:08	18:04	09:12 (Hild 4)	18:04	08:40 (Hild 2)	18:51	08:04	21:27	21:46	21:21	20:23	19:13
26	08:09	07:11	09:03 (Hild 4)		07:11		06:04	05:19	05:13	05:45	06:33	07:22
27	17:10	18:06	09:18 (Hild 4)		07:11		20:44	21:28	21:46	21:19	20:21	19:11
28	08:08	07:12	09:01 (Hild 4)		07:09		06:03	05:19	05:13	05:47	06:35	07:24
29	17:12	18:08	09:19 (Hild 4)		07:10		20:46	21:29	21:46	21:18	20:19	19:08
30	08:07	07:10	09:20 (Hild 4)		07:06		05:18	05:12	05:48	06:36	07:24	08:14
31	17:13	18:09	09:20 (Hild 4)		07:06		21:31	21:16	21:16	20:16	19:03	18:00
1	262	279	367	415	482	495	499	452	380	373	269	247
2	68	559	398	398	398	398	398	398	398	398	398	398
3	0,19	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
4	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
5	0,61	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
6	0,19	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
7	8	9	82	82	82	82	82	82	82	82	82	82
8	68	559	398	398	398	398	398	398	398	398	398	398
9	0,19	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
10	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
11	0,61	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
12	0,19	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
13	8	9	82	82	82	82	82	82	82	82	82	82
14	68	559	398	398	398	398	398	398	398	398	398	398
15	0,19	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
16	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
17	0,61	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
18	0,19	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
19	8	9	82	82	82	82	82	82	82	82	82	82
20	68	559	398	398	398	398	398	398	398	398	398	398
21	0,19	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
22	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
23	0,61	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
24	0,19	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
25	8	9	82	82	82	82	82	82	82	82	82	82
26	68	559	398	398	398	398	398	398	398	398	398	398
27	0,19	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
28	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
29	0,61	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
30	0,19	0,21	0,21	0,21	0,td							

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H38 - Hildfeld, Zum Grund 19

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1 08:31	08:05	09:01 (Hild 4) 07:13	08:18 (Hild 2) 07:04	06:01	05:17	05:14	05:49	06:38	07:25	09:03 (Hild 2) 07:18	08:32 (Hild 4) 08:07	
2 16:28	17:15	26 09:27 (Hild 4) 18:05	29 08:47 (Hild 2) 19:58	20:47	21:32	21:45	21:15	20:14	19:06	12 09:15 (Hild 2) 17:02	25 08:57 (Hild 4) 16:22	
3 08:31	08:02	09:01 (Hild 4) 07:11	08:18 (Hild 2) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	09:00 (Hild 2) 07:19	08:32 (Hild 4) 08:09	
4 16:32	17:17	26 09:27 (Hild 4) 18:07	29 08:47 (Hild 2) 20:00	20:49	21:33	21:45	21:13	20:12	19:04	17 09:17 (Hild 2) 17:00	25 08:57 (Hild 4) 16:22	
5 08:30	08:02	09:00 (Hild 4) 07:09	08:17 (Hild 2) 07:00	05:57	05:15	05:15	05:52	06:41	07:28	08:58 (Hild 2) 07:21	08:31 (Hild 4) 08:10	
6 16:31	17:19	27 09:27 (Hild 4) 18:09	31 08:48 (Hild 2) 20:01	20:51	21:34	21:45	21:11	20:10	19:02	20 09:18 (Hild 2) 16:58	27 08:58 (Hild 4) 16:21	
7 08:30	08:01	09:01 (Hild 4) 07:07	08:17 (Hild 2) 06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:56 (Hild 2) 07:23	08:30 (Hild 4) 08:11	
8 16:32	17:21	27 09:28 (Hild 4) 18:11	31 08:48 (Hild 2) 20:03	20:52	21:35	21:44	21:10	20:08	18:59	24 09:20 (Hild 2) 16:56	27 08:57 (Hild 4) 16:21	
9 08:30	07:59	09:01 (Hild 4) 07:05	08:17 (Hild 2) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:55 (Hild 2) 07:25	08:30 (Hild 4) 08:13	
10 16:33	17:22	27 09:28 (Hild 4) 18:12	29 08:46 (Hild 2) 20:04	20:54	21:36	21:44	21:08	20:05	18:57	26 09:21 (Hild 2) 16:55	28 08:58 (Hild 4) 16:20	
11 08:30	07:57	09:00 (Hild 4) 07:02	08:17 (Hild 2) 06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:54 (Hild 2) 07:26	08:30 (Hild 4) 08:14	
12 16:34	17:24	28 09:28 (Hild 4) 18:14	29 08:46 (Hild 2) 20:06	20:55	21:37	21:43	21:06	20:03	18:55	27 09:21 (Hild 2) 16:53	28 08:58 (Hild 4) 16:20	
13 08:30	07:56	09:00 (Hild 4) 07:00	08:17 (Hild 2) 06:51	05:50	05:13	05:19	05:59	06:47	07:35	08:53 (Hild 2) 07:28	08:31 (Hild 4) 08:15	
14 16:35	17:25	28 09:28 (Hild 4) 18:16	28 08:45 (Hild 2) 20:08	20:57	21:38	21:43	21:05	20:01	18:53	29 09:22 (Hild 2) 16:51	27 08:59 (Hild 4) 16:19	
15 08:29	07:54	09:02 (Hild 4) 06:58	08:18 (Hild 2) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:53 (Hild 2) 07:30	08:31 (Hild 4) 08:16	
16 16:37	17:28	26 09:28 (Hild 4) 18:18	27 08:45 (Hild 2) 20:09	20:59	21:39	21:42	21:03	19:59	18:51	29 09:22 (Hild 2) 16:50	27 08:58 (Hild 4) 16:19	
17 08:29	07:52	09:02 (Hild 4) 06:56	08:18 (Hild 2) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	08:52 (Hild 2) 07:32	08:31 (Hild 4) 08:17	
18 16:38	17:30	26 09:28 (Hild 4) 18:19	25 08:43 (Hild 2) 20:11	21:00	21:39	21:42	21:01	19:56	18:48	29 09:21 (Hild 2) 16:48	27 08:59 (Hild 4) 16:19	
19 08:28	07:50	09:02 (Hild 4) 06:54	08:19 (Hild 2) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	08:52 (Hild 2) 07:19	08:32 (Hild 4) 08:19	
20 16:39	17:31	25 09:27 (Hild 4) 18:21	22 08:41 (Hild 2) 20:13	21:02	21:40	21:41	21:09	19:54	18:46	30 09:22 (Hild 2) 16:46	26 08:59 (Hild 4) 16:19	
21 08:28	07:49	09:03 (Hild 4) 06:51	08:21 (Hild 2) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	08:52 (Hild 2) 07:35	08:33 (Hild 4) 08:20	
22 16:41	17:33	23 09:26 (Hild 4) 18:23	19 08:40 (Hild 2) 20:14	21:03	21:41	21:40	21:07	19:52	18:44	30 09:22 (Hild 2) 16:45	25 08:58 (Hild 4) 16:19	
23 08:27	07:47	09:04 (Hild 4) 06:49	08:23 (Hild 2) 06:40	05:42	05:11	05:23	06:06	06:55	07:43	08:51 (Hild 2) 07:37	08:34 (Hild 4) 08:21	
24 16:42	17:35	21 09:25 (Hild 4) 18:24	14 08:37 (Hild 2) 20:16	21:05	21:42	21:39	21:06	19:50	18:42	29 09:20 (Hild 2) 16:43	23 08:57 (Hild 4) 16:18	
25 08:26	07:45	09:06 (Hild 4) 06:47	08:27 (Hild 2) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	08:51 (Hild 2) 07:38	08:34 (Hild 4) 08:22	
26 16:44	17:37	17 09:23 (Hild 4) 18:26	4 08:31 (Hild 2) 20:18	21:06	21:42	21:39	21:04	19:47	18:40	29 09:20 (Hild 2) 16:42	22 08:56 (Hild 4) 16:18	
27 08:26	07:43	09:07 (Hild 4) 06:45	06:35	05:38	05:10	05:26	06:09	06:58	07:47	08:52 (Hild 2) 07:40	08:35 (Hild 4) 08:23	
28 16:45	17:39	14 09:21 (Hild 4) 18:28	20:19	21:08	21:43	21:38	21:02	19:45	18:37	27 09:19 (Hild 2) 16:40	20 08:55 (Hild 4) 16:18	
29 08:25	07:41	09:11 (Hild 4) 06:42	06:33	05:37	05:10	05:27	06:11	07:00	07:48	08:53 (Hild 2) 07:42	08:37 (Hild 4) 08:23	
30 16:47	17:40	7 09:18 (Hild 4) 18:29	20:21	21:09	21:43	21:37	21:04	19:43	18:35	26 09:19 (Hild 2) 16:39	17 08:54 (Hild 4) 16:18	
31 08:24	07:39	06:40	06:31	05:35	05:10	05:28	06:12	07:01	07:50	08:53 (Hild 2) 07:44	08:39 (Hild 4) 08:24	
1 16:48	17:42	18:31	20:23	21:11	21:44	21:36	21:08	19:40	18:33	24 09:17 (Hild 2) 16:38	14 08:51 (Hild 4) 16:19	
2 08:23	07:38	06:38	06:29	05:34	05:10	05:29	06:14	07:03	07:52	08:54 (Hild 2) 07:45	08:41 (Hild 4) 08:25	
3 16:50	17:44	18:33	20:24	21:12	21:44	21:35	21:06	19:38	18:31	21 09:15 (Hild 2) 16:36	10 08:51 (Hild 4) 16:19	
4 08:22	07:36	06:36	06:27	05:33	05:10	05:30	06:16	07:04	07:53	08:56 (Hild 2) 07:47	08:26	
5 16:51	17:46	18:35	20:26	21:14	21:45	21:34	21:04	19:36	18:29	18 09:14 (Hild 2) 16:35	08:27	
6 08:21	07:34	06:33	06:25	05:31	05:10	05:32	06:17	07:06	07:55	08:59 (Hild 2) 07:49	08:27	
7 16:53	17:48	18:36	20:28	21:15	21:45	21:33	21:04	19:34	18:27	12 09:11 (Hild 2) 16:34	08:27	
8 08:20	07:32	06:31	06:23	05:30	05:10	05:33	06:19	07:08	07:57	08:57 (Hild 2) 07:50	08:27	
9 16:54	17:49	18:38	20:29	21:17	21:45	21:31	21:04	19:31	18:25	19 09:10 (Hild 2) 16:33	08:26	
10 08:19	07:30	06:29	06:20	05:28	05:10	05:34	06:20	07:09	07:58	08:58 (Hild 2) 07:52	08:28	
11 16:56	17:51	18:40	20:31	21:18	21:46	21:30	21:06	19:38	18:29	17 09:12 (Hild 2) 16:32	08:27	
12 08:18	07:28	06:27	06:18	05:27	05:10	05:35	06:22	07:11	08:00	08:59 (Hild 2) 07:53	08:28	
13 16:58	17:53	7 08:37 (Hild 2) 18:41	20:33	21:19	21:46	21:29	21:06	19:37	18:21	16 09:13 (Hild 2) 16:30	08:27	
14 08:17	07:26	06:26	06:16	05:26	05:10	05:37	06:24	07:12	08:02	08:59 (Hild 2) 07:55	08:29	
15 16:59	17:55	18:43	20:34	21:21	21:46	21:29	21:06	19:38	18:29	15 09:14 (Hild 2) 16:31	08:28	
16 08:16	07:24	06:22	06:14	05:25	05:11	05:38	06:25	07:14	08:04	08:59 (Hild 2) 07:57	08:29	
17 17:01	17:57	19 08:43 (Hild 2) 18:45	20:36	21:22	21:46	21:26	21:03	19:34	18:17	14 09:15 (Hild 2) 16:28	08:27	
18 08:15	07:21	06:22	06:12	05:24	05:11	05:39	06:27	07:16	08:05	08:59 (Hild 2) 07:58	08:30	
19 17:03	17:58	23 08:45 (Hild 2) 18:46	20:37	21:23	21:46	21:25	21:06	19:37	18:15	13 09:16 (Hild 2) 16:27	08:27	
20 08:13	07:19	06:21	06:10	05:23	05:11	05:41	06:28	07:17	08:07	08:59 (Hild 2) 07:59	08:31	
21 17:05	17:50	18:00	20:39	21:25	21:46	21:24	21:07	19:38	18:13	12 09:17 (Hild 2) 16:26	08:26	
22 08:11	07:17	06:20	06:08	05:21	05:12	05:42	06:30	07:19	08:09	08:59 (Hild 2) 07:59	08:30	
23 17:06	17:51	18:02	20:41	21:26	21:46	21:22	21:09	19:40	18:15	11 09:18 (Hild 2) 16:25	08:25	
24 08:11	07:15	06:13	06:06	05:20	05:12	05:44	06:31	07:20	08:11	08:59 (Hild 2) 07:59	08:30	
25 17:08	17:53	18:04	20:42	21:27	21:46	21:21	21:09	19:40	18:15	10 09:19 (Hild 2) 16:24	08:24	
26 08:09	07:11	06:11	06:04	05:19	05:13	05:45	06:33	07:22	08:12	08:59 (Hild 2) 07:59	08:31	
27 17:10	17:55	18:05	20:44	21:28	21:46	21:19	21:11	19:41	18:16	9 09:20 (Hild 2) 16:24	08:23	
28 08:08	07:12	06:12	06:03	05:19	05:13	05:47	06:35	07:24	08:14	08:59 (Hild 2) 07:59	08:31	
29 17:12	17:57	18:07	20:46	21:29	21:46	21:18	21:10	19:41	18:16	8 09:21 (Hild 2) 16:23	08:22	
30 08:07	07:13	06:13	06:05	05:20	05:14	05:48	06:36	07:25	08:15	08:59 (Hild 2) 07:59	08:31	
31 17:13	17:58	18:08	20:47	21:31	21:46	21:16	21:12	19:42	18:17	7 09:22 (Hild 2) 16:22	08:21	
Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269	247
astr.max.mögl.Beschattung	131	492	317							545	398	
Red.Sonnenscheinwahrsch.	0.19	0.26	0.33							0.30	0.19	
Reduktion Betriebsdauer	0.98	0.98	0.98							0.98	0.98	
Reduktion Windrichtung	0.61	0.62	0.64							0.63	0.61	
Gesamte Reduktion	0.11	0.16	0.21							0.19	0.11	
Met.wahrsch.Beschattung	15	79	66							101	45	

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H39 - Hildfeld, Zum Grund 23

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	09:04 (Hild 4)	07:13	08:15 (Hild 1)	07:04	06:01	05:17	05:14	05:49	06:38	07:18
2	16:29	17:15	27 09:31 (Hild 4)	18:05	34 08:49 (Hild 2)	19:58	20:47	21:32	21:45	21:15	20:14	19:06
3	08:31	08:04	09:03 (Hild 4)	07:11	08:15 (Hild 1)	07:02	05:59	05:16	05:15	05:51	06:39	07:27
4	16:29	17:17	28 09:31 (Hild 4)	18:07	34 08:49 (Hild 2)	20:00	20:49	21:33	21:45	21:13	20:12	19:04
5	08:31	08:02	09:03 (Hild 4)	07:09	34 08:16 (Hild 1)	07:00	05:57	05:15	05:15	05:52	06:41	07:28
6	16:30	17:19	28 09:31 (Hild 4)	18:09	34 08:50 (Hild 2)	20:01	20:51	21:34	21:45	21:11	20:10	19:02
7	08:30	08:01	09:04 (Hild 4)	07:07	33 08:17 (Hild 1)	06:57	05:55	05:15	05:16	05:54	06:42	07:30
8	16:32	17:21	28 09:32 (Hild 4)	18:11	33 08:50 (Hild 2)	20:03	20:52	21:35	21:44	21:10	20:08	18:59
9	08:30	07:59	09:03 (Hild 4)	07:05	32 08:17 (Hild 1)	06:55	05:53	05:14	05:17	05:55	06:44	07:32
10	16:33	17:22	29 09:32 (Hild 4)	18:12	32 08:49 (Hild 2)	20:04	20:54	21:36	21:44	21:08	20:05	18:57
11	08:29	07:57	09:03 (Hild 4)	06:58	31 08:18 (Hild 1)	06:48	05:48	05:12	05:20	06:00	06:49	07:37
12	16:34	17:24	29 09:32 (Hild 4)	18:14	31 08:49 (Hild 2)	20:06	20:55	21:37	21:43	21:06	20:03	18:55
13	08:30	07:56	09:03 (Hild 4)	07:00	30 08:18 (Hild 1)	06:51	05:50	05:13	05:19	05:59	06:47	07:35
14	16:35	17:25	29 09:32 (Hild 4)	18:16	30 08:48 (Hild 2)	20:08	20:57	21:38	21:43	21:05	20:01	18:53
15	08:29	07:54	09:04 (Hild 4)	06:58	29 08:18 (Hild 1)	06:48	05:48	05:12	05:20	06:00	06:49	07:37
16	16:37	17:28	28 09:32 (Hild 4)	18:18	30 08:48 (Hild 2)	20:09	20:59	21:39	21:42	21:03	20:00	18:51
17	08:29	07:52	09:05 (Hild 4)	06:56	28 08:18 (Hild 1)	06:46	05:46	05:12	05:20	06:02	06:50	07:38
18	16:38	17:30	27 09:32 (Hild 4)	18:19	28 08:46 (Hild 2)	20:11	21:00	21:39	21:42	21:01	20:00	18:48
19	08:28	07:50	09:05 (Hild 4)	06:54	27 08:19 (Hild 1)	06:44	05:45	05:11	05:21	06:03	06:52	07:40
20	16:39	17:31	26 09:31 (Hild 4)	18:21	26 08:45 (Hild 2)	20:13	21:02	21:40	21:41	20:59	19:54	18:46
21	08:28	07:49	09:06 (Hild 4)	06:51	25 08:20 (Hild 1)	06:42	05:43	05:11	05:22	06:05	06:53	07:42
22	16:41	17:33	24 09:30 (Hild 4)	18:23	24 08:44 (Hild 2)	20:14	21:03	21:41	21:40	20:57	19:52	18:44
23	08:27	07:47	09:07 (Hild 4)	06:49	23 08:21 (Hild 1)	06:40	05:41	05:11	05:23	06:06	06:55	07:43
24	16:42	17:35	22 09:29 (Hild 4)	18:24	22 08:43 (Hild 2)	20:16	21:05	21:42	21:39	20:56	19:50	18:42
25	08:26	07:45	09:08 (Hild 4)	06:47	21 08:22 (Hild 1)	06:37	05:40	05:10	05:25	06:08	06:57	07:45
26	16:44	17:37	20 09:28 (Hild 4)	18:26	18 08:40 (Hild 2)	20:18	21:06	21:42	21:39	20:54	19:47	18:40
27	08:26	07:43	09:09 (Hild 4)	06:45	17 08:25 (Hild 1)	06:35	05:38	05:10	05:26	06:09	06:58	07:47
28	16:45	17:39	19 09:26 (Hild 4)	18:28	16 08:36 (Hild 2)	20:19	21:08	21:43	21:38	20:52	19:45	18:37
29	08:25	07:41	09:12 (Hild 4)	06:42	15 08:33 (Hild 1)	06:37	05:37	05:10	05:27	06:11	07:00	07:48
30	16:47	17:40	11 09:23 (Hild 4)	18:29	14 08:33 (Hild 2)	20:21	21:09	21:43	21:37	20:50	19:43	18:35
31	08:24	07:39	09:13 (Hild 4)	06:40	13 08:31 (Hild 1)	06:35	05:35	05:10	05:28	06:12	07:01	07:50
32	16:48	17:42	10 09:21 (Hild 4)	18:31	12 08:31 (Hild 2)	20:23	21:11	21:44	21:36	20:48	19:40	18:33
33	08:23	07:38	09:14 (Hild 4)	06:38	11 08:30 (Hild 1)	06:34	05:34	05:10	05:29	06:14	07:03	07:52
34	16:50	17:44	09:15 (Hild 4)	18:33	10 08:30 (Hild 2)	20:24	21:12	21:44	21:35	20:46	19:38	18:31
35	08:22	07:36	09:16 (Hild 4)	06:36	9 08:29 (Hild 1)	06:33	05:33	05:10	05:30	06:16	07:04	07:53
36	16:51	17:46	09:17 (Hild 4)	18:35	8 08:28 (Hild 2)	20:25	21:13	21:45	21:34	20:44	19:36	18:29
37	08:21	07:34	09:18 (Hild 4)	06:33	7 08:27 (Hild 1)	06:32	05:32	05:10	05:32	06:17	07:06	07:55
38	16:53	17:48	09:19 (Hild 4)	18:36	6 08:26 (Hild 2)	20:26	21:15	21:45	21:33	20:42	19:34	18:27
39	08:20	07:32	09:20 (Hild 4)	06:31	5 08:25 (Hild 1)	06:31	05:31	05:10	05:33	06:19	07:08	07:57
40	16:54	17:49	09:21 (Hild 4)	18:38	4 08:24 (Hild 2)	20:27	21:17	21:45	21:31	20:40	19:31	18:25
41	08:19	07:30	09:22 (Hild 4)	06:29	3 08:23 (Hild 1)	06:30	05:30	05:10	05:34	06:20	07:09	07:58
42	16:56	17:51	14 09:24 (Hild 4)	18:40	2 08:22 (Hild 2)	20:31	21:18	21:46	21:30	20:38	19:29	18:23
43	08:18	07:28	09:25 (Hild 4)	06:27	1 08:21 (Hild 1)	06:29	05:29	05:10	05:35	06:22	07:11	08:00
44	16:58	17:53	15 09:25 (Hild 4)	18:41	0 08:20 (Hild 2)	20:32	21:19	21:46	21:29	20:36	19:27	18:21
45	08:17	07:26	09:26 (Hild 4)	06:24	31 08:19 (Hild 1)	06:28	05:28	05:10	05:37	06:23	07:12	08:02
46	16:59	17:55	23 09:26 (Hild 4)	18:43	30 08:18 (Hild 2)	20:34	21:21	21:46	21:28	20:34	19:24	18:19
47	08:16	07:24	09:27 (Hild 4)	06:22	29 08:17 (Hild 1)	06:27	05:27	05:10	05:38	06:25	07:14	08:04
48	17:01	17:57	5 09:18 (Hild 4)	18:45	28 08:16 (Hild 2)	20:36	21:22	21:46	21:26	20:31	19:22	18:17
49	08:15	07:21	09:19 (Hild 4)	06:20	27 08:15 (Hild 1)	06:25	05:25	05:10	05:39	06:27	07:16	08:05
50	17:03	17:58	11 09:21 (Hild 4)	18:46	26 08:14 (Hild 2)	20:37	21:23	21:46	21:25	20:29	19:20	18:15
51	08:13	07:19	09:22 (Hild 4)	06:18	25 08:13 (Hild 1)	06:24	05:24	05:11	05:41	06:28	07:17	08:07
52	17:05	17:59	16 09:24 (Hild 4)	18:48	24 08:12 (Hild 2)	20:38	21:24	21:46	21:24	20:27	19:18	18:13
53	08:12	07:17	09:25 (Hild 4)	06:15	23 08:11 (Hild 1)	06:23	05:23	05:10	05:42	06:30	07:19	08:09
54	17:06	17:59	19 09:25 (Hild 4)	18:50	22 08:10 (Hild 2)	20:39	21:25	21:46	21:22	20:25	19:15	18:11
55	08:11	07:15	09:26 (Hild 4)	06:13	21 08:09 (Hild 1)	06:22	05:22	05:10	05:44	06:31	07:20	08:11
56	17:08	17:59	21 09:27 (Hild 4)	18:51	20 08:08 (Hild 2)	20:40	21:27	21:46	21:21	20:23	19:13	18:08
57	08:10	07:14	09:28 (Hild 4)	06:11	19 08:07 (Hild 1)	06:21	05:21	05:10	05:45	06:33	07:22	08:13
58	17:10	17:59	23 09:29 (Hild 4)	18:53	18 08:06 (Hild 2)	20:41	21:28	21:46	21:19	20:21	19:11	18:06
59	08:09	07:13	09:30 (Hild 4)	06:10	17 08:05 (Hild 1)	06:20	05:20	05:10	05:47	06:35	07:24	08:15
60	17:12	17:59	24 09:30 (Hild 4)	18:55	16 08:04 (Hild 2)	20:42	21:29	21:46	21:18	20:19	19:08	18:03
61	08:07	07:11	09:31 (Hild 4)	06:09	15 08:03 (Hild 1)	06:19	05:19	05:10	05:48	06:36	07:25	08:16
62	17:13	17:59	25 09:31 (Hild 4)	18:56	14 08:02 (Hild 2)	20:43	21:31	21:46	21:16	20:16	19:03	18:00
63	Sonnenscheinstunden	267	279	367	415	482	495	499	452	380	333	269
64	astr.max.mögl.Beschattung	144	590	387	415	482	495	499	452	380	333	269
65	Red. Sonnenscheinwahrsch.	0,19	0,26	0,33	0,41	0,48	0,49	0,49	0,45	0,37	0,30	0,22
66	Reduktion Betriebsdauer	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
67	Reduktion Windrichtung	0,60	0,62	0,64	0,66	0,67	0,67	0,67	0,64	0,63	0,63	0,60
68	Gesamte Reduktion	0,11	0,16	0,21	0,26	0,31	0,32	0,32	0,29	0,25	0,21	0,16
69	Met. wahrsch. Beschattung	16	95	80	415	482	495	499	452	380	333	269

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H40 - Hildfeld, Zur Legge 1

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember																		
1	08:31 16:28	08:05 17:15	07:13 18:05	08:25 (Hild 4) 07:04 18:05	08:30 (Hild 2) 06:01 18:59 (Hild 2) 20:47	05:17 19:58	05:14 20:45	05:49 21:15	06:38 20:14	07:25 19:06	08:43 (Hild 1) 07:18 18:21 (Hild 1) 17:02	08:07 16:23																		
2	08:31 16:30	08:04 17:17	07:11 18:07	08:25 (Hild 4) 07:02 18:07	08:31 (Hild 2) 05:59 18:58 (Hild 2) 20:49	05:16 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:25 (Hild 1) 07:19 18:26 (Hild 1) 17:00	08:09 16:22																		
3	08:31 16:31	08:02 17:19	07:09 18:09	08:26 (Hild 4) 06:57 18:09	08:31 (Hild 2) 05:57 18:57 (Hild 2) 20:51	05:15 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:28 19:02	08:26 (Hild 1) 07:21 18:36 (Hild 1) 16:58	08:10 16:21																		
4	08:30 16:32	08:00 17:21	07:07 18:11	08:26 (Hild 4) 06:57 18:11	08:32 (Hild 2) 05:55 18:58 (Hild 2) 20:52	05:15 21:35	05:16 21:46	05:54 21:12	06:42 20:11	07:30 19:03	08:27 (Hild 1) 07:22 18:37 (Hild 1) 16:59	08:11 16:22																		
5	08:30 16:33	07:59 17:22	07:05 18:12	08:26 (Hild 4) 06:55 18:05	08:33 (Hild 2) 05:53 18:59 (Hild 2) 20:54	05:14 21:36	05:17 21:47	05:55 21:13	06:44 20:05	07:32 19:04	09:09 (Hild 4) 07:25 19:21 (Hild 4) 16:55	08:13 16:20																		
6	08:30 16:34	07:57 17:24	07:02 18:14	08:27 (Hild 4) 06:53 18:02	08:35 (Hild 2) 05:52 18:51 (Hild 2) 20:55	05:13 21:37	05:18 21:43	05:57 21:06	06:46 20:03	07:33 19:06	09:06 (Hild 4) 07:26 19:23 (Hild 4) 16:53	08:14 16:20																		
7	08:30 16:35	07:56 17:25	07:00 18:16	08:29 (Hild 4) 06:51 18:08	08:38 (Hild 2) 05:50 19:01 (Hild 2) 20:57	05:13 21:38	05:19 21:43	05:59 21:05	06:47 20:04	07:35 19:08	09:04 (Hild 4) 07:28 19:25 (Hild 4) 16:54	08:15 16:19																		
8	08:29 16:37	07:54 17:28	06:58 18:18	08:31 (Hild 4) 06:48 18:15	08:40 (Hild 2) 05:48 19:02 (Hild 2) 20:59	05:12 21:39	05:20 21:42	06:00 21:03	06:49 19:59	07:37 19:10	09:03 (Hild 4) 07:30 19:26 (Hild 4) 16:50	08:16 16:19																		
9	08:29 16:38	07:52 17:30	06:56 18:19	08:34 (Hild 4) 06:46 18:17	08:41 (Hild 2) 05:46 19:03 (Hild 2) 21:00	05:12 21:39	05:20 21:42	06:02 21:01	06:50 19:56	07:38 19:12	09:01 (Hild 4) 07:31 19:27 (Hild 4) 16:48	08:17 16:19																		
10	08:28 16:39	07:50 17:31	06:54 18:21	08:40 (Hild 4) 06:44 18:19	08:42 (Hild 2) 05:45 19:04 (Hild 2) 21:01	05:12 21:40	05:21 21:43	06:03 21:02	06:51 19:54	07:39 19:13	09:00 (Hild 4) 07:32 19:28 (Hild 4) 16:46	08:18 16:19																		
11	08:28 16:41	07:49 17:33	06:51 18:23	08:41 (Hild 4) 06:42 18:23	08:43 (Hild 2) 05:43 19:05 (Hild 2) 21:03	05:11 21:41	05:22 21:40	06:05 21:02	06:53 19:52	07:42 19:14	08:59 (Hild 4) 07:35 19:29 (Hild 4) 16:45	08:20 16:19																		
12	08:27 16:42	07:45 17:35	06:49 18:24	08:44 (Hild 4) 06:40 18:24	08:44 (Hild 2) 05:42 19:06 (Hild 2) 21:04	05:11 21:42	05:24 21:39	06:06 21:05	06:55 19:55	07:43 19:15	08:58 (Hild 4) 07:37 19:30 (Hild 4) 16:43	08:21 16:18																		
13	08:26 16:44	07:47 17:37	06:47 18:26	08:45 (Hild 4) 06:37 18:26	08:45 (Hild 2) 05:40 19:07 (Hild 2) 21:06	05:10 21:42	05:25 21:39	06:07 21:04	06:57 19:54	07:45 19:16	08:58 (Hild 4) 07:38 19:31 (Hild 4) 16:42	08:22 16:18																		
14	08:26 16:45	07:43 17:39	06:45 18:28	08:46 (Hild 4) 06:35 18:28	08:46 (Hild 2) 05:38 19:08 (Hild 2) 21:07	05:10 21:43	05:26 21:38	06:09 21:05	06:58 19:55	07:47 19:17	08:58 (Hild 4) 07:40 19:32 (Hild 4) 16:40	08:23 16:18																		
15	08:25 16:47	07:41 17:40	06:42 18:29	08:47 (Hild 4) 06:33 18:29	08:47 (Hild 2) 05:37 19:09 (Hild 2) 21:08	05:10 21:43	05:27 21:37	06:11 21:06	07:00 19:53	07:48 19:18	08:58 (Hild 4) 07:42 19:33 (Hild 4) 16:39	08:24 16:19																		
16	08:24 16:48	07:39 17:42	06:40 18:31	08:48 (Hild 4) 06:31 18:31	08:48 (Hild 2) 05:35 19:10 (Hild 2) 21:11	05:10 21:44	05:28 21:36	06:13 21:07	07:01 19:54	07:50 19:19	08:57 (Hild 4) 07:44 19:34 (Hild 4) 16:38	08:25 16:19																		
17	08:23 16:50	07:38 17:44	06:38 18:33	08:49 (Hild 4) 06:29 18:33	08:49 (Hild 2) 05:34 19:11 (Hild 2) 21:12	05:10 21:44	05:29 21:35	06:14 21:08	07:03 19:56	07:52 19:20	08:58 (Hild 4) 07:45 19:35 (Hild 4) 16:36	08:26 16:19																		
18	08:22 16:51	07:46 17:46	06:36 18:35	08:50 (Hild 4) 06:27 18:35	08:50 (Hild 2) 05:33 19:12 (Hild 2) 21:13	05:10 21:45	05:30 21:34	06:15 21:09	07:04 19:57	07:53 19:21	08:59 (Hild 4) 07:46 19:36 (Hild 4) 16:35	08:27 16:19																		
19	08:21 16:53	07:44 17:48	06:34 18:36	08:51 (Hild 4) 06:25 18:36	08:51 (Hild 2) 05:32 19:13 (Hild 2) 21:14	05:10 21:45	05:31 21:35	06:16 21:10	07:06 19:58	07:55 19:22	08:59 (Hild 4) 07:49 19:37 (Hild 4) 16:34	08:28 16:19																		
20	08:20 16:54	07:42 17:49	06:32 18:38	08:52 (Hild 4) 06:23 18:38	08:52 (Hild 2) 05:30 19:14 (Hild 2) 21:15	05:10 21:46	05:33 21:34	06:17 21:11	07:08 19:59	07:57 19:23	09:00 (Hild 4) 07:50 19:38 (Hild 4) 16:33	08:29 16:20																		
21	08:19 16:56	07:40 17:51	06:29 18:40	08:53 (Hild 4) 06:21 18:39	08:53 (Hild 2) 05:28 19:15 (Hild 2) 21:16	05:10 21:46	05:34 21:35	06:18 21:12	07:09 19:58	07:58 19:24	09:01 (Hild 4) 07:52 19:39 (Hild 4) 16:32	08:30 16:20																		
22	08:18 16:58	07:28 17:53	06:27 18:41	08:54 (Hild 4) 06:19 18:41	08:54 (Hild 2) 05:27 19:16 (Hild 2) 21:17	05:10 21:46	05:35 21:36	06:19 21:13	07:08 19:58	07:57 19:25	09:02 (Hild 4) 07:53 19:40 (Hild 4) 16:31	08:31 16:21																		
23	08:17 16:59	07:26 17:55	06:24 18:43	08:55 (Hild 4) 06:17 18:43	08:55 (Hild 2) 05:26 19:17 (Hild 2) 21:18	05:10 21:46	05:36 21:37	06:24 21:14	07:12 19:59	08:02 19:26	09:03 (Hild 4) 07:55 19:41 (Hild 4) 16:30	08:32 16:21																		
24	08:16 17:01	07:24 17:57	06:22 18:45	08:56 (Hild 4) 06:15 18:45	08:56 (Hild 2) 05:25 19:18 (Hild 2) 21:19	05:10 21:46	05:37 21:38	06:25 21:15	07:14 19:59	08:04 19:27	09:04 (Hild 4) 07:56 19:42 (Hild 4) 16:29	08:33 16:22																		
25	08:15 17:03	07:21 17:58	06:20 18:46	08:57 (Hild 4) 06:13 18:46	08:57 (Hild 2) 05:24 19:19 (Hild 2) 21:20	05:10 21:46	05:38 21:39	06:26 21:16	07:16 19:59	08:05 19:28	09:05 (Hild 4) 07:57 19:43 (Hild 4) 16:28	08:34 16:23																		
26	08:13 17:05	07:19 18:00	06:18 18:48	08:58 (Hild 4) 06:11 18:48	08:58 (Hild 2) 05:23 19:20 (Hild 2) 21:21	05:11 21:46	05:39 21:40	06:27 21:17	07:17 19:59	08:06 19:29	09:06 (Hild 4) 07:58 19:44 (Hild 4) 16:27	08:35 16:24																		
27	08:12 17:06	07:17 18:02	06:15 18:50	08:59 (Hild 4) 06:09 18:50	08:59 (Hild 2) 05:22 19:21 (Hild 2) 21:22	05:12 21:46	05:40 21:41	06:28 21:18	07:19 19:59	08:07 19:30	09:07 (Hild 4) 07:59 19:45 (Hild 4) 16:26	08:36 16:24																		
28	08:11 17:08	07:15 18:04	06:13 18:51	09:00 (Hild 4) 06:07 18:52	09:00 (Hild 2) 05:21 19:22 (Hild 2) 21:23	05:12 21:46	05:41 21:42	06:29 21:19	07:20 19:59	08:08 19:31	09:08 (Hild 4) 08:00 19:46 (Hild 4) 16:25	08:37 16:25																		
29	08:09 17:10	07:13 18:06	06:11 18:53	09:01 (Hild 4) 06:05 18:53	09:01 (Hild 2) 05:20 19:23 (Hild 2) 21:24	05:13 21:46	05:42 21:43	06:30 21:20	07:21 19:59	08:09 19:32	09:09 (Hild 4) 08:01 19:47 (Hild 4) 16:24	08:38 16:26																		
30	08:08 17:12	07:11 18:07	06:10 18:54	09:02 (Hild 4) 06:03 18:54	09:02 (Hild 2) 05:19 19:24 (Hild 2) 21:25	05:13 21:46	05:43 21:44	06:31 21:21	07:22 19:59	08:10 19:33	09:10 (Hild 4) 08:02 19:48 (Hild 4) 16:23	08:39 16:27																		
31	08:07 17:13	07:10 18:08	06:09 18:55	09:03 (Hild 4) 06:01 18:55	09:03 (Hild 2) 05:18 19:25 (Hild 2) 21:26	05:14 21:46	05:44 21:45	06:32 21:22	07:23 19:59	08:11 19:34	09:11 (Hild 4) 08:03 19:49 (Hild 4) 16:22	08:40 16:28																		
Sonneneinstrahlung												262	279	256	367	738	151	482	495	499	452	380	652	333	501	269	247			
astr. max. mögl. Beschattung												0,26	0,29	0,33	0,38	0,43	0,48	0,53	0,58	0,63	0,68	0,73	0,78	0,83	0,88	0,93	0,98	1,03		
Red. Sonneneinstrahlung												0,98	0,96	0,94	0,92	0,90	0,88	0,86	0,84	0,82	0,80	0,78	0,76	0,74	0,72	0,70	0,68	0,66		
Reduktion Betriebsdauer												0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	
Gesamte Reduktion												0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17
Met. wärsch. Beschattung												42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H41 - Hildfeld, Zur Legge 3

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	08:26 (Hild 4)	07:04	08:29 (Hild 2)	06:01	05:17	05:14	05:49	06:38	07:25
2	16:29	17:15	18:05	30	08:56 (Hild 4)	07:02	31	09:00 (Hild 2)	05:59	05:16	05:51	06:39
3	08:31	08:04	08:46 (Hild 3)	07:11	08:26 (Hild 4)	07:02	08:30 (Hild 2)	05:59	05:16	05:15	05:51	06:39
4	16:30	17:17	3	08:09	30	08:56 (Hild 4)	20:00	30	09:00 (Hild 2)	20:49	21:33	21:15
5	08:31	08:02	08:42 (Hild 3)	07:07	08:26 (Hild 4)	07:00	08:30 (Hild 2)	05:57	05:15	05:15	05:52	06:41
6	16:31	17:19	11	08:09	29	08:59 (Hild 4)	20:03	29	08:59 (Hild 2)	20:55	21:40	21:15
7	08:30	08:00	08:41 (Hild 3)	07:07	08:27 (Hild 4)	06:57	08:31 (Hild 2)	05:55	05:15	05:16	05:54	06:42
8	16:32	17:21	15	08:56 (Hild 4)	20:03	27	08:55 (Hild 4)	20:52	21:35	21:44	21:10	20:08
9	08:30	07:59	08:39 (Hild 3)	07:05	08:26 (Hild 4)	06:55	08:31 (Hild 2)	05:53	05:14	05:17	05:55	06:44
10	16:33	17:22	18	08:57 (Hild 4)	20:12	27	08:53 (Hild 4)	20:54	25	08:52 (Hild 2)	20:56	20:05
11	08:30	07:57	08:39 (Hild 3)	07:02	08:27 (Hild 4)	06:53	08:35 (Hild 2)	05:52	05:13	05:18	05:57	06:46
12	16:34	17:24	20	08:58 (Hild 4)	20:14	25	08:52 (Hild 4)	20:06	22	08:54 (Hild 2)	20:55	21:37
13	08:30	07:56	08:37 (Hild 3)	07:00	08:29 (Hild 4)	06:51	08:34 (Hild 2)	05:50	05:13	05:19	05:59	06:47
14	16:35	17:26	21	08:58 (Hild 4)	20:16	28	08:52 (Hild 4)	20:57	23	08:52 (Hild 2)	21:05	20:01
15	08:29	07:55	08:38 (Hild 3)	06:58	08:30 (Hild 4)	06:50	08:36 (Hild 2)	05:49	05:14	05:21	06:00	06:50
16	16:37	17:28	22	09:00 (Hild 3)	18:18	19	08:49 (Hild 4)	20:09	21	08:49 (Hild 2)	21:03	19:59
17	08:29	07:52	08:37 (Hild 3)	06:56	08:32 (Hild 4)	06:46	08:36 (Hild 2)	05:46	05:12	05:20	06:02	06:50
18	16:38	17:30	23	09:00 (Hild 3)	18:19	13	08:45 (Hild 4)	20:11	25	08:45 (Hild 2)	21:01	19:56
19	08:28	07:50	08:37 (Hild 3)	06:54	08:33 (Hild 4)	06:44	08:37 (Hild 2)	05:44	05:11	05:21	06:03	06:52
20	16:39	17:31	23	09:00 (Hild 3)	18:21	24	08:46 (Hild 4)	20:13	21	08:46 (Hild 2)	21:01	19:54
21	08:28	07:49	08:36 (Hild 3)	06:51	08:34 (Hild 4)	06:42	08:38 (Hild 2)	05:43	05:11	05:22	06:05	06:53
22	16:41	17:33	24	09:00 (Hild 3)	18:23	11	07:59 (Hild 4)	20:14	21	08:01 (Hild 2)	21:04	19:57
23	08:27	07:47	08:36 (Hild 3)	06:49	08:35 (Hild 4)	06:40	08:39 (Hild 2)	05:43	05:12	05:23	06:06	06:55
24	16:42	17:35	24	09:00 (Hild 3)	18:24	15	08:01 (Hild 4)	20:16	21	08:01 (Hild 2)	21:05	19:50
25	08:26	07:45	08:37 (Hild 3)	06:47	08:36 (Hild 4)	06:37	08:40 (Hild 2)	05:40	05:10	05:25	06:08	06:57
26	16:44	17:37	23	09:00 (Hild 3)	18:26	19	08:02 (Hild 4)	20:18	21	08:02 (Hild 2)	21:06	19:52
27	08:26	07:44	08:37 (Hild 3)	06:45	08:37 (Hild 4)	06:35	08:42 (Hild 2)	05:38	05:10	05:26	06:09	06:58
28	16:45	17:39	22	08:59 (Hild 3)	18:28	21	08:03 (Hild 4)	20:19	21	08:03 (Hild 2)	21:08	19:53
29	08:25	07:41	08:37 (Hild 3)	06:42	08:38 (Hild 4)	06:33	08:43 (Hild 2)	05:37	05:10	05:27	06:11	07:00
30	16:47	17:40	22	08:59 (Hild 3)	18:29	23	08:04 (Hild 4)	20:21	21	08:04 (Hild 2)	21:09	19:54
31	08:24	07:39	08:38 (Hild 3)	06:40	08:39 (Hild 4)	06:34	08:44 (Hild 2)	05:36	05:09	05:28	06:12	07:01
1	16:48	17:42	20	08:58 (Hild 3)	18:31	23	08:04 (Hild 4)	20:23	21	08:04 (Hild 2)	21:11	19:54
2	08:23	07:38	08:39 (Hild 3)	06:38	08:40 (Hild 4)	06:29	08:45 (Hild 2)	05:35	05:08	05:29	06:14	07:03
3	16:50	17:44	18	08:57 (Hild 3)	18:33	25	08:04 (Hild 4)	20:24	21	08:04 (Hild 2)	21:12	19:54
4	08:22	07:36	08:40 (Hild 3)	06:38	08:41 (Hild 4)	06:27	08:46 (Hild 2)	05:34	05:07	05:29	06:15	07:04
5	16:51	17:46	14	08:55 (Hild 3)	18:35	25	08:04 (Hild 4)	20:26	21	08:04 (Hild 2)	21:14	19:55
6	08:21	07:34	08:36 (Hild 3)	06:34	08:42 (Hild 4)	06:25	08:47 (Hild 2)	05:33	05:06	05:29	06:16	07:05
7	16:53	17:48	16	08:52 (Hild 3)	18:36	24	08:03 (Hild 4)	20:28	21	08:03 (Hild 2)	21:15	19:55
8	08:20	07:32	08:37 (Hild 3)	06:33	08:43 (Hild 4)	06:24	08:48 (Hild 2)	05:32	05:05	05:29	06:17	07:06
9	16:54	17:49	18	08:51 (Hild 3)	18:38	23	08:02 (Hild 4)	20:29	21	08:02 (Hild 2)	21:17	19:55
10	08:19	07:30	08:31 (Hild 3)	06:29	08:44 (Hild 4)	06:20	08:49 (Hild 2)	05:31	05:04	05:29	06:18	07:07
11	16:56	17:51	22	08:53 (Hild 3)	18:40	22	08:01 (Hild 4)	20:31	21	08:01 (Hild 2)	21:18	19:56
12	08:18	07:28	08:32 (Hild 3)	06:27	08:45 (Hild 4)	06:18	08:50 (Hild 2)	05:30	05:03	05:29	06:19	07:08
13	16:58	17:53	24	08:54 (Hild 3)	18:41	23	08:01 (Hild 4)	20:33	21	08:01 (Hild 2)	21:19	19:56
14	08:17	07:26	08:29 (Hild 3)	06:24	08:46 (Hild 4)	06:16	08:51 (Hild 2)	05:29	05:02	05:29	06:20	07:09
15	16:59	17:55	26	08:55 (Hild 3)	18:43	25	08:01 (Hild 4)	20:34	21	08:01 (Hild 2)	21:21	19:56
16	08:16	07:24	08:28 (Hild 3)	06:22	08:47 (Hild 4)	06:14	08:52 (Hild 2)	05:28	05:01	05:29	06:21	07:10
17	17:01	17:57	28	08:56 (Hild 3)	18:45	24	08:02 (Hild 4)	20:36	21	08:02 (Hild 2)	21:23	19:57
18	08:15	07:21	08:28 (Hild 3)	06:20	08:48 (Hild 4)	06:12	08:53 (Hild 2)	05:27	05:00	05:29	06:22	07:11
19	17:03	17:58	28	08:56 (Hild 4)	18:46	29	08:02 (Hild 4)	20:37	21	08:02 (Hild 2)	21:23	19:57
20	08:13	07:19	08:27 (Hild 4)	06:18	08:49 (Hild 4)	06:10	08:54 (Hild 2)	05:26	05:03	05:29	06:23	07:12
21	17:05	18:00	30	08:57 (Hild 4)	18:49	31	08:03 (Hild 4)	20:40	21	08:03 (Hild 2)	21:24	19:58
22	08:12	07:17	08:27 (Hild 4)	06:15	08:50 (Hild 4)	06:08	08:55 (Hild 2)	05:25	05:02	05:29	06:24	07:13
23	17:06	18:02	30	08:57 (Hild 4)	18:50	31	08:03 (Hild 4)	20:41	21	08:03 (Hild 2)	21:26	19:58
24	08:11	07:15	08:26 (Hild 4)	06:13	08:51 (Hild 4)	06:06	08:56 (Hild 2)	05:24	05:01	05:29	06:25	07:14
25	17:08	18:04	30	08:56 (Hild 4)	18:51	32	08:02 (Hild 4)	20:42	21	08:02 (Hild 2)	21:27	19:59
26	08:09			07:11	08:30 (Hild 4)	06:04	08:57 (Hild 2)	05:19	05:03	05:29	06:26	07:15
27	17:10			19:53	32	09:02 (Hild 4)	20:44	21	08:58 (Hild 2)	21:28	19:59	19:11
28	08:08			07:09	08:30 (Hild 4)	06:03	08:58 (Hild 2)	05:19	05:03	05:29	06:27	07:16
29	17:12			19:55	32	09:02 (Hild 4)	20:46	21	08:59 (Hild 2)	21:29	19:59	19:12
30	08:07			07:06	32	08:29 (Hild 4)	20:47	21	08:58 (Hild 2)	21:30	19:59	19:13
31	17:13			19:56	32	09:01 (Hild 4)	20:48	21	08:59 (Hild 2)	21:31	19:59	19:14
Sonnenscheinstunden	262	279		367	747	415	482	495	499	452	380	697
astr. max. mögl. Bestrahlung												
Red. Sonnenscheinwärsch.		0,26		0,33	0,98		0,41			0,37		0,30
Reduktion Betriebsdauer		0,98		0,98	0,98		0,98			0,98		0,98
Reduktion Windrichtung		0,63		0,64	0,65		0,65			0,64		0,63
Geäte Reduktion		0,16		0,21	0,21		0,21			0,21		0,19
Mit. wärsch. Beschattung		0,94		0,55	0,50		0,50			0,50		0,63
										128		188

Projekt: 24-1-3219-001	Beschreibung: Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW	Lizenzierter Anwender: Ramboll Deutschland GmbH Elisabeth-Consbruch-Straße 3 DE-34131 Kassel - H. Ristow / hri@ramboll.com Berechnet: 21.03.2025 11:20/4.1.273	
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Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H43 - Hildfeld, Zur Legge 6

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	07:13	08:23 (Hild 4)	07:04	08:26 (Hild 2)	06:01	05:17	05:14	05:49	06:38	07:25
2	16:26	17:15	18:05	08:53 (Hild 4)	19:58	08:58 (Hild 2)	20:47	21:32	21:45	21:15	20:14	19:06
3	08:31	08:04	07:11	08:23 (Hild 4)	07:02	08:26 (Hild 2)	05:59	05:16	05:15	05:51	06:39	07:27
4	16:30	17:17	18:07	08:53 (Hild 4)	20:00	08:58 (Hild 2)	20:49	21:33	21:45	21:13	20:12	19:04
5	08:31	08:02	07:09	08:23 (Hild 4)	07:00	08:27 (Hild 2)	05:57	05:15	05:15	05:52	06:41	07:28
6	16:31	17:18	18:09	08:53 (Hild 4)	20:01	08:57 (Hild 2)	20:51	21:34	21:45	21:11	20:10	19:02
7	08:30	08:00	07:07	08:23 (Hild 4)	06:57	08:27 (Hild 2)	05:55	05:15	05:16	05:54	06:42	07:30
8	16:32	17:21	18:11	08:53 (Hild 4)	20:03	08:56 (Hild 2)	20:52	21:35	21:44	21:10	20:08	18:59
9	08:30	07:59	07:05	08:23 (Hild 4)	06:55	08:27 (Hild 2)	05:53	05:14	05:17	05:55	06:44	07:32
10	16:33	17:22	18:12	08:53 (Hild 4)	20:04	08:54 (Hild 2)	20:54	21:36	21:44	21:08	20:05	18:57
11	08:29	07:54	06:58	08:26 (Hild 4)	06:48	08:30 (Hild 2)	05:48	05:12	05:20	06:00	06:49	07:37
12	16:34	17:24	18:14	08:54 (Hild 4)	20:06	08:53 (Hild 2)	20:55	21:37	21:43	21:06	20:03	18:55
13	08:30	07:56	07:00	08:24 (Hild 4)	06:51	08:29 (Hild 2)	05:50	05:13	05:19	05:59	06:47	07:35
14	16:35	17:26	18:16	08:55 (Hild 4)	20:08	08:51 (Hild 2)	20:57	21:38	21:43	21:05	20:01	18:53
15	08:29	07:54	06:58	08:26 (Hild 4)	06:48	08:30 (Hild 2)	05:48	05:12	05:20	06:00	06:49	07:37
16	16:37	17:28	18:18	08:57 (Hild 4)	20:09	08:49 (Hild 2)	20:59	21:39	21:42	21:03	19:59	18:50
17	08:29	07:52	06:56	08:26 (Hild 4)	06:46	08:33 (Hild 2)	05:46	05:12	05:20	06:02	06:50	07:38
18	16:38	17:30	18:19	08:57 (Hild 4)	20:11	08:47 (Hild 2)	21:00	21:39	21:42	21:01	19:56	18:48
19	08:28	07:50	06:54	08:29 (Hild 4)	06:44	08:36 (Hild 2)	05:45	05:11	05:21	06:03	06:52	07:40
20	16:39	17:31	18:21	08:58 (Hild 4)	20:13	08:41 (Hild 2)	21:02	21:40	21:41	20:59	19:54	18:46
21	08:28	07:49	06:51	08:33 (Hild 4)	06:42	08:33 (Hild 2)	05:43	05:11	05:22	06:05	06:53	07:42
22	16:41	17:33	18:23	08:58 (Hild 4)	20:14	08:38 (Hild 2)	20:14	21:03	21:41	21:40	19:52	18:44
23	08:27	07:47	06:49	08:34 (Hild 4)	06:40	07:46 (Hild 1)	06:40	05:42	05:11	06:24	06:06	06:55
24	16:42	17:35	18:24	08:59 (Hild 4)	20:16	07:57 (Hild 1)	06:42	21:05	21:42	21:39	19:50	18:42
25	08:26	07:45	06:47	08:34 (Hild 4)	06:47	07:43 (Hild 1)	06:37	05:40	05:10	06:25	06:08	06:57
26	16:44	17:37	18:26	08:58 (Hild 4)	20:18	07:58 (Hild 1)	06:38	21:06	21:42	21:39	19:47	18:40
27	08:26	07:43	06:45	08:34 (Hild 4)	06:45	07:41 (Hild 1)	06:35	05:38	05:10	06:26	06:09	06:58
28	16:45	17:39	18:28	08:58 (Hild 4)	20:19	08:00 (Hild 1)	06:39	21:08	21:43	21:38	19:52	18:45
29	08:25	07:41	06:42	08:35 (Hild 4)	06:42	07:40 (Hild 1)	06:33	05:37	05:10	06:27	06:11	07:00
30	16:47	17:40	18:29	08:57 (Hild 4)	20:21	08:01 (Hild 1)	06:31	21:09	21:43	21:37	19:43	18:35
31	08:24	07:39	06:40	08:35 (Hild 4)	06:40	07:39 (Hild 1)	06:31	05:35	05:10	06:28	06:13	07:01
32	16:48	17:42	18:31	08:57 (Hild 4)	20:23	08:02 (Hild 1)	06:33	21:11	21:44	21:36	19:40	18:33
33	08:23	07:38	06:38	08:36 (Hild 4)	06:38	07:38 (Hild 1)	06:29	05:34	05:10	06:29	06:14	07:03
34	16:50	17:44	18:33	08:56 (Hild 4)	20:24	08:01 (Hild 1)	06:31	21:12	21:44	21:35	19:38	18:31
35	08:22	07:36	06:36	08:37 (Hild 4)	06:36	07:37 (Hild 1)	06:27	05:33	05:10	06:30	06:16	07:04
36	16:51	17:46	18:35	08:55 (Hild 4)	20:25	08:01 (Hild 1)	06:26	21:14	21:45	21:34	19:36	18:29
37	08:21	07:34	06:33	08:39 (Hild 4)	06:33	07:37 (Hild 1)	06:25	05:31	05:10	06:32	06:17	07:06
38	16:53	17:48	18:36	08:53 (Hild 4)	20:26	08:02 (Hild 1)	06:28	21:15	21:45	21:33	19:32	18:27
39	08:20	07:32	06:31	08:34 (Hild 4)	06:31	07:36 (Hild 1)	06:23	05:30	05:10	06:33	06:19	07:08
40	16:54	17:49	18:38	08:50 (Hild 4)	20:29	08:00 (Hild 1)	06:29	21:17	21:45	21:31	19:31	18:25
41	08:19	07:30	06:29	08:31 (Hild 4)	06:29	07:37 (Hild 1)	06:20	05:28	05:10	06:34	06:20	07:09
42	16:56	17:51	18:40	08:47 (Hild 4)	20:31	08:00 (Hild 1)	06:31	21:18	21:46	21:30	19:29	18:23
43	08:18	07:28	06:27	08:29 (Hild 4)	06:27	07:37 (Hild 1)	06:18	05:27	05:10	06:35	06:22	07:11
44	16:58	17:53	18:41	08:49 (Hild 4)	20:33	07:59 (Hild 1)	06:20	21:19	21:46	21:29	19:27	18:21
45	08:17	07:26	06:24	08:28 (Hild 4)	06:24	07:35 (Hild 1)	06:16	05:26	05:10	06:37	06:24	07:12
46	16:59	17:55	18:43	08:51 (Hild 4)	20:34	07:58 (Hild 1)	06:24	21:21	21:46	21:28	19:24	18:19
47	08:16	07:24	06:22	08:27 (Hild 4)	06:22	07:33 (Hild 1)	06:14	05:25	05:11	06:38	06:25	07:14
48	17:01	17:57	18:45	08:52 (Hild 4)	20:36	07:57 (Hild 1)	06:26	21:22	21:46	21:26	19:21	18:17
49	08:15	07:21	06:20	08:26 (Hild 4)	06:20	07:32 (Hild 1)	06:12	05:24	05:11	06:39	06:27	07:16
50	17:03	17:58	18:46	08:53 (Hild 4)	20:37	07:58 (Hild 1)	06:27	21:23	21:46	21:25	19:20	18:15
51	08:13	07:19	06:18	08:25 (Hild 4)	06:18	07:31 (Hild 1)	06:10	05:23	05:11	06:41	06:28	07:17
52	17:05	18:00	18:48	08:53 (Hild 4)	20:39	07:59 (Hild 1)	06:28	21:25	21:46	21:24	19:18	18:13
53	08:12	07:17	06:15	08:24 (Hild 4)	06:15	07:30 (Hild 1)	06:08	05:21	05:12	06:42	06:30	07:19
54	17:06	18:02	18:50	08:54 (Hild 4)	20:41	08:00 (Hild 1)	06:29	21:26	21:46	21:22	19:15	18:11
55	08:11	07:15	06:13	08:23 (Hild 4)	06:13	07:28 (Hild 1)	06:06	05:20	05:12	06:44	06:31	07:20
56	17:08	18:04	18:51	08:53 (Hild 4)	20:42	07:59 (Hild 1)	06:29	21:27	21:46	21:21	19:13	18:09
57	08:10	07:11	06:09	08:28 (Hild 4)	06:09	07:29 (Hild 1)	06:05	05:19	05:13	06:45	06:33	07:22
58	17:10	18:06	18:53	08:55 (Hild 4)	20:44	08:01 (Hild 1)	06:30	21:28	21:46	21:19	19:11	18:07
59	08:08	07:09	06:07	08:27 (Hild 4)	06:07	07:28 (Hild 1)	06:03	05:19	05:13	06:47	06:35	07:24
60	17:12	18:08	18:55	08:56 (Hild 4)	20:46	08:02 (Hild 1)	06:31	21:29	21:46	21:18	19:08	18:04
61	08:07	07:06	06:05	08:26 (Hild 4)	06:05	07:27 (Hild 1)	06:01	05:18	05:12	06:48	06:36	07:25
62	17:13	18:09	18:56	08:57 (Hild 4)	20:47	08:03 (Hild 1)	06:32	21:31	21:46	21:16	19:06	18:02
63	Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269
64	astr.max.mögl.Beschattung		533	746	235					713	697	121
65	Red. Sonnenscheinwahrsch.		0,26	0,33	0,41					0,37	0,30	0,19
66	Reduktion Betriebsdauer		0,96	0,96	0,98					0,98	0,98	0,98
67	Reduktion Windrichtung		0,63	0,64	0,65					0,65	0,64	0,63
68	Gesamte Reduktion		0,16	0,21	0,26					0,23	0,19	0,12
69	Met.wahrsch.Beschattung		88	155	61					167	129	14

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

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H44 - Hildfeld, Zur Legge 8

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember				
1	08:31 08:05		07:13	08:23 (Hild 4) 07:04	08:25 (Hild 2) 06:01	05:17	05:14	05:49	06:38	08:33 (Hild 2) 07:25	08:25 (Hild 1) 07:18	08:05 (Hild 3) 08:07				
2	16:26 17:15		18:05	30	08:53 (Hild 4) 19:58	30	08:58 (Hild 2) 20:47	21:32	21:44	7	08:40 (Hild 2) 19:06	9	08:34 (Hild 1) 17:02			
3	08:31 08:04		07:11	08:23 (Hild 4) 07:02	08:25 (Hild 2) 05:59	05:16	05:15	05:51	06:39	08:29 (Hild 2) 07:27	09:10 (Hild 4) 07:19	08:05 (Hild 3) 08:09				
4	16:30 17:17		18:07	30	08:53 (Hild 4) 20:00	32	08:57 (Hild 2) 20:49	21:33	21:45	21:13	20:12	15	08:44 (Hild 2) 19:04			
5	08:31 08:02		07:09	08:23 (Hild 4) 07:00	08:25 (Hild 2) 05:57	05:15	05:15	05:52	06:41	08:26 (Hild 2) 07:28	09:05 (Hild 4) 07:21	08:06 (Hild 3) 08:10				
6	16:31 17:19		18:09	30	08:53 (Hild 4) 20:01	32	08:57 (Hild 2) 20:51	21:34	21:45	21:10	20:10	16	08:46 (Hild 2) 19:02			
7	08:30 08:00		07:07	08:23 (Hild 4) 06:57	08:26 (Hild 2) 05:55	05:15	05:16	05:54	06:42	20	08:25 (Hild 2) 07:30	09:03 (Hild 4) 07:23				
8	16:32 17:21	6	08:49 (Hild 3) 18:11	30	08:53 (Hild 4) 20:03	30	08:56 (Hild 2) 20:52	21:35	21:44	21:10	20:08	23	08:48 (Hild 2) 18:59			
9	08:30 07:59		08:40 (Hild 3) 07:05	29	08:22 (Hild 4) 06:55	29	08:25 (Hild 2) 05:53	05:14	05:17	05:55	06:44	08:23 (Hild 2) 07:32				
10	16:33 17:22	12	08:52 (Hild 3) 18:12	29	08:51 (Hild 4) 20:04	29	08:54 (Hild 2) 20:54	21:36	21:44	21:08	20:05	25	08:48 (Hild 2) 18:57			
11	08:30 07:57		07:02	08:23 (Hild 4) 06:53	08:26 (Hild 2) 05:52	05:13	05:18	05:57	06:46	08:22 (Hild 2) 07:33	09:04 (Hild 4) 07:24	08:09 (Hild 3) 08:14				
12	16:34 17:24	15	08:53 (Hild 3) 18:14	28	08:51 (Hild 4) 20:06	27	08:53 (Hild 2) 20:55	21:37	21:43	21:06	20:03	27	08:49 (Hild 2) 18:55			
13	08:30 07:56		08:36 (Hild 3) 07:00	27	08:23 (Hild 4) 06:51	27	08:27 (Hild 2) 05:50	05:13	05:19	05:59	06:47	08:20 (Hild 2) 07:35				
14	16:35 17:26	19	08:55 (Hild 3) 18:16	27	08:50 (Hild 4) 20:08	25	08:52 (Hild 2) 20:57	21:38	21:43	21:05	20:01	29	08:49 (Hild 2) 18:53			
15	08:29 07:54		08:36 (Hild 3) 06:58	26	08:24 (Hild 4) 06:48	25	08:28 (Hild 2) 05:48	05:12	05:20	06:00	06:49	08:20 (Hild 2) 07:37				
16	16:37 17:28	20	08:56 (Hild 3) 18:18	25	08:49 (Hild 4) 20:09	23	08:51 (Hild 2) 20:59	21:39	21:42	21:03	20:03	30	08:50 (Hild 2) 18:51			
17	08:29 07:52		08:35 (Hild 3) 06:56	25	08:25 (Hild 4) 06:46	25	08:29 (Hild 2) 05:46	05:12	05:20	06:02	06:50	08:19 (Hild 2) 07:38				
18	16:38 17:30	22	08:57 (Hild 3) 18:19	21	08:46 (Hild 4) 20:11	20	08:49 (Hild 2) 21:00	21:39	21:42	21:01	20:01	31	08:50 (Hild 2) 18:48			
19	08:28 07:50		08:35 (Hild 3) 06:54	20	08:26 (Hild 4) 06:44	20	08:30 (Hild 2) 05:45	05:11	05:21	06:03	06:52	08:19 (Hild 2) 07:40				
20	16:39 17:31	23	08:58 (Hild 3) 18:21	18	08:44 (Hild 4) 20:13	15	08:45 (Hild 2) 21:02	21:40	21:41	20:59	19:54	31	08:50 (Hild 2) 18:46			
21	08:28 07:49		08:34 (Hild 3) 06:51	18	08:29 (Hild 4) 06:42	18	08:35 (Hild 2) 05:43	05:11	05:22	06:05	06:53	08:19 (Hild 2) 07:42				
22	16:41 17:33	24	08:58 (Hild 3) 18:23	13	08:42 (Hild 4) 20:14	6	08:41 (Hild 2) 21:03	21:41	21:40	20:57	19:52	32	08:51 (Hild 2) 18:44			
23	08:27 07:47		08:34 (Hild 3) 06:49	12	08:41 (Hild 4) 20:13	12	08:42 (Hild 2) 05:42	05:11	05:24	06:06	06:55	08:18 (Hild 2) 07:43				
24	16:42 17:35	24	08:58 (Hild 3) 18:24	4	07:53 (Hild 4) 20:16	4	07:53 (Hild 2) 21:05	21:42	21:39	20:55	19:50	32	08:50 (Hild 2) 18:42			
25	08:26 07:45		08:34 (Hild 3) 06:47	12	08:41 (Hild 4) 20:16	12	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
26	16:44 17:37	24	08:58 (Hild 3) 18:26	12	08:41 (Hild 4) 20:18	12	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
27	08:26 07:43		08:34 (Hild 3) 06:45	11	08:41 (Hild 4) 20:17	11	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
28	16:45 17:39	24	08:58 (Hild 3) 18:28	16	08:41 (Hild 4) 20:19	16	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
29	08:25 07:41		08:34 (Hild 3) 06:42	10	08:41 (Hild 4) 20:16	10	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
30	16:47 17:40	23	08:57 (Hild 3) 18:29	20	08:41 (Hild 4) 20:21	20	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
31	08:24 07:39		08:35 (Hild 3) 06:40	19	08:41 (Hild 4) 20:18	19	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
32	16:48 17:42	22	08:57 (Hild 3) 18:31	22	08:01 (Hild 1) 20:23	21	21:11	21:44	21:36	20:48	19:40	29	08:47 (Hild 2) 18:33			
33	08:23 07:38		08:35 (Hild 3) 06:38	17	08:41 (Hild 4) 20:24	17	08:42 (Hild 2) 05:42	05:10	05:25	06:08	06:57	08:18 (Hild 2) 07:45				
34	16:50 17:44	21	08:56 (Hild 3) 18:33	23	08:00 (Hild 1) 20:29	22	21:12	21:44	21:39	20:46	19:38	27	08:46 (Hild 2) 18:31			
35	08:22 07:36		08:36 (Hild 3) 06:36	18	08:41 (Hild 4) 20:25	18	08:42 (Hild 2) 05:42	05:10	05:30	06:17	07:04	27	08:45 (Hild 2) 18:30			
36	16:51 17:46	19	08:55 (Hild 3) 18:35	24	08:01 (Hild 1) 20:26	24	21:14	21:45	21:34	20:44	19:36	25	08:44 (Hild 2) 18:29			
37	08:21 07:34		08:36 (Hild 3) 06:37	19	08:41 (Hild 4) 20:27	19	08:42 (Hild 2) 05:42	05:10	05:32	06:17	07:06	28	08:20 (Hild 2) 07:55			
38	16:53 17:48	16	08:54 (Hild 3) 18:36	24	08:01 (Hild 1) 20:28	24	21:15	21:45	21:33	20:42	19:34	28	08:44 (Hild 1) 18:27			
39	08:20 07:32		08:39 (Hild 3) 06:31	20	08:41 (Hild 4) 20:29	20	08:42 (Hild 2) 05:42	05:10	05:33	06:18	07:05	28	08:21 (Hild 2) 07:56			
40	16:54 17:49	13	08:52 (Hild 3) 18:38	24	08:00 (Hild 1) 20:29	24	21:17	21:45	21:31	20:40	19:31	23	08:44 (Hild 1) 18:25			
41	08:19 07:30		08:33 (Hild 3) 06:29	21	08:41 (Hild 4) 20:30	21	08:42 (Hild 2) 05:42	05:10	05:34	06:20	07:09	29	08:22 (Hild 1) 07:58			
42	16:56 17:51	14	08:47 (Hild 3) 18:40	24	08:00 (Hild 1) 20:31	24	21:18	21:46	21:30	20:38	19:29	23	08:45 (Hild 1) 18:23			
43	08:18 07:28		08:30 (Hild 3) 06:27	22	08:41 (Hild 4) 20:32	22	21:15	21:45	05:27	06:11	07:11	16	08:03 (Hild 1) 18:20			
44	16:58 17:53	18	08:48 (Hild 3) 18:41	23	07:59 (Hild 1) 20:33	23	21:19	21:46	05:29	20:36	19:27	24	08:45 (Hild 1) 18:21			
45	08:17 07:26		08:28 (Hild 3) 06:24	24	07:37 (Hild 2) 06:16	24	05:26	05:10	05:37	06:24	07:12	24	08:20 (Hild 1) 08:02			
46	16:59 17:55	22	08:50 (Hild 3) 18:43	21	07:58 (Hild 1) 20:34	21	21:21	21:46	05:28	20:34	19:24	25	08:45 (Hild 1) 18:19			
47	08:16 07:24		08:27 (Hild 3) 06:22	24	07:33 (Hild 2) 06:14	24	05:25	05:11	05:38	06:25	07:14	25	08:45 (Hild 1) 08:04			
48	17:01 17:57	24	08:51 (Hild 3) 18:45	23	07:56 (Hild 1) 20:35	23	21:22	21:46	05:29	20:38	19:22	25	08:45 (Hild 1) 18:17			
49	08:15 07:21		08:26 (Hild 3) 06:20	25	07:32 (Hild 2) 06:12	25	05:24	05:11	05:39	06:27	07:16	26	08:20 (Hild 1) 07:05			
50	17:03 17:58	26	08:52 (Hild 3) 18:46	24	07:56 (Hild 2) 20:37	24	21:23	21:46	05:25	20:29	19:20	24	08:40 (Hild 1) 17:15			
51	08:13 07:19		08:25 (Hild 3) 06:18	26	07:31 (Hild 2) 06:10	26	05:23	05:11	05:41	06:28	07:17	28	08:20 (Hild 1) 07:07			
52	17:05 18:00	28	08:53 (Hild 3) 18:48	27	07:30 (Hild 2) 06:08	27	05:21	05:18	05:43	06:29	07:18	28	08:19 (Hild 1) 07:06			
53	08:12 07:17		08:24 (Hild 3) 06:15	28	07:30 (Hild 2) 06:08	28	05:21	05:12	05:42	06:30	07:19	29	08:20 (Hild 1) 07:09			
54	17:06 18:02	29	08:53 (Hild 3) 18:50	28	07:58 (Hild 2) 20:41	28	21:26	21:46	05:22	20:25	19:15	22	08:42 (Hild 1) 17:11			
55	08:11 07:15		08:23 (Hild 3) 06:13	30	07:28 (Hild 2) 06:06	30	05:20	05:12	05:44	06:31	07:20	20	08:21 (Hild 1) 07:11			
56	17:08 18:04	30	08:53 (Hild 3) 18:51	30	07:30 (Hild 2) 06:06	30	21:27	21:46	05:21	20:23	19:13	20	08:21 (Hild 1) 07:09			
57	08:09 07:09		07:11	30	08:27 (Hild 2) 06:05	30	05:19	05:13	05:45	06:33	07:22	20	08:22 (Hild 1) 07:12			
58	17:10 18:06	31	08:58 (Hild 3) 19:01	31	08:58 (Hild 2) 20:44	31	21:28	21:46	05:19	20:21	19:11	18	08:40 (Hild 1) 17:07			
59	08:08 07:08		07:09	32	08:27 (Hild 2) 06:03	32	05:19	05:13	05:47	06:35	07:24	20	08:40 (Hild 1) 07:14			
60	17:12 18:08	31	08:59 (Hild 3) 19:02	31	08:27 (Hild 2) 06:06	31	21:29	21:46	05:18	20:22	17:05	23	08:27 (Hild 1) 07:16			
61	08:07 07:07		07:06	33	08:25 (Hild 2) 06:04	33	05:19	05:13	05:48	06:36	07:25	23	08:27 (Hild 1) 07:16			
62	17:13 18:09	31	08:56 (Hild 3) 19:07	33	08:58 (Hild 2) 20:46	33	21:31	21:46	05:16	20:16	19:02	23	08:27 (Hild 1) 07:16			
Sonnenscheinstunden	262	279	518	746	415	272	482	495	499	452	380	742	703	703	113	247
astr. max. mögl. Beschattung			0,26	0,33	0,41					0,55		0,37	0,30	0,30	0,19	
Red. Sonnenscheinwarsch.			0,98	0,98	0,98					0,98		0,98	0,98	0,98	0,98	
Reduktion Betriebsdauer			0,63	0,64	0,65					0,65		0,65	0,64	0,63	0,63	
Reduktion Windrichtung			0,21	0,26	0,31					0,29		0,29	0,29	0,29	0,12	
Mit währsch. Beschattung			85	155	165					174		130	1			

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H45 - Hildfeld, Zur Lücke 10

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H46 - Hildfeld, Zur Lücke 12

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H47 - Hildfeld, Zur Lücke 13

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1 08:31	08:05	09:03 (Hild 4) 07:13	08:16 (Hild 1) 07:04	06:01	05:17	05:14	05:49	06:38	07:25	09:06 (Hild 2) 07:18	08:34 (Hild 4) 08:07		
2 16:28	17:15	27 09:30 (Hild 4) 18:05	33 08:49 (Hild 2) 19:58	20:47	21:32	21:45	21:15	20:14	19:06	10 09:16 (Hild 2) 17:02	25 08:59 (Hild 4) 16:22		
3 08:31	08:04	09:02 (Hild 4) 07:11	08:16 (Hild 1) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	09:03 (Hild 2) 07:19	08:34 (Hild 4) 08:09		
4 16:29	17:17	28 09:30 (Hild 4) 18:07	34 08:50 (Hild 2) 20:00	20:49	21:33	21:45	21:13	20:12	19:04	16 09:19 (Hild 2) 17:00	25 08:59 (Hild 4) 16:22		
5 08:31	08:02	09:02 (Hild 4) 07:09	08:17 (Hild 1) 07:00	05:57	05:15	05:15	05:52	06:41	07:28	09:00 (Hild 2) 07:21	08:34 (Hild 4) 08:10		
6 16:31	17:19	28 09:30 (Hild 4) 18:09	33 08:50 (Hild 2) 20:01	20:51	21:34	21:45	21:11	20:10	19:02	20 09:20 (Hild 2) 16:58	26 09:00 (Hild 4) 16:21		
7 08:30	08:01	09:03 (Hild 4) 07:07	08:19 (Hild 2) 06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:58 (Hild 2) 07:23	08:32 (Hild 4) 08:11		
8 16:32	17:21	28 09:31 (Hild 4) 18:11	31 08:50 (Hild 2) 20:03	20:52	21:35	21:44	21:10	20:08	18:59	24 09:22 (Hild 2) 16:56	28 09:00 (Hild 4) 16:21		
9 08:30	07:59	09:03 (Hild 4) 07:05	08:18 (Hild 2) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:57 (Hild 2) 07:25	08:32 (Hild 4) 08:13		
10 16:33	17:22	28 09:31 (Hild 4) 18:12	30 08:48 (Hild 2) 20:04	20:54	21:36	21:44	21:08	20:05	18:57	26 09:23 (Hild 2) 16:55	28 09:00 (Hild 4) 16:20		
11 08:30	07:57	09:03 (Hild 4) 07:02	08:19 (Hild 2) 06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:56 (Hild 2) 07:26	08:32 (Hild 4) 08:14		
12 16:34	17:24	27 09:30 (Hild 4) 18:14	29 08:48 (Hild 2) 20:06	20:55	21:37	21:43	21:06	20:03	18:55	28 09:23 (Hild 2) 16:53	28 09:00 (Hild 4) 16:20		
13 08:30	07:56	09:03 (Hild 4) 07:00	08:19 (Hild 2) 06:51	05:50	05:13	05:19	05:59	06:47	07:35	08:55 (Hild 2) 07:28	08:33 (Hild 4) 08:15		
14 16:35	17:26	27 09:30 (Hild 4) 18:16	28 08:47 (Hild 2) 20:08	20:57	21:38	21:43	21:05	20:01	18:53	29 09:24 (Hild 2) 16:51	28 09:01 (Hild 4) 16:19		
15 08:29	07:54	09:04 (Hild 4) 06:58	08:20 (Hild 2) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:54 (Hild 2) 07:30	08:33 (Hild 4) 08:16		
16 16:37	17:28	26 09:30 (Hild 4) 18:18	26 08:46 (Hild 2) 20:09	20:59	21:39	21:42	21:03	19:59	18:51	30 09:24 (Hild 2) 16:50	28 09:01 (Hild 4) 16:19		
17 08:29	07:52	09:04 (Hild 4) 06:56	08:20 (Hild 2) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	08:53 (Hild 2) 07:32	08:33 (Hild 4) 08:17		
18 16:38	17:30	26 09:30 (Hild 4) 18:19	24 08:44 (Hild 2) 20:11	21:00	21:39	21:42	21:01	19:56	18:48	30 09:23 (Hild 2) 16:48	28 09:01 (Hild 4) 16:19		
19 08:28	07:50	09:05 (Hild 4) 06:54	08:21 (Hild 2) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	08:52 (Hild 1) 07:37	08:34 (Hild 4) 08:19		
20 16:39	17:31	24 09:29 (Hild 4) 18:21	22 08:43 (Hild 2) 20:13	21:02	21:40	21:41	21:09	19:54	18:46	32 09:24 (Hild 2) 16:46	27 09:01 (Hild 4) 16:19		
21 08:28	07:49	09:06 (Hild 4) 06:51	08:23 (Hild 2) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	08:51 (Hild 1) 07:35	08:35 (Hild 4) 08:20		
22 16:41	17:33	22 09:28 (Hild 4) 18:23	18 08:41 (Hild 2) 20:14	21:03	21:41	21:40	21:05	19:52	18:44	33 09:24 (Hild 2) 16:45	25 09:00 (Hild 4) 16:19		
23 08:27	07:47	09:07 (Hild 4) 06:49	08:25 (Hild 2) 06:40	05:41	05:11	05:23	06:06	06:55	07:43	08:49 (Hild 1) 07:37	08:35 (Hild 4) 08:21		
24 16:42	17:35	19 09:26 (Hild 4) 18:24	13 08:42 (Hild 2) 20:16	21:05	21:42	21:39	21:06	19:50	18:42	34 09:23 (Hild 2) 16:43	25 09:00 (Hild 4) 16:18		
25 08:26	07:45	09:08 (Hild 4) 06:47	08:38 (Hild 2) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	08:48 (Hild 1) 07:38	08:35 (Hild 4) 08:22		
26 16:44	17:37	17 09:25 (Hild 4) 18:26	20 08:43 (Hild 2) 20:18	21:06	21:42	21:39	21:04	19:47	18:40	34 09:22 (Hild 2) 16:42	24 08:59 (Hild 4) 16:18		
27 08:26	07:43	09:11 (Hild 4) 06:45	08:35 (Hild 2) 06:35	05:38	05:10	05:26	06:09	06:58	07:47	08:48 (Hild 1) 07:40	08:36 (Hild 4) 08:23		
28 16:45	17:39	11 09:22 (Hild 4) 18:28	20 08:42 (Hild 2) 20:19	21:08	21:43	21:38	21:02	19:45	18:37	34 09:22 (Hild 2) 16:40	22 08:58 (Hild 4) 16:18		
29 08:25	07:41	09:09 (Hild 4) 06:42	08:33 (Hild 2) 06:33	05:37	05:10	05:27	06:11	07:00	07:48	08:46 (Hild 1) 07:42	08:38 (Hild 4) 08:23		
30 16:47	17:40	09:29 (Hild 4) 18:29	21 08:43 (Hild 2) 20:21	21:09	21:43	21:37	21:05	19:43	18:35	33 09:21 (Hild 2) 16:39	19 08:57 (Hild 4) 16:18		
31 08:24	07:39	09:09 (Hild 4) 06:40	08:31 (Hild 2) 06:31	05:35	05:10	05:28	06:12	07:01	07:50	08:47 (Hild 1) 07:44	08:39 (Hild 4) 08:24		
32 16:48	17:42	09:30 (Hild 4) 18:31	20 08:43 (Hild 2) 20:23	21:11	21:44	21:36	21:04	19:40	18:33	32 09:19 (Hild 2) 16:38	18 08:57 (Hild 4) 16:19		
33 08:23	07:38	09:09 (Hild 4) 06:38	08:32 (Hild 2) 06:29	05:34	05:10	05:29	06:14	07:03	07:52	08:47 (Hild 1) 07:45	08:41 (Hild 4) 08:25		
34 16:50	17:44	09:30 (Hild 4) 18:33	20 08:44 (Hild 2) 20:24	21:12	21:44	21:35	21:06	19:38	18:31	31 09:18 (Hild 2) 16:36	14 08:55 (Hild 4) 16:19		
35 08:22	07:36	09:06 (Hild 4) 06:36	08:33 (Hild 2) 06:27	05:33	05:10	05:30	06:16	07:04	07:53	08:46 (Hild 1) 07:47	08:44 (Hild 4) 08:26		
36 16:51	17:46	09:31 (Hild 4) 18:35	20 08:45 (Hild 2) 20:26	21:14	21:45	21:34	21:04	19:36	18:29	29 09:17 (Hild 2) 16:35	10 08:54 (Hild 4) 16:19		
37 08:21	07:34	09:07 (Hild 4) 06:33	08:35 (Hild 2) 06:25	05:31	05:10	05:32	06:17	07:06	07:55	08:49 (Hild 1) 07:49	08:37 (Hild 4) 08:27		
38 16:53	17:48	8 08:32 (Hild 1) 18:36	20 08:28	21:15	21:45	21:33	21:02	19:34	18:27	25 09:14 (Hild 2) 16:34		16:19	
39 08:20	07:32	09:08 (Hild 4) 06:31	08:37 (Hild 2) 06:23	05:30	05:10	05:33	06:19	07:08	07:57	08:50 (Hild 1) 07:50	08:37 (Hild 4) 08:27		
40 16:54	17:49	13 08:36 (Hild 1) 18:38	20 08:29	21:17	21:45	21:31	21:04	19:31	18:25	21 09:11 (Hild 2) 16:33		16:20	
41 08:19	07:30	09:09 (Hild 4) 06:29	08:38 (Hild 2) 06:20	05:28	05:10	05:34	06:20	07:09	07:58	08:50 (Hild 1) 07:52	08:38 (Hild 4) 08:28		
42 16:56	17:51	17 08:36 (Hild 1) 18:40	20 08:30	21:18	21:46	21:30	21:03	19:29	18:23	16 09:06 (Hild 2) 16:32		16:20	
43 08:18	07:28	09:08 (Hild 4) 06:27	08:39 (Hild 2) 06:18	05:27	05:10	05:35	06:22	07:11	08:00	08:52 (Hild 1) 07:53	08:39 (Hild 4) 08:28		
44 16:58	17:53	23 08:41 (Hild 2) 18:41	20 08:33	21:19	21:46	21:29	21:06	19:27	18:21	12 09:04 (Hild 2) 16:30		16:21	
45 08:17	07:26	09:09 (Hild 4) 06:24	08:40 (Hild 2) 06:16	05:26	05:10	05:37	06:24	07:12	08:02	08:56 (Hild 1) 07:55	08:39 (Hild 4) 08:29		
46 16:59	17:55	27 09:40 (Hild 4) 18:43	21 08:54 (Hild 2) 20:34	21:24	21:46	21:28	21:04	19:24	18:19	5 09:01 (Hild 2) 16:29		16:21	
47 08:16	07:24	09:10 (Hild 4) 06:22	08:41 (Hild 2) 06:14	05:25	05:11	05:38	06:25	07:14	08:04	08:57 (Hild 1) 07:57	08:39 (Hild 4) 08:29		
48 17:01	10	09:20 (Hild 4) 17:57	30 08:46 (Hild 2) 18:45	20:36	21:22	21:46	21:26	21:01	19:22	18:17		16:28	
49 08:15	07:07 (Hild 4) 07:21	08:16 (Hild 1) 06:20	06:12	05:24	05:11	05:39	06:27	07:16	07:05		07:58	08:30	
50 17:03	14	09:21 (Hild 4) 17:58	31 08:47 (Hild 2) 18:46	20:37	21:23	21:46	21:25	21:01	19:20		16:27	16:22	
51 08:13	09:06 (Hild 4) 07:19	08:16 (Hild 1) 06:18	06:10	05:23	05:11	05:41	06:28	07:17	07:07		08:00	08:30	
52 17:05	18	09:24 (Hild 4) 18:00	32 08:48 (Hild 2) 18:48	20:39	21:25	21:46	21:24	21:02	19:18	17:13		16:26	16:23
53 08:12	09:06 (Hild 4) 07:17	08:16 (Hild 1) 06:15	06:08	05:21	05:12	05:42	06:30	07:19	07:09	08:44 (Hild 4) 08:01		08:30	
54 17:06	19	09:25 (Hild 4) 18:02	33 08:49 (Hild 2) 18:50	20:41	21:26	21:46	21:22	21:05	19:15	17:11	4 08:48 (Hild 4) 16:26		16:24
55 08:11	09:04 (Hild 4) 07:15	08:15 (Hild 1) 06:13	06:06	05:20	05:12	05:44	06:31	07:20	07:11	08:40 (Hild 4) 08:03		08:30	
56 17:08	22	09:26 (Hild 4) 18:04	34 08:49 (Hild 2) 18:51	20:42	21:27	21:46	21:23	21:01	19:13	12 08:52 (Hild 4) 16:25		16:25	
57 08:09	09:04 (Hild 4) 07:11	08:15 (Hild 1) 06:13	06:04	05:19	05:13	05:45	06:33	07:22	07:12	08:38 (Hild 4) 08:04		08:31	
58 17:10	24	09:28 (Hild 4) 18:06	31 08:53 (Hild 2) 20:44	21:28	21:46	21:19	21:01	19:11	17:07	17 08:55 (Hild 4) 16:24		16:25	
59 08:08	09:03 (Hild 4) 07:09	08:16 (Hild 1) 06:14	06:03	05:19	05:13	05:47	06:35	07:24	07:14	08:36 (Hild 4) 08:06		08:31	
60 17:12	25	09:28 (Hild 4) 18:06	31 08:53 (Hild 2) 20:46	21:29	21:46	21:18	21:01	19:08	17:05	20 08:56 (Hild 4) 16:23		16:26	
61 08:07	09:03 (Hild 4) 07:06	08:16 (Hild 1) 06:14	06:03	05:19	05:13	05:47	06:35	07:24	07:14	08:36 (Hild 4) 08:06		08:31	
62 17:13	25	09:28 (Hild 4) 18:06	31 08:53 (Hild 2) 20:46	21:29	21:46	21:18	21:01	19:08	17:05	20 08:56 (Hild 4) 16:23		16:26	
63													
Sonnenscheinstunden	262		279	367	415	482	495	499	452	380	333	247	
astr.max.mögl.Beschattung	157		586	321							660	428	
Red.Sonnenscheinwahrsch.	0,19		0,26	0,33							0,30	0,19	
Reduktion Betriebswärder													

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H48 - Hildfeld, Zur Lücke 14

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1 08:31	08:05	09:05 (Hild 4) 07:13	08:16 (Hild 1) 07:04	06:01	05:17	05:14	05:49	06:38	07:25	09:06 (Hild 2) 07:18	08:36 (Hild 4) 08:07	
2 16:28	17:15	27 09:32 (Hild 4) 18:05	35 08:51 (Hild 2) 19:58	20:47	21:32	21:45	21:15	20:14	19:06	12 09:18 (Hild 2) 17:02	25 09:01 (Hild 4) 16:22	
3 08:31	08:04	09:04 (Hild 4) 07:11	08:17 (Hild 1) 07:02	05:59	05:16	05:15	05:51	06:39	07:27	09:03 (Hild 2) 07:19	08:36 (Hild 4) 08:09	
4 16:29	17:17	28 09:32 (Hild 4) 18:07	34 08:51 (Hild 2) 19:58	20:49	21:33	21:45	21:13	20:12	19:04	18 09:21 (Hild 2) 17:00	25 09:01 (Hild 4) 16:22	
5 08:30	08:02	09:04 (Hild 4) 07:09	08:18 (Hild 1) 07:00	05:57	05:15	05:15	05:52	06:41	07:28	09:00 (Hild 2) 07:21	08:35 (Hild 4) 08:10	
6 16:31	17:19	28 09:32 (Hild 4) 18:09	33 08:51 (Hild 2) 20:01	20:51	21:34	21:45	21:11	20:10	19:02	22 09:22 (Hild 2) 17:58	27 09:02 (Hild 4) 16:21	
7 08:30	08:01	09:04 (Hild 4) 07:07	08:19 (Hild 1) 06:57	05:55	05:15	05:16	05:54	06:42	07:30	08:59 (Hild 2) 06:23	08:34 (Hild 4) 08:11	
8 16:32	17:21	29 09:33 (Hild 4) 18:11	32 08:51 (Hild 2) 20:03	20:52	21:35	21:44	21:10	20:08	18:59	25 09:24 (Hild 2) 16:56	28 09:02 (Hild 4) 16:21	
9 08:30	07:59	09:04 (Hild 4) 07:05	08:19 (Hild 1) 06:55	05:53	05:14	05:17	05:55	06:44	07:32	08:58 (Hild 2) 07:25	08:34 (Hild 4) 08:13	
10 16:33	17:22	29 09:33 (Hild 4) 18:12	31 08:50 (Hild 2) 20:04	20:54	21:36	21:44	21:08	20:05	18:57	27 09:25 (Hild 2) 16:55	28 09:02 (Hild 4) 16:20	
11 08:30	07:57	09:04 (Hild 4) 07:02	08:20 (Hild 2) 06:53	05:52	05:13	05:18	05:57	06:46	07:33	08:56 (Hild 2) 07:26	08:34 (Hild 4) 08:14	
12 16:34	17:24	28 09:32 (Hild 4) 18:14	30 08:50 (Hild 2) 20:06	20:55	21:37	21:43	21:06	20:03	18:55	29 09:25 (Hild 2) 16:53	29 09:03 (Hild 4) 16:20	
13 08:30	07:58	09:04 (Hild 4) 07:00	08:20 (Hild 2) 06:51	05:50	05:13	05:19	05:59	06:47	07:35	08:56 (Hild 2) 07:28	08:34 (Hild 4) 08:15	
14 16:35	17:26	28 09:32 (Hild 4) 18:16	29 08:49 (Hild 2) 20:08	20:51	21:38	21:45	21:05	20:05	18:53	29 09:25 (Hild 2) 16:51	29 09:03 (Hild 4) 16:19	
15 08:29	07:54	09:06 (Hild 4) 06:58	08:21 (Hild 2) 06:48	05:48	05:12	05:20	06:00	06:49	07:37	08:56 (Hild 2) 07:30	08:35 (Hild 4) 08:16	
16 16:37	17:28	26 09:32 (Hild 4) 18:18	27 08:48 (Hild 2) 20:09	20:59	21:39	21:42	21:03	19:59	18:51	30 09:26 (Hild 2) 16:50	28 09:03 (Hild 4) 16:19	
17 08:29	07:52	09:06 (Hild 4) 06:56	08:21 (Hild 2) 06:46	05:46	05:12	05:20	06:02	06:50	07:38	08:54 (Hild 2) 07:32	08:35 (Hild 4) 08:17	
18 16:38	17:30	26 09:32 (Hild 4) 18:19	25 08:46 (Hild 2) 20:11	21:00	21:39	21:42	21:01	19:56	18:48	31 09:25 (Hild 2) 16:48	28 09:02 (Hild 4) 16:19	
19 08:28	07:50	09:07 (Hild 4) 06:54	08:22 (Hild 2) 06:44	05:45	05:11	05:21	06:03	06:52	07:40	08:53 (Hild 1) 07:33	08:35 (Hild 4) 08:19	
20 16:39	17:31	24 09:31 (Hild 4) 18:21	23 08:45 (Hild 2) 20:13	20:43	21:45	21:48	21:04	19:54	18:45	32 09:25 (Hild 2) 16:49	28 09:03 (Hild 4) 16:19	
21 08:28	07:49	09:08 (Hild 4) 06:51	08:23 (Hild 2) 06:42	05:43	05:11	05:22	06:05	06:53	07:42	08:52 (Hild 1) 07:35	08:36 (Hild 4) 08:20	
22 16:41	17:33	22 09:30 (Hild 4) 18:23	20 08:43 (Hild 2) 20:14	21:03	21:41	21:40	20:57	19:52	18:44	33 09:25 (Hild 2) 16:45	27 09:03 (Hild 4) 16:19	
23 08:27	07:47	09:09 (Hild 4) 06:49	08:26 (Hild 2) 06:40	05:41	05:11	05:23	06:06	06:55	07:43	08:50 (Hild 1) 07:37	08:37 (Hild 4) 08:21	
24 16:42	17:35	19 09:28 (Hild 4) 18:24	15 08:41 (Hild 2) 20:16	21:05	21:42	21:39	20:56	19:50	18:42	34 09:24 (Hild 2) 16:43	29 09:02 (Hild 4) 16:18	
25 08:26	07:45	09:11 (Hild 4) 06:47	08:29 (Hild 2) 06:37	05:40	05:10	05:25	06:08	06:57	07:45	08:49 (Hild 1) 07:38	08:37 (Hild 4) 08:22	
26 16:44	17:37	15 09:26 (Hild 4) 18:26	7 08:36 (Hild 2) 20:18	21:06	21:42	21:39	20:54	19:47	18:40	35 09:24 (Hild 2) 16:42	24 09:01 (Hild 4) 16:18	
27 08:26	07:43	09:13 (Hild 4) 06:45	08:21 (Hild 2) 06:35	05:38	05:10	05:26	06:09	06:58	07:47	08:49 (Hild 1) 07:40	08:38 (Hild 4) 08:23	
28 16:45	17:39	11 09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
29 08:25	07:41	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
30 16:47	17:40	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
31 08:24	07:39	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
32 16:48	17:42	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
33 08:23	07:38	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
34 16:50	17:44	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
35 08:22	07:36	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
36 16:51	17:46	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
37 08:21	07:34	09:24 (Hild 4) 18:28	08:33 (Hild 2) 20:19	21:08	21:43	21:38	20:52	19:45	18:37	34 09:23 (Hild 2) 16:40	23 09:01 (Hild 4) 16:18	
38 16:53	17:48	9 08:33 (Hild 1) 18:36	06:33	06:29	05:34	05:10	05:29	06:14	07:03	07:52	08:42 (Hild 4) 08:25	
39 08:20	07:32	14 08:36 (Hild 1) 18:38	06:28	06:23	05:30	05:10	05:33	06:19	07:08	07:57	08:50 (Hild 1) 16:50	
40 16:54	17:49	18 08:36 (Hild 1) 18:38	06:29	06:24	05:31	05:10	05:32	06:17	07:06	07:55	08:49 (Hild 1) 07:49	
41 08:19	07:30	23 08:36 (Hild 1) 18:40	06:29	06:24	05:31	05:10	05:32	06:17	07:06	07:55	08:49 (Hild 1) 07:49	
42 16:56	17:51	17 08:37 (Hild 1) 18:40	06:29	06:24	05:31	05:10	05:32	06:17	07:06	07:55	08:49 (Hild 1) 07:49	
43 08:18	07:28	24 08:39 (Hild 1) 18:41	06:27	06:18	05:27	05:10	05:35	06:22	07:11	08:00	08:53 (Hild 1) 07:53	
44 16:58	17:53	24 08:43 (Hild 2) 18:41	06:27	06:18	05:27	05:10	05:35	06:22	07:11	08:00	08:53 (Hild 1) 07:53	
45 08:17	07:26	28 08:18 (Hild 1) 18:43	06:24	06:14	05:26	05:10	05:37	06:23	07:12	08:02	08:56 (Hild 1) 07:55	
46 16:59	17:55	28 08:46 (Hild 2) 18:43	06:24	06:14	05:26	05:10	05:37	06:23	07:12	08:02	08:56 (Hild 1) 07:55	
47 08:16	07:24	09:10 (Hild 4) 07:24	08:17 (Hild 1) 06:22	05:14	05:25	05:11	05:38	06:25	07:14	08:04	09:02 (Hild 1) 16:29	
48 17:01	13 09:23 (Hild 4) 17:57	30 08:47 (Hild 2) 18:45	06:12	05:24	05:11	05:39	06:27	07:16	08:05	09:01 (Hild 4) 16:28		
49 08:15	07:21	09:08 (Hild 4) 07:21	08:17 (Hild 1) 06:20	05:12	05:24	05:11	05:39	06:27	07:16	08:05	09:01 (Hild 4) 16:28	
50 17:03	16 09:24 (Hild 4) 17:58	32 08:49 (Hild 2) 18:46	06:12	05:24	05:11	05:39	06:27	07:16	08:05	09:01 (Hild 4) 16:28		
51 08:19	07:19	19 09:17 (Hild 1) 18:18	06:10	05:23	05:10	05:38	06:26	07:15	08:04	09:00	09:02 (Hild 4) 16:29	
52 17:05	19 09:25 (Hild 4) 18:00	33 08:50 (Hild 2) 18:48	06:09	05:23	05:11	05:39	06:27	07:16	08:05	09:01 (Hild 4) 16:28		
53 08:12	07:17	20 09:07 (Hild 4) 07:17	08:17 (Hild 1) 06:15	05:11	05:23	05:12	05:42	06:30	07:19	08:09	09:01 (Hild 4) 16:28	
54 17:06	21 09:28 (Hild 4) 18:02	34 08:51 (Hild 2) 18:50	06:08	05:21	05:12	05:42	06:30	07:19	08:09	09:01 (Hild 4) 16:28		
55 08:11	07:15	23 09:06 (Hild 4) 07:15	08:16 (Hild 1) 06:13	05:10	05:22	05:11	05:41	06:31	07:20	08:11	08:42 (Hild 4) 08:03	
56 17:08	23 09:29 (Hild 4) 18:04	34 08:50 (Hild 2) 18:51	06:07	05:20	05:12	05:44	06:31	07:20	08:11	08:42 (Hild 4) 08:03		
57 08:09	07:06	24 09:06 (Hild 4) 07:06	08:11 (Hild 1) 06:11	05:04	05:19	05:13	05:45	06:33	07:22	08:13	08:43 (Hild 4) 08:04	
58 17:10	24 09:30 (Hild 4) 18:04	35 08:52 (Hild 2) 19:04	06:06	05:20	05:12	05:44	06:31	07:20	08:11	08:42 (Hild 4) 08:03		
59 08:08	07:09	26 09:05 (Hild 4) 07:09	08:12 (Hild 1) 06:12	05:05	05:18	05:12	05:46	06:34	07:23	08:14	08:44 (Hild 4) 08:05	
60 17:12	26 09:31 (Hild 4) 18:06	36 08:54 (Hild 2) 19:06	06:07	05:21	05:13	05:47	06:35	07:24	08:15	08:45 (Hild 4) 08:06		
61 08:07	07:06	27 09:06 (Hild 4) 07:06	08:13 (Hild 1) 06:13	05:06	05:19	05:13	05:47	06:35	07:24	08:15	08:45 (Hild 4) 08:06	
62 17:13	27 09:31 (Hild 4) 18:07	37 08:55 (Hild 2) 19:07	06:08	05:22	05:14	05:48	06:36	07:25	08:16	08:46 (Hild 4) 08:07		
Sonnenscheinstunden	262	279	367	415	482	495	499	452	380	333	269	247
astr.max.mögl.Beschattung	177	595	341								674	451
Red.Sonnenscheinwahrsch.	0.19	0.26	0.33								0.30	0.19
Reduktion Betriebswärder	0.98	0.98	0.98								0.98	0.98
Reduktion Windrichtung	0.62	0.62	0.64								0.64	0.64
Gesamte Reduktion	0.11	0.1										

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H49 - Hildfeld, Zur Lücke 18

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	09:03 (Hild 4) 18:05	07:13 18:05	32	08:11 (Hild 1) 07:04	06:01 19:06	05:17 21:32	05:14 21:45	06:38 20:14	07:18 19:06	08:31 (Hild 4) 16:22
2	08:31 16:29	08:04 17:17	09:02 (Hild 4) 18:07	07:11 18:07	33	08:11 (Hild 1) 07:02	06:01 19:06	05:16 21:33	05:15 21:45	06:39 20:12	07:19 19:04	08:31 (Hild 4) 16:22
3	08:31 16:31	08:02 17:19	09:01 (Hild 4) 18:09	07:09 18:09	34	08:12 (Hild 1) 07:00	06:01 19:06	05:15 21:34	05:15 21:45	06:41 20:10	07:21 19:02	08:31 (Hild 4) 16:21
4	08:30 16:32	08:01 17:21	09:01 (Hild 4) 18:11	07:07 18:11	35	08:12 (Hild 1) 06:57	06:01 19:06	05:15 21:35	05:15 21:44	06:42 20:08	07:23 18:59	08:30 (Hild 4) 16:21
5	08:30 16:33	07:59 17:22	09:01 (Hild 4) 18:12	07:05 18:12	36	08:12 (Hild 1) 06:55	06:01 19:06	05:14 21:36	05:15 21:44	06:44 20:05	07:25 18:57	08:30 (Hild 4) 16:20
6	08:30 16:34	07:57 17:24	09:00 (Hild 4) 18:14	07:02 18:14	37	08:13 (Hild 1) 06:53	06:01 19:06	05:13 21:37	05:15 21:43	06:46 20:03	07:26 18:55	08:31 (Hild 4) 16:19
7	08:30 16:35	07:56 17:25	09:00 (Hild 4) 18:16	07:00 18:16	38	08:14 (Hild 1) 06:51	06:01 19:06	05:13 21:38	05:15 21:43	06:47 20:01	07:28 18:53	08:31 (Hild 4) 16:19
8	08:29 16:37	07:54 17:26	09:01 (Hild 4) 18:18	06:58 18:18	39	08:14 (Hild 1) 06:48	06:01 19:06	05:12 21:39	05:15 21:43	06:49 20:01	07:30 18:51	08:31 (Hild 4) 16:19
9	08:29 16:38	07:52 17:30	09:01 (Hild 4) 18:19	06:56 18:19	40	08:13 (Hild 1) 06:46	06:01 19:06	05:12 21:39	05:15 21:42	06:50 20:02	07:31 18:48	08:31 (Hild 4) 16:19
10	08:29 16:39	07:50 17:31	09:01 (Hild 4) 18:21	06:54 18:21	41	08:13 (Hild 1) 06:44	06:01 19:06	05:11 21:40	05:15 21:42	06:51 20:01	07:32 18:46	08:31 (Hild 4) 16:19
11	08:28 16:41	07:49 17:33	09:01 (Hild 4) 18:23	06:51 18:23	42	08:14 (Hild 1) 06:42	06:01 19:06	05:11 21:41	05:15 21:43	06:53 20:02	07:33 18:44	08:31 (Hild 4) 16:19
12	08:27 16:42	07:47 17:35	09:02 (Hild 4) 18:24	06:49 18:24	43	08:14 (Hild 1) 06:40	06:01 19:06	05:11 21:42	05:15 21:44	06:55 20:03	07:34 18:43	08:31 (Hild 4) 16:19
13	08:26 16:44	07:45 17:37	09:02 (Hild 4) 18:26	06:47 18:26	44	08:14 (Hild 1) 06:37	06:01 19:06	05:10 21:42	05:15 21:45	06:57 20:04	07:35 18:40	08:31 (Hild 4) 16:19
14	08:26 16:45	07:43 17:39	09:03 (Hild 4) 18:28	06:45 18:28	45	08:15 (Hild 1) 06:35	06:01 19:06	05:10 21:43	05:15 21:46	06:58 20:05	07:36 18:39	08:31 (Hild 4) 16:19
15	08:25 16:47	07:41 17:40	09:04 (Hild 4) 18:29	06:42 18:29	46	08:17 (Hild 1) 06:33	06:01 19:06	05:10 21:43	05:15 21:48	07:00 20:06	07:37 18:35	08:31 (Hild 4) 16:19
16	08:24 16:48	07:39 17:42	09:06 (Hild 4) 18:31	06:40 18:31	47	08:19 (Hild 1) 06:31	06:01 19:06	05:10 21:43	05:15 21:50	07:01 20:07	07:38 18:32	08:31 (Hild 4) 16:19
17	08:23 16:50	07:38 17:44	09:08 (Hild 4) 18:33	06:38 18:33	48	08:21 (Hild 1) 06:29	06:01 19:06	05:10 21:44	05:15 21:53	07:03 20:08	07:39 18:31	08:31 (Hild 4) 16:19
18	08:22 16:51	07:36 17:46	09:12 (Hild 4) 18:35	06:36 18:35	49	08:21 (Hild 1) 06:27	06:01 19:06	05:10 21:45	05:15 21:56	07:04 20:09	07:40 18:29	08:31 (Hild 4) 16:19
19	08:21 16:53	07:34 17:48	09:17 (Hild 4) 18:36	06:33 18:36	50	08:21 (Hild 1) 06:25	06:01 19:06	05:10 21:46	05:15 21:58	07:06 20:10	07:41 18:27	08:31 (Hild 4) 16:19
20	08:20 16:54	07:32 17:49	09:20 (Hild 4) 18:38	06:31 18:38	51	08:22 (Hild 1) 06:23	06:01 19:06	05:10 21:47	05:15 21:59	07:08 20:11	07:42 18:25	08:31 (Hild 4) 16:19
21	08:19 16:56	07:30 17:51	09:23 (Hild 4) 18:40	06:29 18:40	52	08:23 (Hild 1) 06:21	06:01 19:06	05:10 21:48	05:15 22:00	07:09 20:12	07:43 18:23	08:31 (Hild 4) 16:19
22	08:18 16:58	07:28 17:53	09:26 (Hild 4) 18:41	06:27 18:41	53	08:24 (Hild 1) 06:20	06:01 19:06	05:10 21:49	05:15 22:01	07:11 20:13	07:44 18:20	08:31 (Hild 4) 16:19
23	08:17 16:59	07:26 17:55	09:29 (Hild 4) 18:43	06:24 18:43	54	08:25 (Hild 1) 06:19	06:01 19:06	05:10 21:50	05:15 22:02	07:12 20:14	07:45 18:19	08:31 (Hild 4) 16:19
24	08:16 17:01	07:24 17:57	09:32 (Hild 1) 18:45	06:22 18:45	55	08:26 (Hild 1) 06:17	06:01 19:06	05:10 21:51	05:15 22:03	07:14 20:15	07:46 18:17	08:31 (Hild 4) 16:19
25	08:15 17:03	07:21 17:58	09:35 (Hild 1) 18:46	06:20 18:46	56	08:27 (Hild 1) 06:15	06:01 19:06	05:10 21:52	05:15 22:04	07:15 20:16	07:47 18:15	08:31 (Hild 4) 16:19
26	08:13 17:05	07:19 18:00	09:38 (Hild 1) 18:48	06:18 18:48	57	08:28 (Hild 1) 06:13	06:01 19:06	05:10 21:53	05:15 22:05	07:16 20:17	07:48 18:13	08:31 (Hild 4) 16:19
27	08:12 17:06	07:17 18:02	09:41 (Hild 1) 18:50	06:16 18:50	58	08:29 (Hild 1) 06:11	06:01 19:06	05:10 21:54	05:15 22:06	07:17 20:18	07:49 18:11	08:31 (Hild 4) 16:19
28	08:11 17:08	07:15 18:04	09:44 (Hild 1) 18:51	06:13 18:51	59	08:30 (Hild 1) 06:09	06:01 19:06	05:10 21:55	05:15 22:07	07:18 20:19	07:50 18:10	08:31 (Hild 4) 16:19
29	08:09 17:10	07:13 18:07	09:47 (Hild 1) 18:53	06:11 18:53	60	08:31 (Hild 1) 06:07	06:01 19:06	05:10 21:56	05:15 22:08	07:19 20:20	07:51 18:09	08:31 (Hild 4) 16:19
30	08:08 17:12	07:11 18:09	09:50 (Hild 1) 18:55	06:09 18:55	61	08:32 (Hild 1) 06:05	06:01 19:06	05:10 21:57	05:15 22:09	07:20 20:21	07:52 18:08	08:31 (Hild 4) 16:19
31	08:07 17:13	07:10 18:10	09:53 (Hild 1) 18:56	06:07 18:56	62	08:33 (Hild 1) 06:03	06:01 19:06	05:10 21:58	05:15 22:10	07:21 20:22	07:53 18:07	08:31 (Hild 4) 16:19
Sonnenscheinstunden												
astr.max.mögl.Beschattung												
Red. Sonnenscheinwahrsch.												
Reduktion Betriebsdauer												
Reduktion Windrichtung												
Gesamte Reduktion												
Met. wahrsch. 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)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H50 - Hildfeld, Zur Lücke 3

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	08:06 (Hild 1) 19:58	06:01 20:47	05:17 21:32	05:14 21:45	05:49 21:15	06:38 20:14	07:25 19:06	08:42 (Hild 2) 17:02	08:22 (Hild 4) 16:22
2	08:31 16:30	08:04 17:17	07:11 18:07	08:05 (Hild 1) 19:58	06:01 20:49	05:17 21:33	05:15 21:45	05:51 21:13	06:39 20:12	07:27 19:04	08:42 (Hild 2) 17:00	08:22 (Hild 4) 16:22
3	08:31 16:31	08:02 17:19	07:09 18:09	08:05 (Hild 1) 19:58	06:01 20:51	05:17 21:34	05:15 21:45	05:52 21:11	06:41 20:10	07:28 19:02	08:41 (Hild 2) 17:02	08:23 (Hild 4) 16:21
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Red.Sonnenscheinwahrsch.	0,26	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
Reduktion Betriebsdauer	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
Reduktion Windrichtung	0,62	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64	0,64
Gesamte Reduktion	0,16	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,21
Met.wahrsch.Beschattung	83	119	119	119	119	119	119	119	119	119	119	119

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)
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Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H52 - Hildfeld, Zur Lücke 6

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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38:08 20:40 38:10 20:39 38:12 20:38 38:14 20:37 38:16 20:36 38:18 20:35 38:20 20:34 38:22 20:33 38:24 20:32 38:26 20:31 38:28 20:30 38:30 20:29 38:32 20:28 38:34 20:27 38:36 20:26 38:38 20:25 38:40 20:24 38:42 20:23 38:44 20:22 38:46 20:21 38:48 20:20 38:50 20:19 38:52 20:18 38:54 20:17 38:56 20:16 38:58 20:15 39:00 20:14 39:02 20:13 39:04 20:12 39:06 20:11 39:08 20:10 39:10 20:09 39:12 20:08 39:14 20:07 39:16 20:06 39:18 20:05 39:20 20:04 39:22 20:03 39:24 20:02 39:26 20:01 39:28 20:00 39:30 19:59 39:32 19:58 39:34 19:57 39:36 19:56 39:38 19:55 39:40 19:54 39:42 19:53 39:44 19:52 39:46 19:51 39:48 19:50 39:50 19:49 39:52 19:48 39:54 19:47 39:56 19:46 39:58 19:45 40:00 19:44 40:02 19:43 40:04 19:42 40:06 19:41 40:08 19:40 40:10 19:39 40:12 19:38 40:14 19:37 40:16 19:36 40:18 19:35 40:20 19:34 40:22 19:33 40:24 19:32 40:26 19:31 40:28 19:30 40:30 19:29 40:32 19:28 40:34 19:27 40:36 19:26 40:38 19:25 40:40 19:24 40:42 19:23 40:44 19:22 40:46 19:21 40:48 19:20 40:50 19:19 40:52 19:18 40:54 19:17 40:56 19:16 40:58 19:15 41:00 19:14 41:02 19:13 41:04 19:12 41:06 19:11 41:08 19:10 41:10 19:09 41:12 19:08 41:14 19:07 41:16 19:06 41:18 19:05 41:20 19:04 41:22 19:03 41:24 19:02 41:26 19:01 41:28 19:00 41:30 18:59 41:32 18:58 41:34 18:57 41:36 18:56 41:38 18:55 41:40 18:54 41:42 18:53 41:44 18:52 41:46 18:51 41:48 18:50 41:50 18:49 41:52 18:48 41:54 18:47 41:56 18:46 41:58 18:45 22:00 18:44 22:02 18:43 22:04 18:42 22:06 18:41 22:08 18:40 22:10 18:39 22:12 18:38 22:14 18:37 22:16 18:36 22:18 18:35 22:20 18:34 22:22 18:33 22:24 18:32 22:26 18:31 22:28 18:30 22:30 18:29 22:32 18:28 22:34 18:27 22:36 18:26 22:38 18:25 22:40 18:24 22:42 18:23 22:44 18:22 22:46 18:21 22:48 18:20 22:50 18:19 22:52 18:18 22:54 18:17 22:56 18:16 									
Sonnenscheinstunden	262	279	367	637	415	482	495	499	452	380	333	269
astr.max.mögl.Beschattung		479							396	676		52
Red.Sonnenscheinwahrsch.		0.26		0.33					0.37	0.30		0.19
Reduktion Betriebswährsch.		0.98		0.98								

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis,
NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H53 - Hildfeld, Zur Lücke 7

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31	08:05	09:00 (Hild 4)	07:13	08:08 (Hild 1)	07:04	06:01	05:17	05:14	05:49	06:38	07:18
2	16:28	17:15	17	08:05 (Hild 4)	18:05	25	08:33 (Hild 2)	19:58	20:47	21:32	21:45	21:15
3	08:31	08:04	08:59 (Hild 4)	07:11	08:07 (Hild 1)	07:02	05:59	05:16	05:15	05:51	06:39	07:19
4	08:31	17:17	19	09:18 (Hild 4)	18:07	28	08:35 (Hild 2)	20:00	20:49	21:33	21:45	21:13
5	08:31	08:02	08:57 (Hild 4)	07:09	08:07 (Hild 1)	07:00	05:57	05:15	05:15	05:52	06:41	07:21
6	16:31	17:19	19	09:19 (Hild 4)	18:09	30	08:37 (Hild 2)	20:01	20:51	21:34	21:45	21:11
7	08:30	08:01	08:57 (Hild 4)	07:07	08:07 (Hild 1)	06:57	05:55	05:15	05:15	05:54	06:42	07:20
8	16:32	17:21	24	09:21 (Hild 4)	18:11	31	08:38 (Hild 2)	20:03	20:52	21:35	21:44	21:10
9	08:30	07:59	08:56 (Hild 4)	07:05	08:07 (Hild 1)	06:55	05:53	05:14	05:17	05:55	06:44	07:25
10	16:33	17:22	25	09:21 (Hild 4)	18:12	31	08:38 (Hild 2)	20:04	20:54	21:36	21:44	21:08
11	08:29	07:54	08:55 (Hild 4)	06:58	08:09 (Hild 2)	06:48	05:48	05:12	05:20	06:00	06:49	07:30
12	16:34	17:24	27	09:22 (Hild 4)	18:14	31	08:38 (Hild 2)	20:06	20:55	21:37	21:43	21:06
13	08:30	07:56	08:55 (Hild 4)	07:00	08:08 (Hild 1)	06:51	05:50	05:13	05:19	05:59	06:47	07:35
14	16:35	17:25	27	09:22 (Hild 4)	18:16	31	08:39 (Hild 2)	20:08	20:57	21:38	21:43	21:05
15	08:29	07:54	08:55 (Hild 4)	06:58	08:09 (Hild 2)	06:48	05:48	05:12	05:20	06:00	06:49	07:30
16	16:37	17:28	28	09:23 (Hild 4)	18:18	30	08:39 (Hild 2)	20:09	20:59	21:39	21:42	21:03
17	08:29	07:52	08:55 (Hild 4)	06:56	08:07 (Hild 2)	06:46	05:46	05:12	05:20	06:02	06:50	07:38
18	16:38	17:30	28	09:23 (Hild 4)	18:19	31	08:38 (Hild 2)	20:11	21:00	21:39	21:42	21:01
19	08:28	07:50	08:55 (Hild 4)	06:54	08:07 (Hild 2)	06:44	05:45	05:11	05:21	06:03	06:52	07:40
20	16:39	17:31	28	09:23 (Hild 4)	18:21	31	08:38 (Hild 2)	20:13	21:02	21:40	21:41	20:59
21	08:28	07:49	08:55 (Hild 4)	06:51	08:07 (Hild 2)	06:42	05:43	05:11	05:22	06:05	06:53	07:42
22	16:41	17:33	28	09:23 (Hild 4)	18:23	31	08:38 (Hild 2)	20:14	21:03	21:41	21:40	20:57
23	08:27	07:47	08:55 (Hild 4)	06:49	08:08 (Hild 2)	06:40	05:42	05:11	05:23	06:06	06:55	07:43
24	16:42	17:35	28	09:23 (Hild 4)	18:24	30	08:38 (Hild 2)	20:16	21:05	21:42	21:39	20:56
25	08:26	07:45	08:55 (Hild 4)	06:47	08:07 (Hild 2)	06:37	05:40	05:10	05:25	06:08	06:57	07:45
26	16:44	17:37	28	09:23 (Hild 4)	18:26	29	08:36 (Hild 2)	20:18	21:06	21:42	21:39	20:54
27	08:26	07:43	08:55 (Hild 4)	06:45	08:08 (Hild 2)	06:35	05:38	05:10	05:26	06:09	06:58	07:47
28	16:45	17:39	27	09:22 (Hild 4)	18:28	27	08:35 (Hild 2)	20:19	21:08	21:43	21:38	20:52
29	08:25	07:41	08:56 (Hild 4)	06:42	08:09 (Hild 2)	06:33	05:37	05:10	05:27	06:11	07:00	07:48
30	16:47	17:40	25	09:21 (Hild 4)	18:29	25	08:34 (Hild 2)	20:21	21:09	21:43	21:37	20:50
31	08:24	07:39	08:57 (Hild 4)	06:40	08:10 (Hild 2)	06:31	05:35	05:10	05:28	06:12	07:01	07:50
1	16:48	17:42	23	09:20 (Hild 4)	18:31	23	08:33 (Hild 2)	20:23	21:11	21:44	21:36	20:48
2	08:23	07:38	08:58 (Hild 4)	06:38	08:11 (Hild 2)	06:29	05:34	05:10	05:29	06:14	07:03	07:52
3	16:50	17:44	21	09:19 (Hild 4)	18:33	19	08:30 (Hild 2)	20:24	21:12	21:44	21:35	20:46
4	08:22	07:36	08:59 (Hild 4)	06:36	08:13 (Hild 2)	06:27	05:33	05:10	05:30	06:16	07:04	07:53
5	16:51	17:46	19	09:19 (Hild 4)	18:35	15	08:28 (Hild 2)	20:26	21:14	21:45	21:34	20:44
6	08:21	07:34	09:01 (Hild 4)	06:33	08:17 (Hild 2)	06:25	05:31	05:10	05:32	06:17	07:06	07:55
7	16:53	17:48	14	09:15 (Hild 4)	18:36	6	08:23 (Hild 2)	20:28	21:15	21:45	21:33	20:42
8	08:20	07:32	09:05 (Hild 4)	06:31	08:23 (Hild 2)	06:23	05:30	05:10	05:33	06:19	07:08	07:57
9	16:54	17:49	7	09:12 (Hild 4)	18:38	20	08:20 (Hild 2)	20:29	21:17	21:45	21:31	20:40
10	08:19	07:30		06:29	08:20	05:28	05:10	05:34	06:20	07:09	07:58	08:47
11	16:56	17:51		18:40	20:31	21:18	21:46	21:30	20:38	19:29	18:23	16:32
12	08:18	07:28		06:27	08:18	05:27	05:10	05:35	06:22	07:11	08:00	08:49
13	16:58	17:53		18:41	20:33	21:19	21:46	21:29	20:36	19:27	18:21	16:30
14	08:17	07:26		06:24	08:16	05:26	05:10	05:37	06:24	07:12	08:02	08:51
15	16:59	17:55		18:43	20:34	21:21	21:46	21:28	20:34	19:24	18:19	16:29
16	08:16	07:24	08:15 (Hild 1)	06:22	08:14	05:25	05:11	05:38	06:25	07:14	08:04	08:50
17	17:01	17:57	10	08:25 (Hild 1)	18:45	20:36	21:22	21:46	21:26	20:31	19:22	18:17
18	08:15	07:21	08:13 (Hild 1)	06:20	08:12	05:24	05:11	05:39	06:27	07:16	08:06	08:52
19	17:03	17:58	15	08:28 (Hild 1)	18:46	20:37	21:23	21:46	21:25	20:29	19:20	18:15
20	08:13	07:19	08:11 (Hild 1)	06:18	08:10	05:23	05:11	05:41	06:28	07:17	08:07	08:54
21	17:05	18:00	18	08:29 (Hild 1)	18:48	20:39	21:25	21:46	21:24	20:27	19:18	18:12
22	08:12	07:17	08:10 (Hild 1)	06:15	08:08	05:21	05:12	05:42	06:30	07:19	08:09	08:51
23	17:06	18:02	20	08:30 (Hild 1)	18:50	20:41	21:26	21:46	21:22	20:25	19:15	18:10
24	08:11	07:15	08:08 (Hild 1)	06:13	08:06	05:20	05:12	05:44	06:31	07:20	08:10	08:50
25	17:08	18:04	22	08:30 (Hild 2)	18:51	20:42	21:27	21:46	21:21	20:23	19:13	18:08
26	08:09			07:11	08:04	05:19	05:13	05:45	06:33	07:22	08:12	08:52
27	17:10			19:53	20:44	21:28	21:46	21:19	20:21	19:11	18:06	17:07
28	08:08		09:05 (Hild 4)		07:09	08:03	05:19	05:13	05:47	06:35	07:24	08:14
29	17:12	5	09:10 (Hild 4)		19:55	20:46	21:29	21:46	21:18	20:19	19:08	18:03
30	08:07		09:02 (Hild 4)		07:06		05:18		05:48	06:36		07:16
31	17:13	12	09:14 (Hild 4)		19:56		21:31		21:16	20:16		17:03
Sonnenscheinstunden	262	279		367	504	415	482	495	499	452	380	333
astr.max.mögl.Beschattung	17	550		504							133	691
Red. Sonnenscheinwahrsch.	0.19	0.26		0.33							0.37	0.30
Reduktion Betriebsdauer	0.98	0.98		0.98							0.98	0.98
Reduktion Windrichtung	0.61	0.62		0.64							0.64	0.63
Gesamte Reduktion	0.11	0.16		0.21							0.23	0.18
Met. wahrsch. Beschattung	2	88		105							31	128

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

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

Projekt:	Beschreibung:	Lizenzierter Anwender:
24-1-3219-001	Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW	Ramboll Deutschland GmbH Elisabeth-Consbruch-Straße 3 DE-34131 Kassel - H. Ristow / hri@ramboll.com Berechnet: 21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: H55 - Hildfeld, Am Ufer 13

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
538	347	302	494	560	497	650	937	1.350	1.257	937	732	8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

RAMBOLL

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: K01 - Küstelberg, Zum Hillekopf 24

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe

538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:31 16:28	08:05 17:15	07:13 18:05	07:04 19:58	06:01 20:47	05:17 21:32	05:14 21:45	20:59 (Hild 3) 21:05 (Hild 3)	05:49 21:15	06:38 20:14	07:25 19:06	07:17 16:22
2	08:31 16:29	08:03 17:17	07:11 18:07	07:02 19:59	05:59 20:49	05:16 21:33	05:15 21:45	20:59 (Hild 3) 21:05 (Hild 3)	05:51 21:13	06:39 20:12	07:27 19:04	07:19 16:22
3	08:30 16:31	08:02 17:19	07:09 18:09	06:59 20:01	05:57 20:50	05:15 21:34	05:15 21:45	20:59 (Hild 3) 21:05 (Hild 3)	05:52 21:11	06:41 20:10	07:28 19:02	07:21 16:21
4	08:30 16:32	08:00 17:20	07:07 18:10	06:57 20:03	05:55 20:52	05:14 21:35	05:16 21:44	20:59 (Hild 3) 21:05 (Hild 3)	05:54 21:10	06:42 20:07	07:30 18:59	07:23 16:21
5	08:30 16:33	07:59 17:22	07:04 18:12	06:55 20:04	05:53 20:54	05:14 21:36	05:17 21:44	20:59 (Hild 3) 21:05 (Hild 3)	05:55 21:08	06:44 20:05	07:32 18:57	07:24 16:20
6	08:30 16:34	07:57 17:24	07:02 18:14	06:53 20:06	05:51 20:55	05:13 21:37	05:18 21:43	20:59 (Hild 3) 21:05 (Hild 3)	05:57 21:06	06:45 20:03	07:26 18:55	07:25 16:20
7	08:29 16:35	07:55 17:26	07:00 18:16	06:50 20:08	05:50 20:57	05:13 21:37	05:19 21:43	20:59 (Hild 3) 21:05 (Hild 3)	05:58 21:04	06:47 20:01	07:35 18:53	07:28 16:19
8	08:29 16:37	07:54 17:28	06:58 18:17	06:48 20:09	05:48 20:58	05:12 21:38	05:19 21:42	20:59 (Hild 3) 21:05 (Hild 3)	06:00 21:03	06:49 19:58	07:36 18:50	07:30 16:19
9	08:28 16:38	07:52 17:29	06:56 18:19	06:46 20:11	05:46 21:00	05:12 21:39	05:20 21:41	20:59 (Hild 3) 21:05 (Hild 3)	06:02 21:01	06:50 19:56	07:38 18:48	07:31 16:19
10	08:28 16:39	07:50 17:31	06:53 18:21	06:44 20:13	05:45 21:01	05:11 21:40	05:21 21:41	20:59 (Hild 3) 21:05 (Hild 3)	06:03 20:59	06:52 19:54	07:40 18:46	07:33 16:19
11	08:27 16:41	07:48 17:33	6 16:36 (VB KU01) 16:42 (VB KU01)	06:51 18:23	06:42 20:14	05:43 21:03	05:11 21:41	20:56 (Hild 3) 21:00 (Hild 3)	06:05 20:57	06:53 19:52	07:41 18:44	07:35 16:18
12	08:27 16:42	07:47 17:35	16:35 (VB KU01) 16:43 (VB KU01)	06:49 18:24	06:39 20:16	05:41 21:05	05:11 21:41	20:55 (Hild 3) 21:02 (Hild 3)	06:06 20:58	06:55 19:49	07:43 18:42	07:36 16:18
13	08:26 16:43	07:45 17:40	16:34 (VB KU01) 16:44 (VB KU01)	06:47 18:24	06:37 20:18	05:40 21:06	05:10 21:42	20:53 (Hild 3) 21:02 (Hild 3)	06:05 20:58	06:56 19:49	07:45 18:42	07:38 16:18
14	08:25 16:45	07:43 17:41	16:33 (VB KU01) 16:44 (VB KU01)	06:45 18:28	06:35 20:19	05:38 21:08	05:10 21:43	20:53 (Hild 3) 21:03 (Hild 3)	06:09 20:51	06:58 19:45	07:46 18:37	07:40 16:18
15	08:25 16:46	07:41 17:40	16:33 (VB KU01) 16:44 (VB KU01)	06:42 18:29	06:33 20:21	05:37 21:09	05:10 21:43	20:53 (Hild 3) 21:04 (Hild 3)	06:11 20:50	07:00 19:43	07:48 18:35	07:42 16:18
16	08:24 16:48	07:39 17:42	16:34 (VB KU01) 16:45 (VB KU01)	06:40 18:31	06:31 20:22	05:35 21:11	05:10 21:44	20:52 (Hild 3) 21:05 (Hild 3)	06:12 20:48	07:01 19:40	07:50 18:33	07:43 16:19
17	08:23 16:50	07:37 17:44	16:35 (VB KU01) 16:43 (VB KU01)	06:38 18:33	06:29 20:24	05:34 21:12	05:10 21:44	20:52 (Hild 3) 21:05 (Hild 3)	06:14 20:46	07:03 19:38	07:51 18:31	07:45 16:19
18	08:22 16:51	07:35 17:46	16:37 (VB KU01) 16:41 (VB KU01)	06:36 18:34	06:27 20:26	05:32 21:13	05:10 21:44	20:52 (Hild 3) 21:06 (Hild 3)	06:16 20:44	07:04 19:36	07:53 18:29	07:47 16:19
19	08:21 16:53	07:33 17:48	06:33 18:36	06:25 20:27	05:31 21:15	05:10 21:45	05:10 21:45	20:52 (Hild 3) 21:06 (Hild 3)	06:17 20:42	07:06 19:33	07:55 18:27	07:48 16:19
20	08:20 16:54	07:31 17:49	06:31 18:38	06:22 20:29	05:30 21:16	05:10 21:45	05:10 21:45	20:53 (Hild 3) 21:07 (Hild 3)	06:19 20:40	07:08 19:31	07:57 18:25	07:50 16:20
21	08:19 16:56	07:29 17:51	06:29 18:39	06:20 20:31	05:28 21:18	05:10 21:45	05:10 21:45	20:53 (Hild 3) 21:07 (Hild 3)	06:20 20:38	07:09 19:29	07:58 18:23	07:52 16:20
22	08:18 16:58	07:27 17:53	06:26 18:41	06:18 20:32	05:27 21:19	05:10 21:46	05:10 21:46	20:53 (Hild 3) 21:07 (Hild 3)	06:22 20:35	07:11 19:27	08:00 18:21	07:53 16:21
23	08:17 16:59	07:25 17:55	06:24 18:43	06:16 20:34	05:26 21:20	05:10 21:46	05:10 21:46	20:53 (Hild 3) 21:07 (Hild 3)	06:23 20:33	07:12 19:24	08:02 18:19	07:55 16:21
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27	08:12 17:06	07:17 18:02	06:15 18:49	06:08 20:41	05:21 21:26	05:12 21:46	05:12 21:46	20:56 (Hild 3) 21:07 (Hild 3)	06:30 20:25	07:19 19:15	07:09 17:11	08:01 16:24
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30	08:08 17:11		07:08 19:54	06:02 20:45	05:18 21:29	05:13 21:45	05:13 21:45	20:57 (Hild 3) 21:06 (Hild 3)	06:34 20:18	07:23 19:08	07:14 17:05	08:06 16:26
31	08:06 17:13		07:06 19:56		05:18 21:30			20:57 (Hild 3) 20:56 (Hild 3)	06:36 20:16	07:16 17:03	07:16 16:11	08:31 16:27
Sonnenscheinstunden	262	279	367	415	482	495	498	452	380	333	269	247
astr.max.mögl.Beschattung		68				232	6			70		
Red.Sonnenscheinwahrsch.		0,26				0,39	0,40			0,30		
Reduktion Betriebsdauer		0,98				0,98	0,98			0,98		
Reduktion Windrichtung		0,68				0,63	0,63			0,68		
Gesamte Reduktion		0,18				0,24	0,25			0,20		
Met. wahrsch. Beschattung		12				56	1			14		

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)

24-1-3219-001 S Schattenwurfprognose Hillekopf-Winterberg

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3
DE-34131 Kassel

H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Kalender

Berechnung: Gesamtbelastung Schattenrezeptor: K02 - Küstelberg, Zum Hillekopf 30

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez
1,58 2,64 3,90 5,63 6,26 6,50 6,48 6,13 4,67 3,19 1,70 1,23

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe
538 347 302 494 560 497 650 937 1.350 1.257 937 732 8.601

Startwindgeschwindigkeit: Startwindgeschw. aus Leistungskennlinie

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

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consruch-Straße 3
DE-34131 Kassel

RAMBOLL

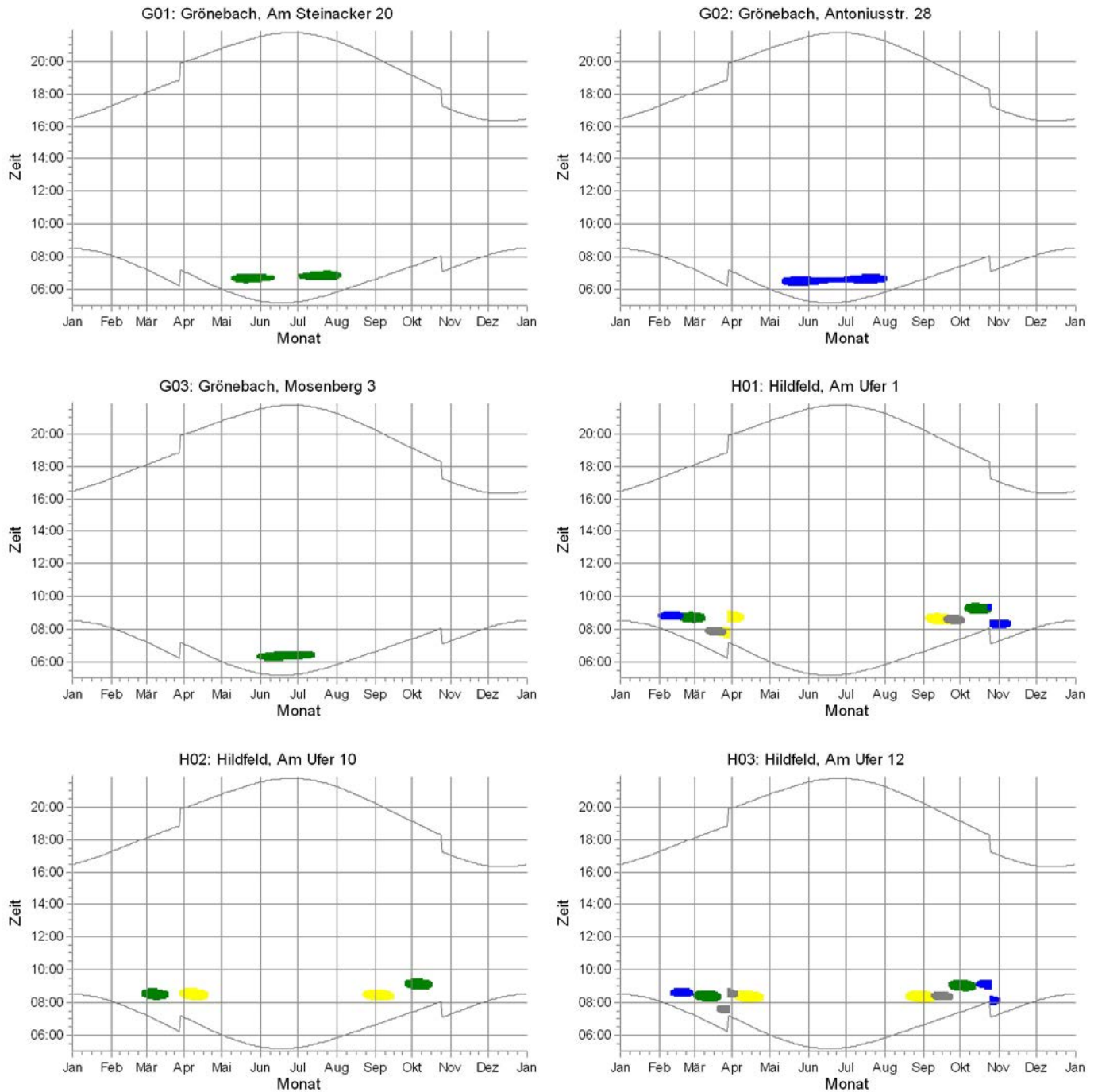
H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA

	Hild 4: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)
	Hild 2: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)
	Hild 3: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (101)
	Hild 1: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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Elisabeth-Consruch-Straße 3
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RAMBOLL

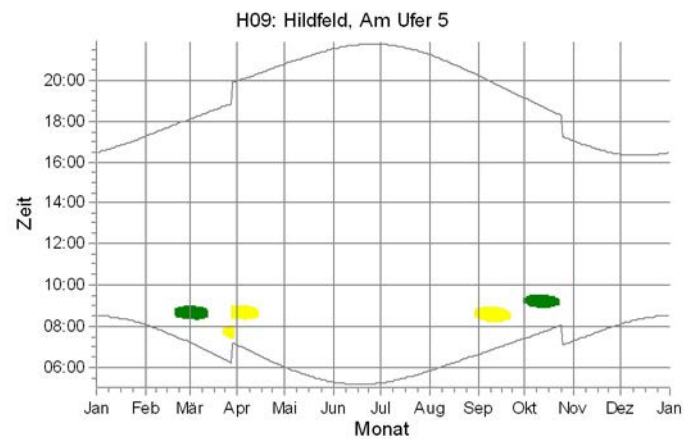
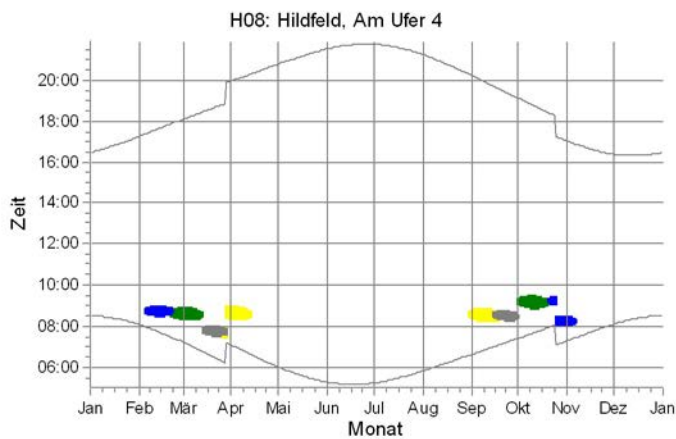
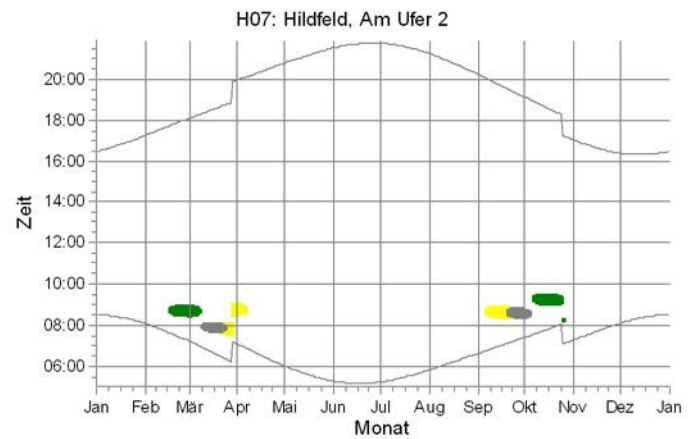
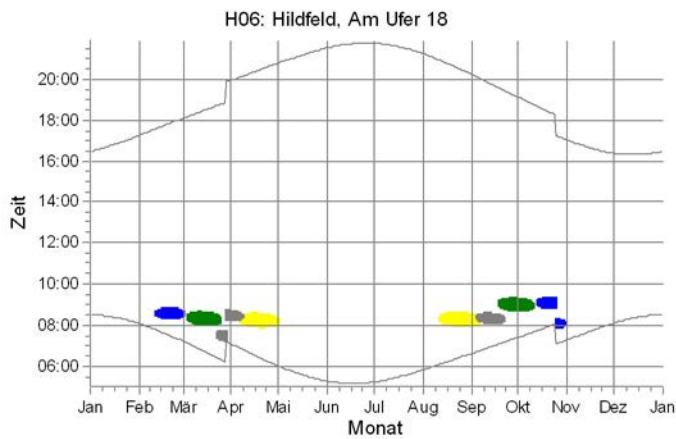
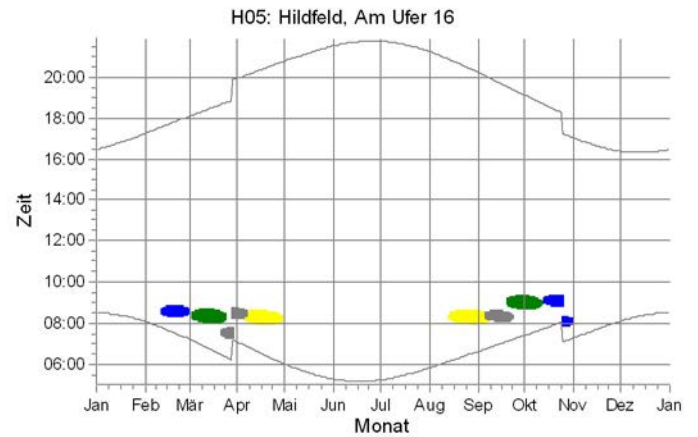
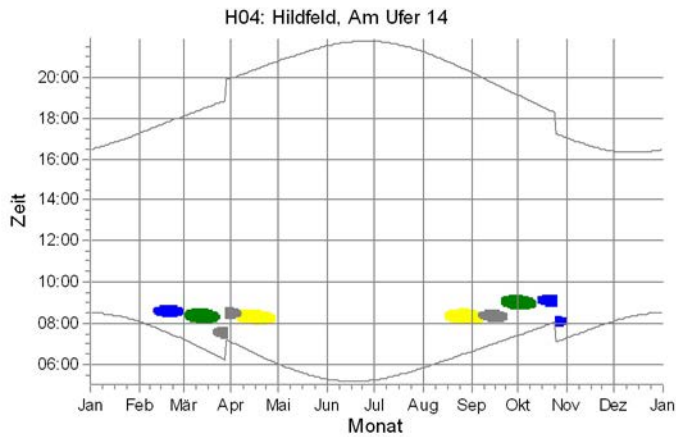
H. Ristow / hri@ramboll.com

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SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA

	Hild 4: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)
	Hild 2: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)
	Hild 3: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (101)
	Hild 1: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

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RAMBOLL

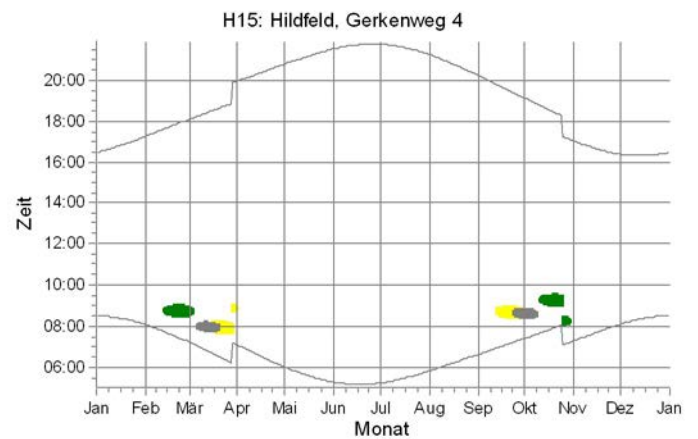
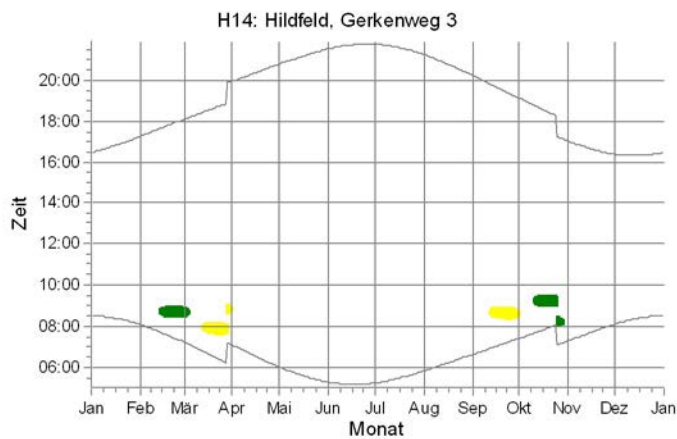
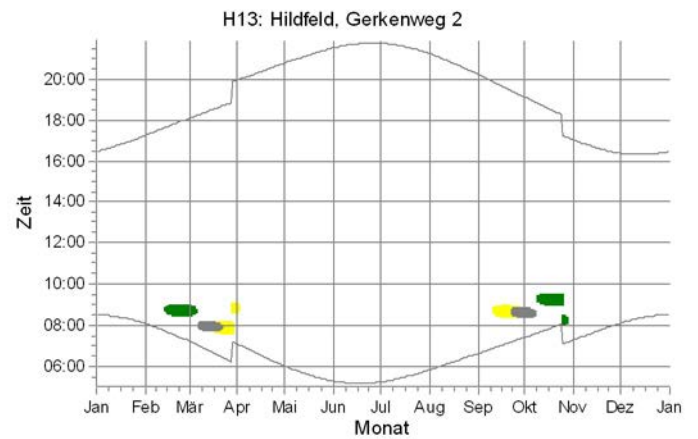
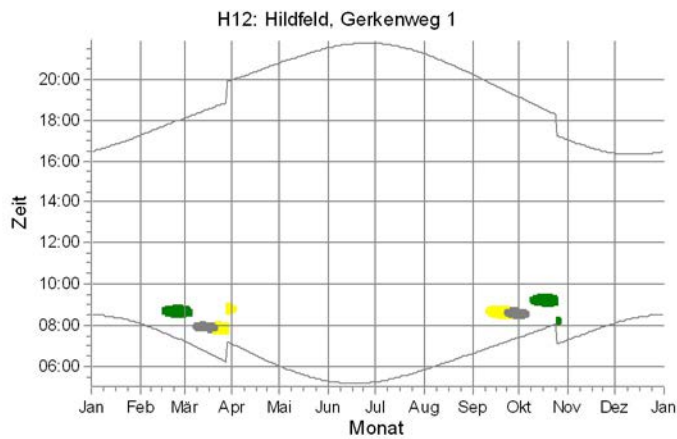
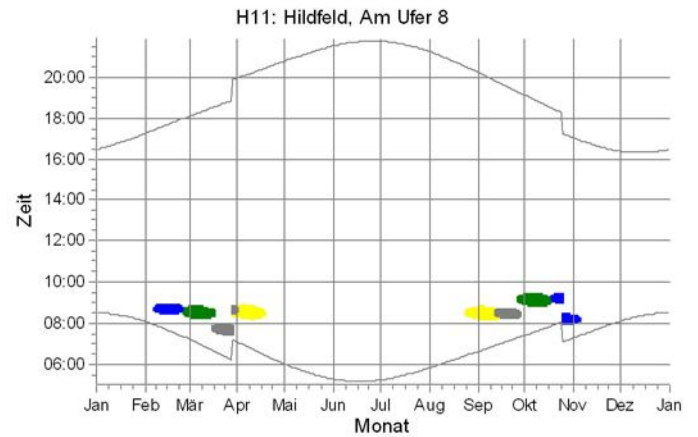
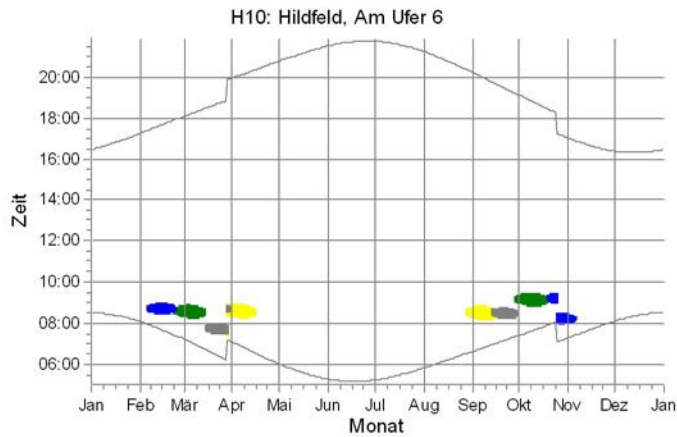
H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA

	Hild 4: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)
	Hild 2: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)
	Hild 3: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (101)
	Hild 1: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

Ramboll Deutschland GmbH
Elisabeth-Consruch-Straße 3
DE-34131 Kassel

RAMBOLL

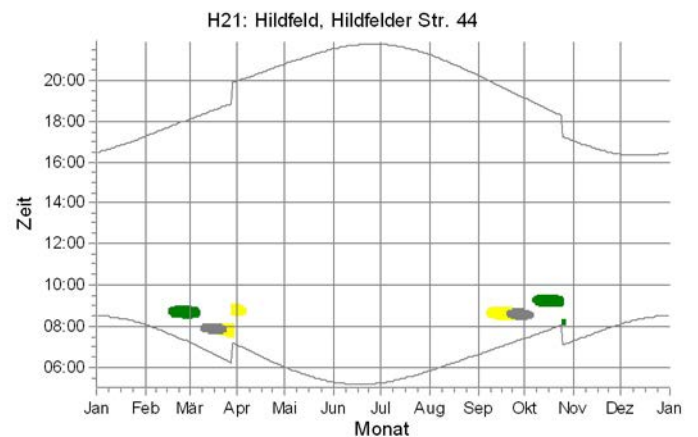
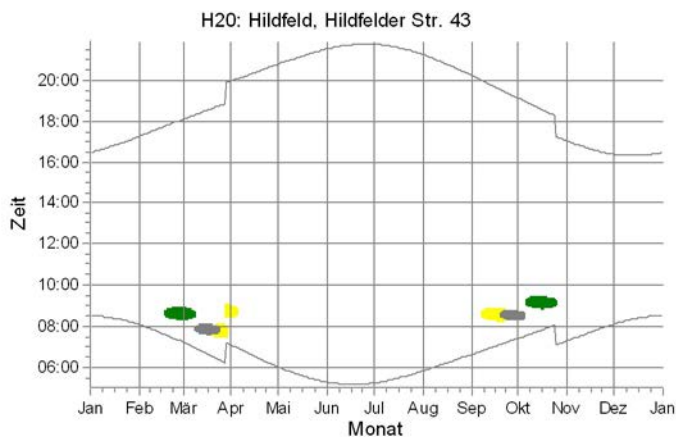
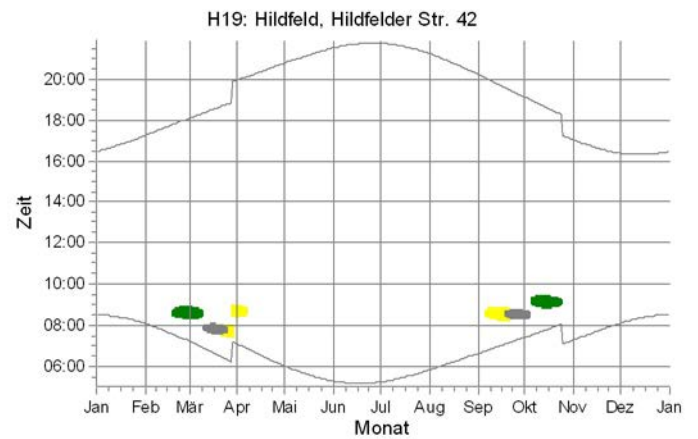
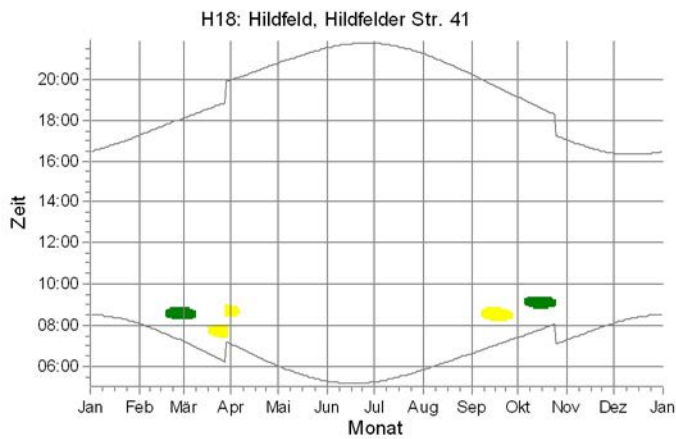
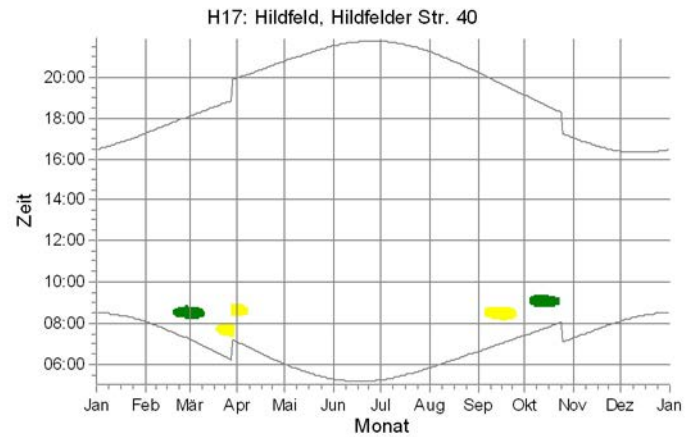
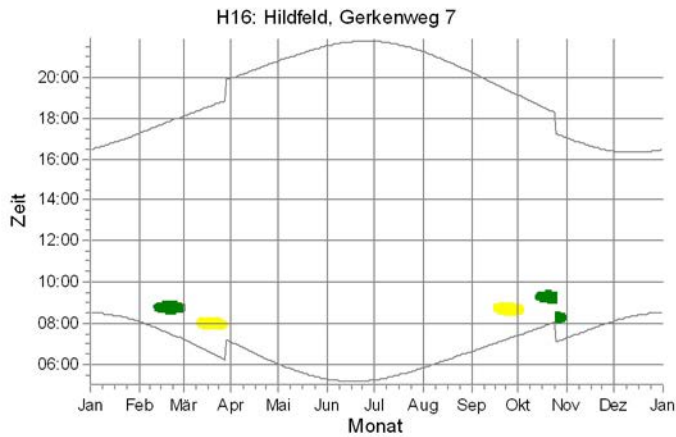
H. Ristow / hri@ramboll.com

Berechnet:

21.03.2025 11:20/4.1.273

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA



Hild 4: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (99)

Hild 2: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (100)

Hild 1: ENERCON E-175 EP5 E2 7000 175.0 !O! NH: 175,0 m (Ges:262,5 m) (102)

Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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DE-34131 Kassel

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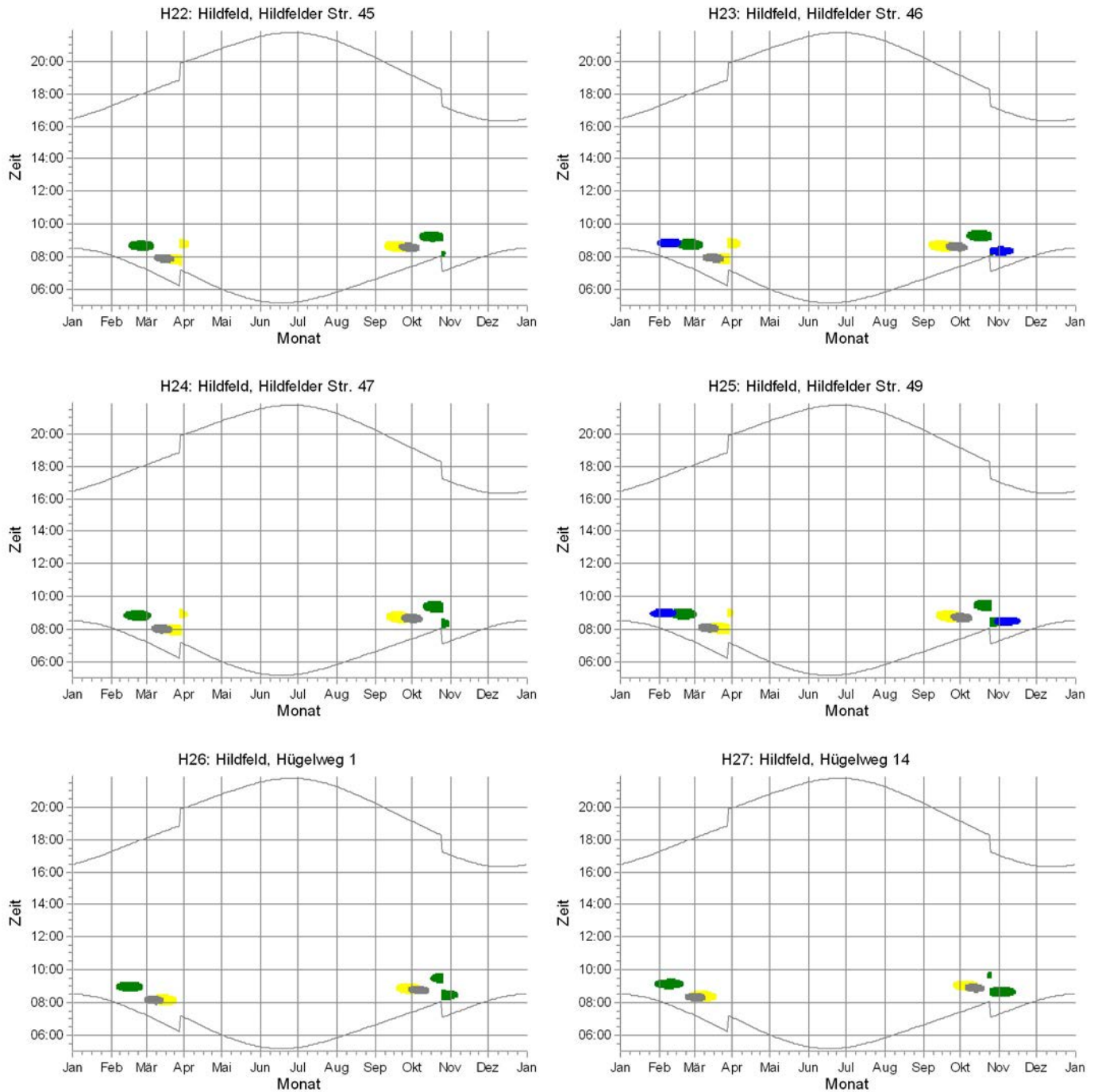
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21.03.2025 11:20/4.1.273

RAMBOLL

SHADOW - Grafischer Kalender

Berechnung: Gesamtbelastung



WEA

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Projekt:

24-1-3219-001

Beschreibung:

Windpark Hillekopf-Winterberg, Stadt Winterberg, Hochsauerlandkreis, NRW

Lizenzierter Anwender:

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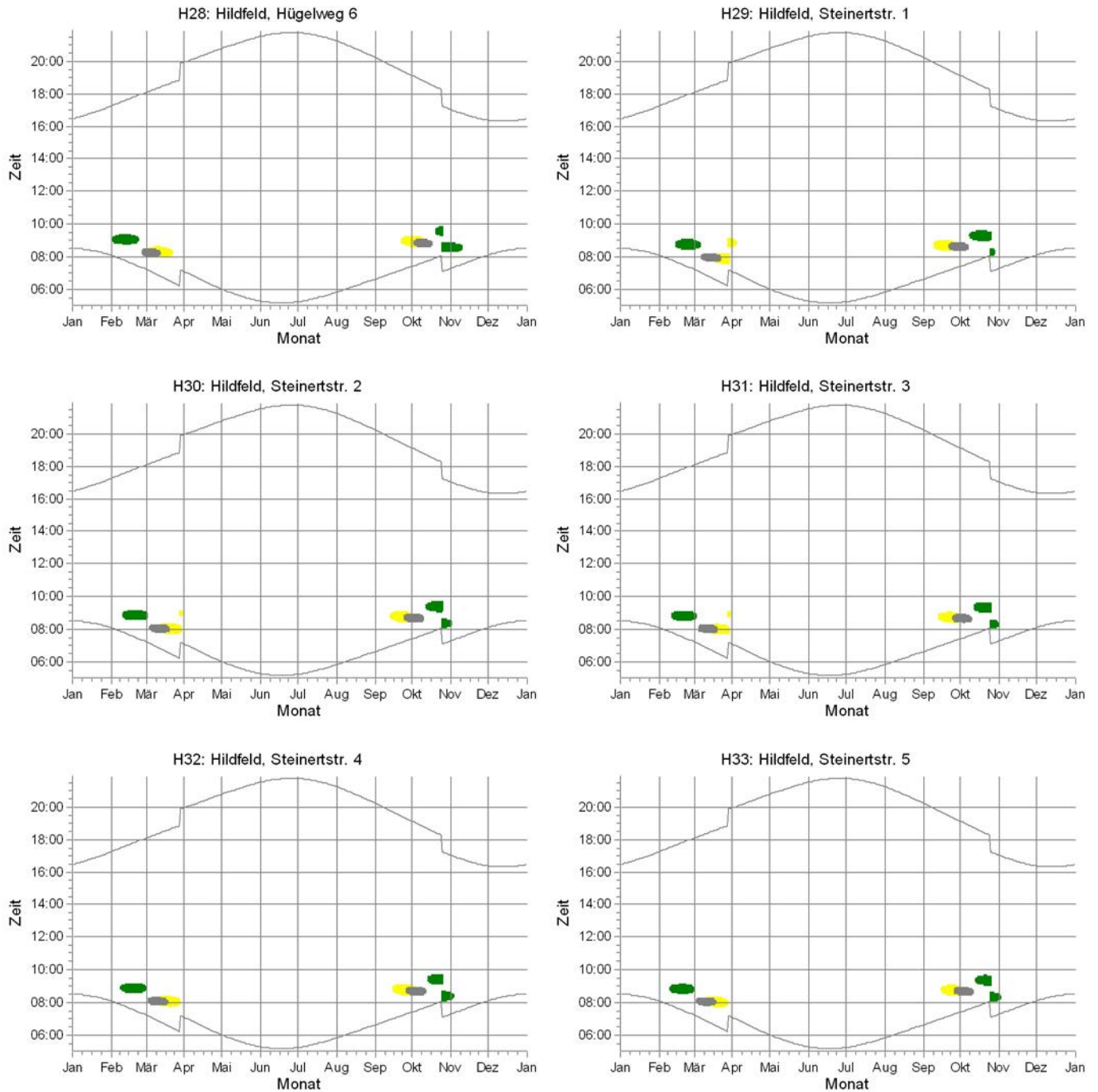
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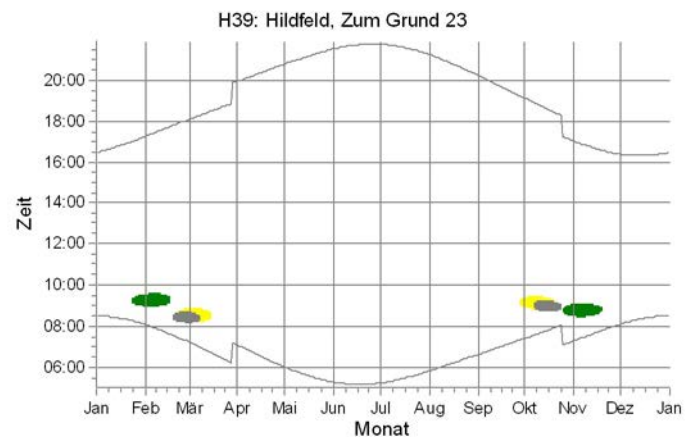
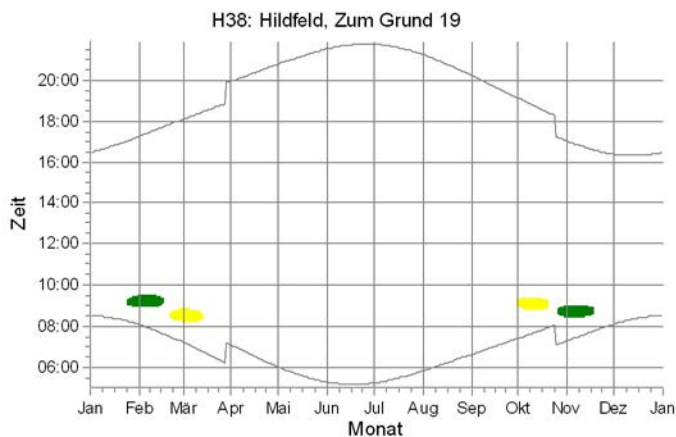
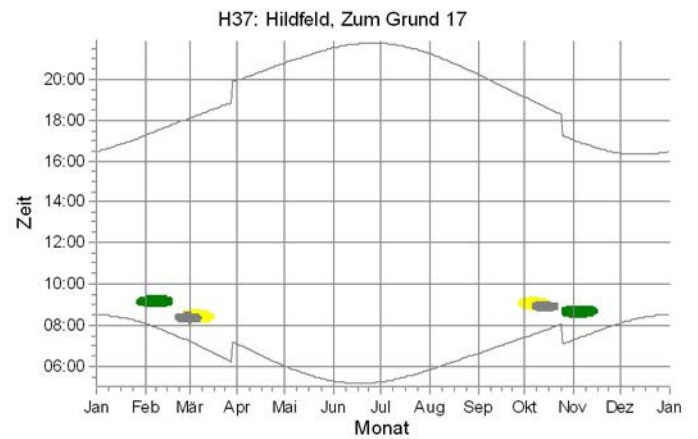
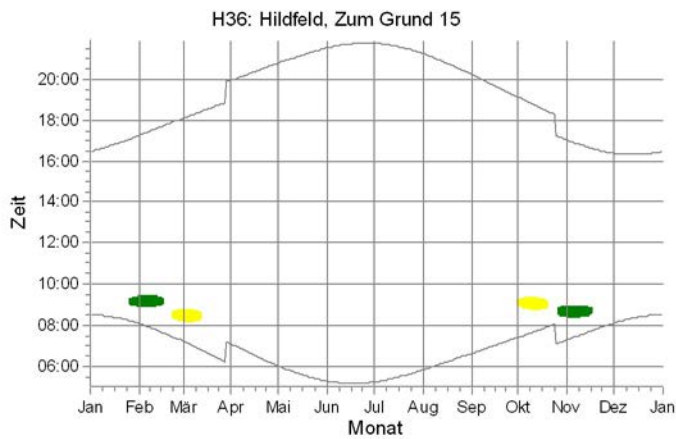
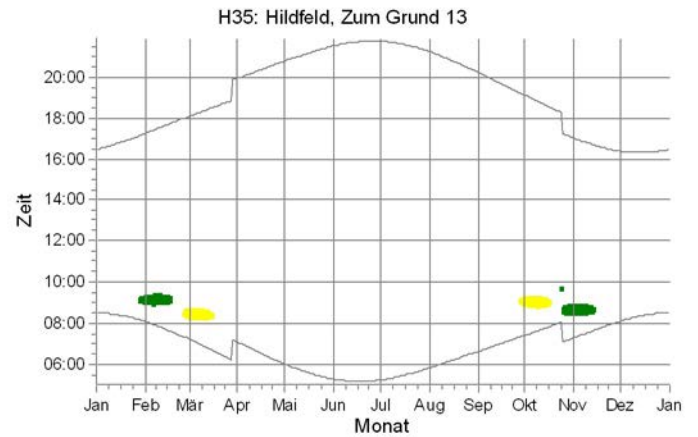
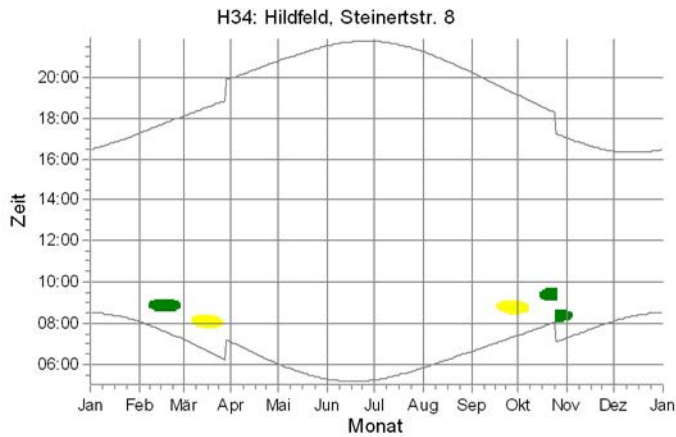
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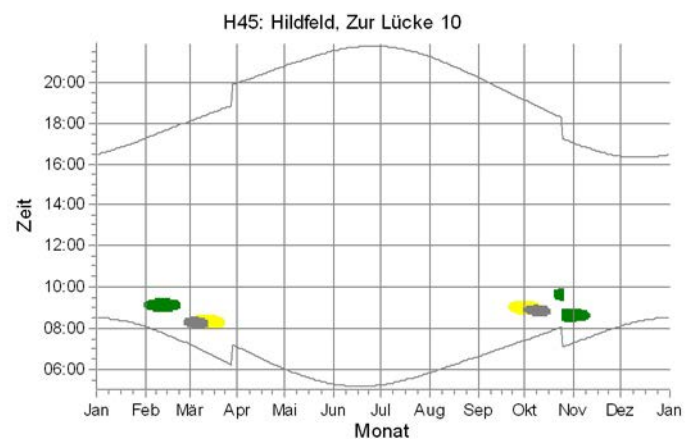
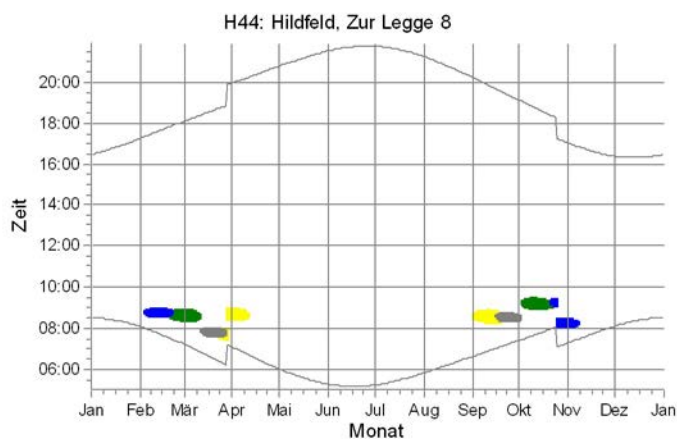
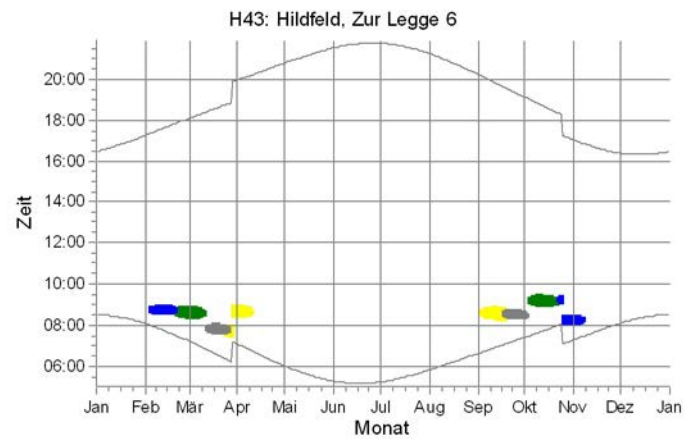
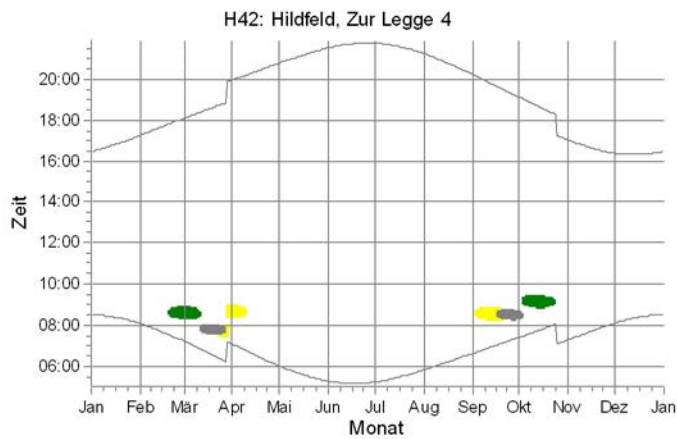
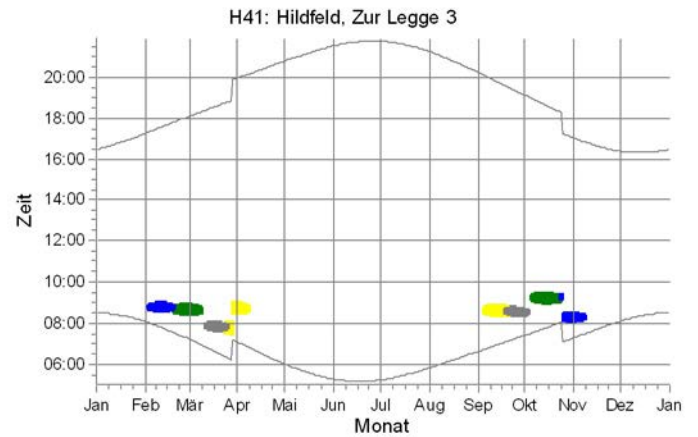
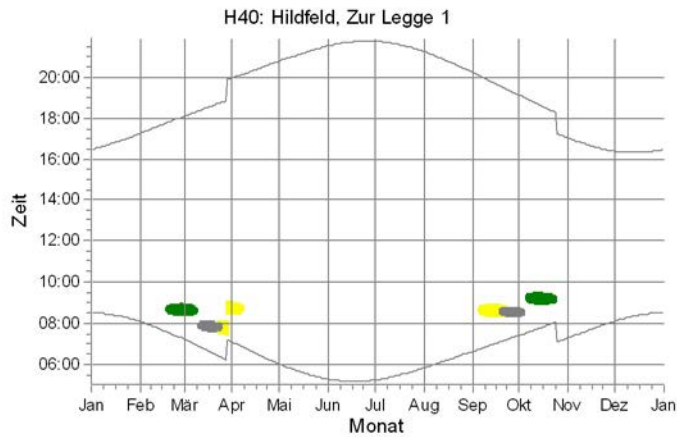
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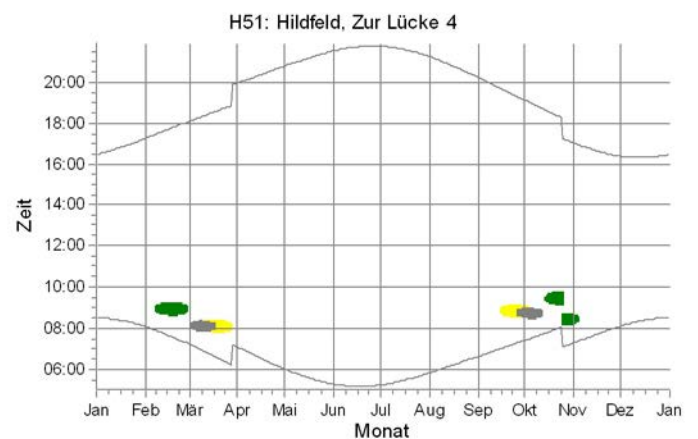
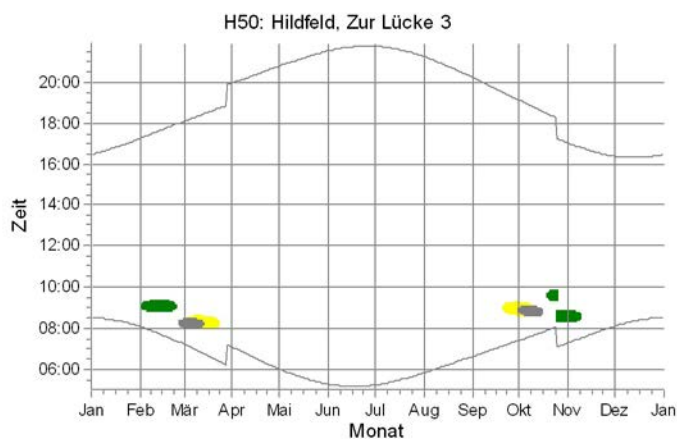
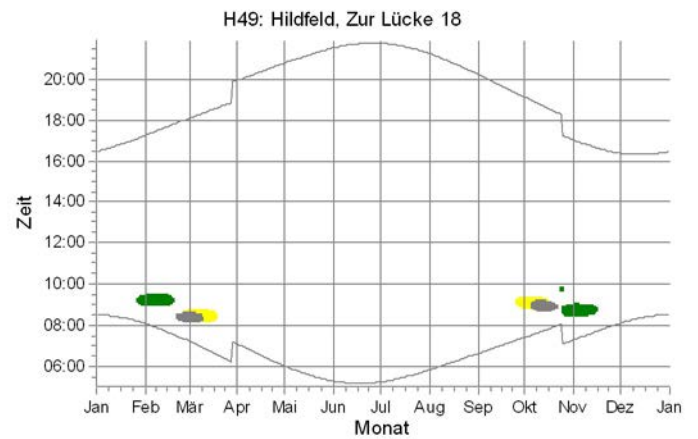
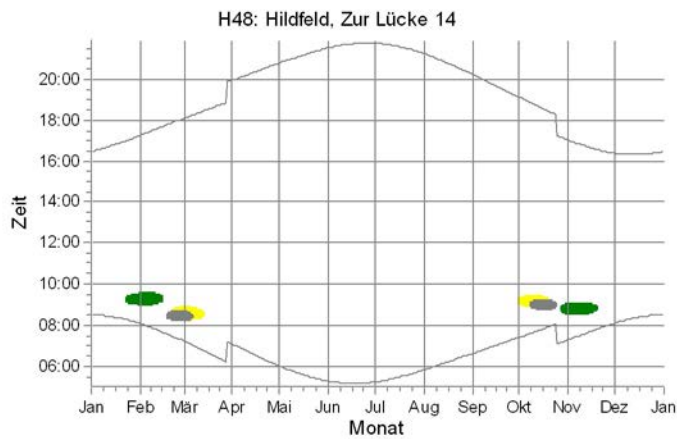
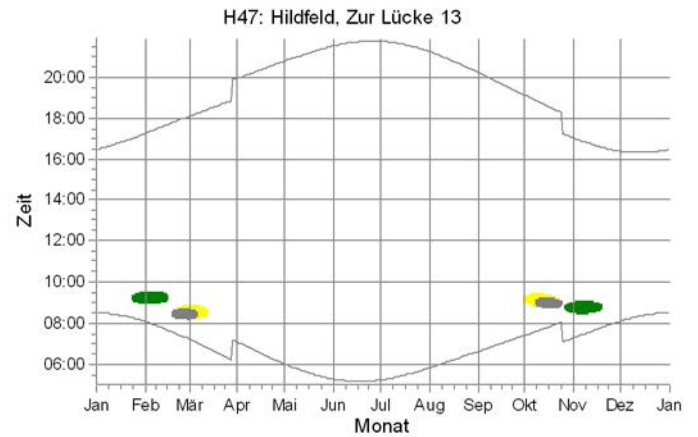
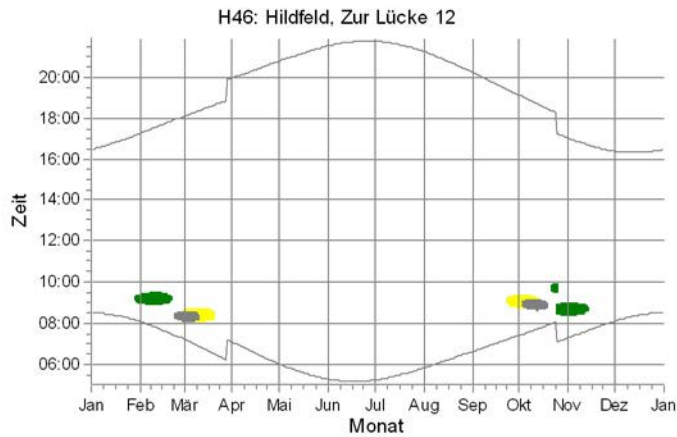
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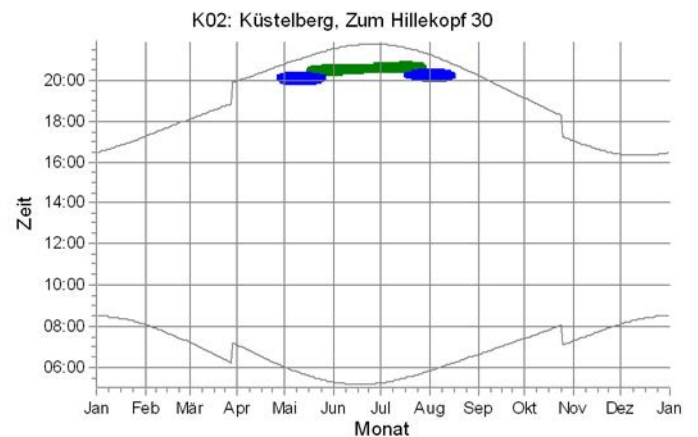
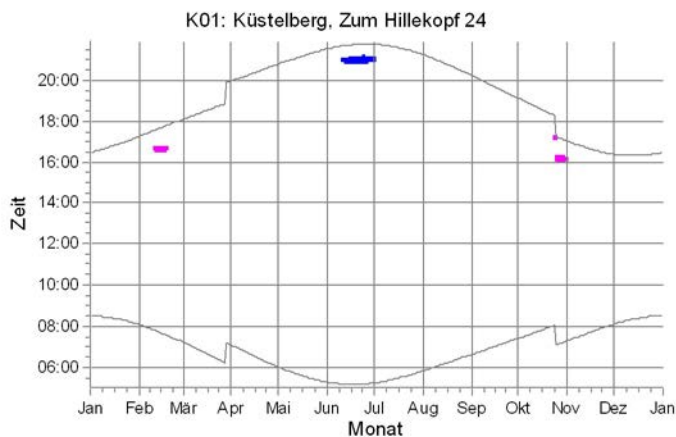
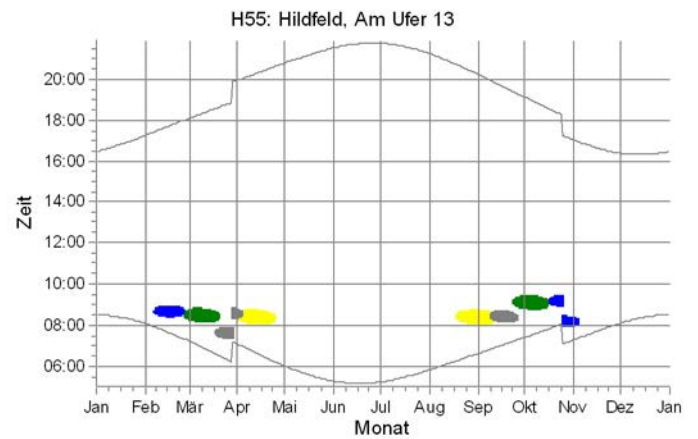
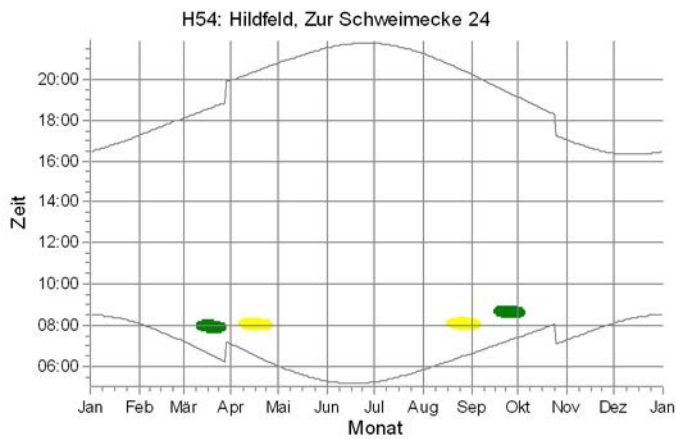
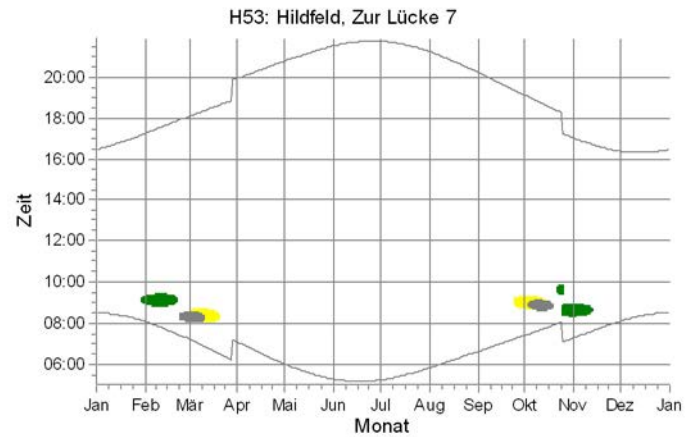
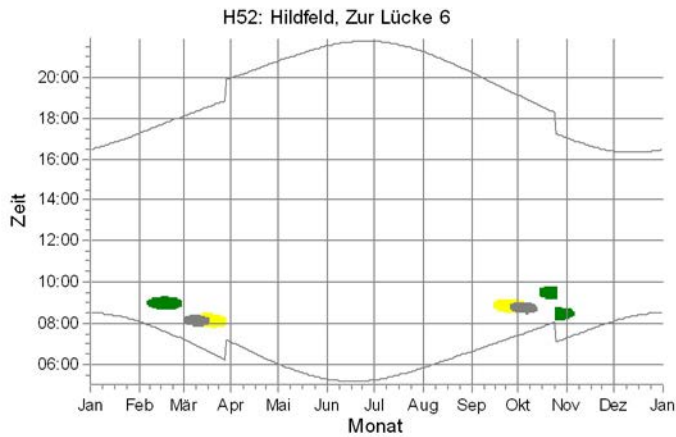
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Anhang: Akkreditierung und theoretische Grundlagen

Akkreditierung



Die Deutsche Akkreditierungsstelle bestätigt mit dieser **Akkreditierungsurkunde**, dass das Prüflaboratorium

Ramboll Deutschland GmbH
Elisabeth-Consbruch-Straße 3, 34131 Kassel
Lister Straße 9, 30163 Hannover

die Anforderungen gemäß DIN EN ISO/IEC 17025:2018 für die in der Anlage zu dieser Urkunde aufgeführten Konformitätsbewertungstätigkeiten erfüllt. Dies schließt zusätzliche bestehende gesetzliche und normative Anforderungen an das Prüflaboratorium ein, einschließlich solcher in relevanten sektoralen Programmen, sofern diese in der Anlage zu dieser Urkunde ausdrücklich bestätigt werden.

Die Anforderungen an das Managementsystem in der DIN EN ISO/IEC 17025 sind in einer für Prüflaboratorien relevanten Sprache verfasst und stehen insgesamt in Übereinstimmung mit den Prinzipien der DIN EN ISO 9001.

Diese Akkreditierung wurde gemäß Art. 5 Abs. 1 Satz 2 VO (EG) 765/2008, nach Durchführung eines Akkreditierungsverfahrens unter Beachtung der Mindestanforderungen der DIN EN ISO/IEC 17011 und auf Grundlage einer Bewertung und Entscheidung durch den eingesetzten Akkreditierungsausschuss ausgestellt.

im Auftrag 

Diese Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 16.07.2024 mit der Akkreditierungsnummer D-PL-21488-01.
Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 04 Seiten.

Registrierungsnummer der Akkreditierungsurkunde: **D-PL-21488-01-00**

Berlin, 16.07.2024 Im Auftrag B. Sc. Maik Kadraha
Fachbereichsleitung

Diese Urkunde gibt den Stand zum Zeitpunkt des Ausstellungsdatums wieder. Der jeweils aktuelle Stand der gültigen und überwachten Akkreditierung ist der Datenbank akkreditierter Stellen der Deutschen Akkreditierungsstelle zu entnehmen (www.dakks.de).

[Akkreditierungsurkunde](#)

THEORETISCHE GRUNDLAGEN

1 SONNENSTAND

Der Sonnenstand bildet die Grundlage für die Berechnung des Schattenwurfs. Der Stand der Sonne am Firmament ist im Wesentlichen von der geographischen Position sowie von der Tages- und der Jahreszeit abhängig, wobei die Erdrotation, die Neigung der Erdachse und der elliptischen Laufbahn der Erde um die Sonne berücksichtigt werden.

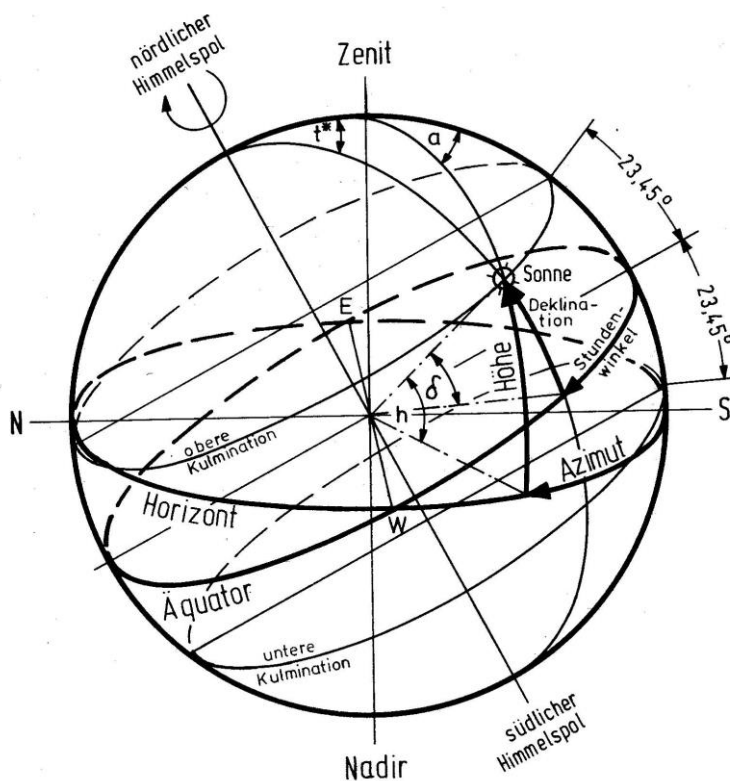


Abbildung 1: Winkelzusammenhänge des Sonnenstands an einem Betrachtungspunkt

Mit diesen Daten werden die Deklination δ , der Stundenwinkel ω , die Sonnenhöhe h , der Azimut γ sowie der Sonnenauf- und -untergang t_a und t_u berechnet. Die Begriffe bedeuten:

- **Deklination δ :** Jahresgang der Sonne. Winkel, in welchem sich die Sonne im Verlauf der Jahreszeiten über den Zenit am Äquator in südlicher und nördlicher Richtung hinausbewegt. [Winteranfang (21.12.) $-23,45^\circ$; Sommeranfang (21.6.) $23,45^\circ$; Herbst- (23.9.) und Frühlingsanfang (21.3.) 0°]
- **Sonnenhöhe h :** Einfallswinkel der Sonne gegenüber einer horizontalen Fläche.
- **Stundenwinkel ω :** Winkel zwischen dem Sonnenhöchststand und der aktuellen Sonneneinstrahlung.

- **Azimet γ :** Winkel zwischen der Südrichtung und dem auf die horizontale Ebene projizierten Sonnenstand.
- **Sonnenaufgang t_a , Sonnenuntergang t_u :** Aufgang/Untergang in dem Moment, wenn der Sonnenmittelpunkt über der horizontalen Fläche morgens/abends am Horizont sichtbar/verdeckt wird.

Die Berechnungen berücksichtigen die sich verändernde Tageslänge von einem zum nächsten Sonnenhöchststand, die aufgrund der elliptischen Umlaufbahn der Erde um die Sonne um bis zu 16 Minuten variiert. In Abbildung 2 ist die Abweichung (Zeitkorrektur) der Tagesdauer von einem 24-Stunden Tag sowie die Deklination über ein Jahr dargestellt.

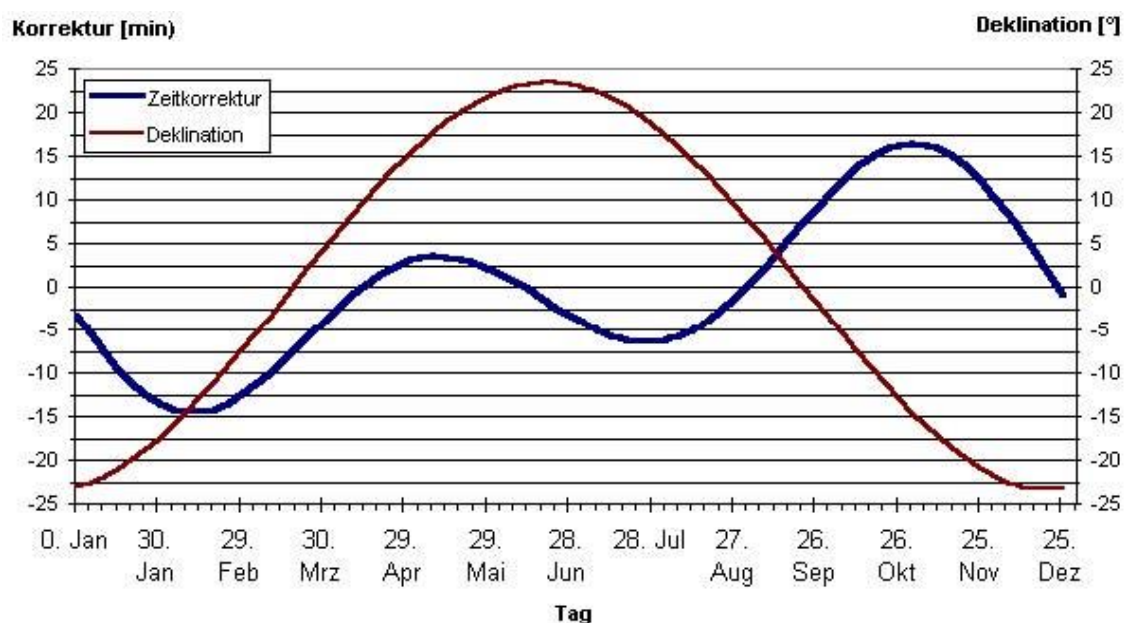


Abbildung 2: Zeitkorrektur und Deklination über ein Jahr

Da die Ergebnisse nicht nur für ein Jahr gültig sein sollen, wird in den Berechnungen die Zahl der Tage pro Jahr auf 365,25 Tage gemittelt. Dadurch können sich die Ergebnisse innerhalb eines Zeitraums von vier Jahren um bis zu einem Tag verschieben.

2 SCHATTENWURF VON WEA

2.1 Beschattungsbereich

Periodischer Schattenwurf wird durch die sich bewegenden Rotorblätter einer WEA erzeugt. Der Bereich, in dem der periodische Schattenwurf einer WEA untersucht werden muss (*Beschattungsbereich*), ist definiert als der Bereich, von dem aus die Sonnenscheibe mehr als 20 % durch das Rotorblatt verdeckt wird. Wird durch ein Rotorblatt weniger als 20 % der Sonnenscheibe verdeckt, so ist der dadurch entstehende Helligkeitswechsel wenig wahrnehmbar und nicht mehr relevant. Da die Breite eines Rotorblatts nicht über die ganze Länge konstant ist, wird, um den Beschattungsbereich zu berechnen, ersatzweise ein rechteckiges Rotorblatt mit einer mittleren Blatattiefe ermittelt und zugrunde gelegt. Abbildung 3 zeigt den Verlauf der Schattenintensität bei einem typischen Rotorblatt von rund 63 m Länge in Abhängigkeit von der Entfernung.

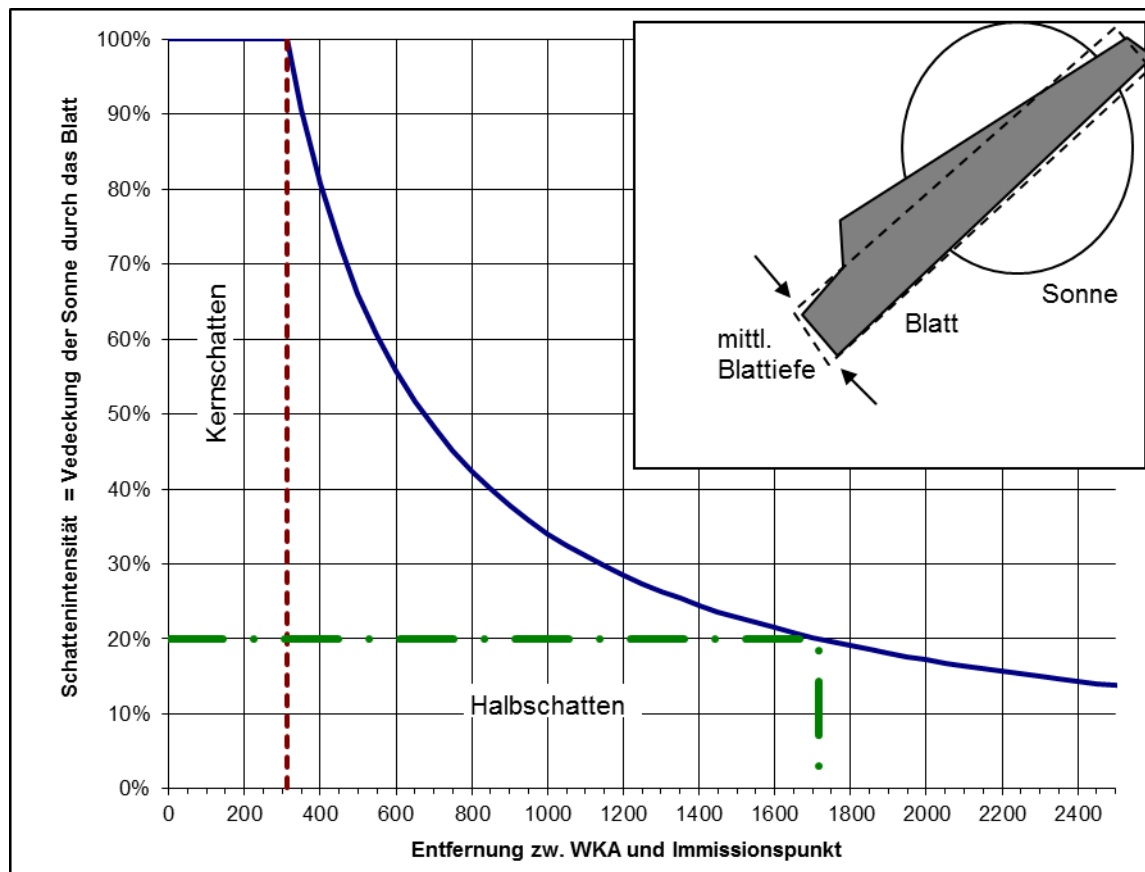


Abbildung 3: Schattenintensität in Abhängigkeit von Rotorblatattiefe und Entfernung

2.2 Schattenverlauf und Berechnung der Beschattungsdauern

Der Verlauf des periodischen Schattenwurfs wird über den Sonnenstand, den Standort bzw. die Standorte der WEA und die Lage der maßgeblichen Immissionsorte ermittelt. Dazu sind die folgenden Daten notwendig:

- die Positionen der WEA und der Immissionsorte (Koordinaten, Höhe über N.N., Genauigkeit +/- 5 m)
- Ausmaße der WEA (Nabenhöhe, Rotorradius und Rotorblatttiefe)

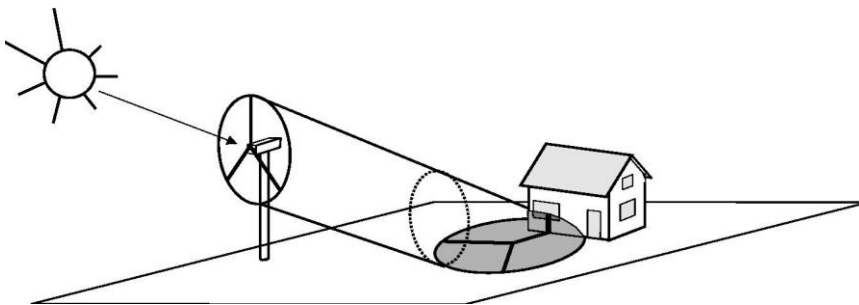


Abbildung 4: Schattenwurf des Rotors

Zur Ermittlung des Schattenwurfs an einem Immissionsort wird dort ein virtueller Schattenrezeptor mit den Ausmaßen der zu untersuchenden Fläche platziert. Bei der Simulation des Sonnenstands über ein Jahr registriert der virtuelle Rezeptor den Schattenwurf in diesem Zeitraum (Abbildung 5). Die Simulation des Verlaufs der Sonne wird mit der Software windPRO (Modul SHADOW) (1) mit einer minütlichen Auflösung von Sonnenaufgang bis Sonnenuntergang über das ganze Jahr durchgeführt. Unter Berücksichtigung einer minimalen Sonnenhöhe, der Koordinaten, der Lage und der Größe des Rezeptors sowie der WEA-Daten, wird so über die Simulation ermittelt, ob am Rezeptor ein Schattenwurf durch eine oder mehrere Windenergieanlagen auftritt. Tritt ein Schlagschatten auf, werden für diesen das Datum, der Beginn, das Ende und die Dauer sowie die verursachende WEA des Schattens angegeben (siehe die Kalender zu jedem Schattenrezeptor). Daraus werden wiederum über ein ganzes Jahr die Anzahl der Schattentage und die gesamte Schattenwurfdauer berechnet.

Der Schattenwurf für Sonnenstände unter 3° Erhöhung über Horizont kann wegen Bewuchs, Bebauung und der zu durchdringenden Atmosphärenschichten in ebenem Gelände vernachlässigt werden. Ob hier auch ein höherer Wert angesetzt werden kann, hängt von der Orographie, der Bebauung und dem Bewuchs um den WEA-Standort ab und muss im Einzelnen evtl. dann genauer untersucht werden, wenn davon auszugehen ist, dass durch die Gegebenheiten vor Ort eine wesentliche Reduktion der Beeinträchtigung zu erwarten ist.

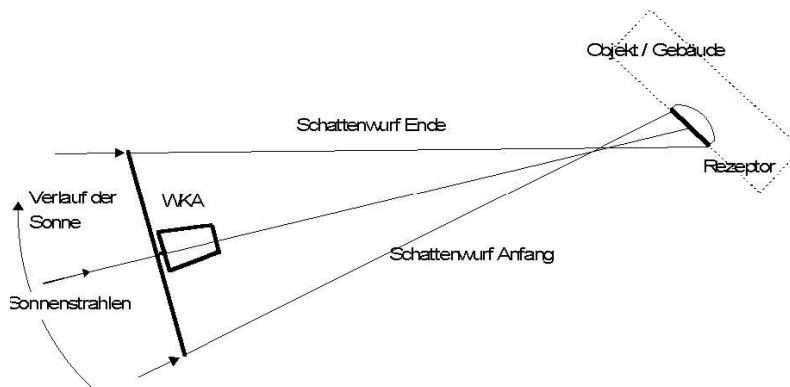


Abbildung 5: Schattenbeziehung WEA – Gebäude (Draufsicht)

2.3 Richtlinien

Die Bund-Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI) (2) hat die federführend vom staatlichen Umweltamt Schleswig unter Mitarbeit von Fachleuten (3) (4) (5) (6), Gutachtern (u.a. auch der Ramboll Deutschland GmbH), Gewerbeaufsichtsämtern und Weiteren erarbeiteten Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen (WKA-Schattenwurfhinweise) im Jahr 2002 als Standard anerkannt. Die WKA-Schattenwurfhinweise enthalten folgende Anhaltswerte:

- Die Astronomisch maximal mögliche Beschattungsdauer (worst case) an einem Immissionsort darf maximal 30 Stunden im Jahr und maximal 30 Minuten am Tag betragen.
- Ein Schattenwurf bei einem Sonnenstand unter 3° ist nicht zu berücksichtigen.
- Der Beschattungsbereich ist der Bereich, in dem die Sonnenscheibe zu mehr als 20 % durch das Rotorblatt verdeckt ist.
- Um die Vergleichbarkeit der Ergebnisse zu ermöglichen, wird die Berechnung des Schattenwurfs für einen punktförmigen Rezeptor (in der Simulation: $0,1 \times 0,1 \text{ m}$) in 2 m Höhe am Immissionsort empfohlen.
- Darüber hinaus sollen zusätzlich die realen (bzw. meteorologisch statistisch auftretenden) Schattenwurfzeiten (unter Berücksichtigung von Sonnenscheinwahrscheinlichkeit, Windrichtungsverteilung und Stillstandszeiten), bezogen auf ein Fenster von üblichen Ausmaßen, angegeben werden; überschreiten diese einen Immissionsrichtwert von 8 Stunden, so ist der darüber hinausgehende Schattenwurf zu unterbinden.

2.4 Wahrscheinlichkeitsbetrachtung

Um aus der astronomisch maximal möglichen Beschattungsdauer (Worstcase) die meteorologisch wahrscheinliche Beschattungsdauer zu ermitteln, fließen statistische Daten zur Sonnenscheinwahrscheinlichkeit, zu den Betriebsstunden der WEA und zur Windrichtung in die Berechnung ein. Diese Einflussfaktoren werden in den folgenden Abschnitten erläutert. Aufgrund der Sensibilität der Berechnung von den meteorologischen Eingangsgrößen sind diese mit Unsicherheiten von 5-15 % behaftet.

2.4.1 Sonnenscheinwahrscheinlichkeit

Den Berechnungen der astronomisch maximal möglichen Beschattungsdauer (worst case) wurde die Annahme kontinuierlichen Sonnenscheins zugrunde gelegt. Um dagegen die meteorologisch wahrscheinliche Beschattungsdauer zu bestimmen, muss die Sonnenscheinwahrscheinlichkeit mitberücksichtigt werden, die in der Praxis gleichzusetzen ist mit der Wahrscheinlichkeit der Existenz eines Schattenwurfs. Die Sonnenscheinwahrscheinlichkeit ist von Region zu Region unterschiedlich und wird über die Sonneneinstrahlung an Wetterstationen gemessen. Die dazu erhältlichen Daten basieren auf mehrjährigen Messungen. Angegeben wird üblicherweise die mittlere tägliche Sonnenscheindauer in Stunden, jeweils bezogen auf die einzelnen Monate. Teilt man diese Sonnenscheindauer durch die mittlere Zeitdauer von Sonnenaufgang bis -untergang im gleichen Monat, erhält man die Sonnenscheinwahrscheinlichkeit im jeweiligen Monat. Dieser Wert liegt im Dezember zwischen 10 % (Kassel) und 22 % (Freiburg) und im Juli/August zwischen 40 % (Düsseldorf) und 52 % (Freiburg) (7).

2.4.2 Reduktion der Schattenwurfdauer durch den Azimutwinkel

Bei der Berechnung der astronomisch maximal möglichen Beschattungsdauer (worst case) wird ebenfalls vom ungünstigsten Fall ausgegangen, dass die Windrichtung mit der Richtung der Sonnenstrahlen (Azimutwinkel) identisch ist und die Ausrichtung des Rotors damit den größtmöglichen Schatten zur Folge hat. Wird die statistische Windrichtungsverteilung berücksichtigt, so verkürzt sich die Dauer des Schattenwurfs pro Tag, da eine Abweichung zwischen der Windrichtung und dem Sonnenazimut einen schmaleren, ellipsenförmigen Schattenwurf verursacht (vgl. Abbildung 4).

Als Basis dient hier die Windrichtungsverteilung in 12 Sektoren, die einem Windgutachten oder einer in der Nähe gemessenen Windstatistik aus einer meteorologischen Station entnommen werden kann. Entsprechend der sektoriellen Windrichtungsverteilung wird die relevante Schattenwurfrichtungsbeziehung (WEA - Immissionspunkt) einem Windrichtungssektor zugeordnet. Gegenüberliegende Sektoren (Luv oder Lee von der Sonne angestrahlt) werden dabei in gleicher Weise berücksichtigt. Durch die Schrägstellung der Rotorebene verkleinern sich der Schattenwurfkegel und somit auch die Zeitpunkte des Schattenanfangs und des Schattenendes, also die Dauer des Schattenwurfs auf den Immissionspunkt.

2.4.3 Schattenwurf nur bei Betrieb der Anlage

Weiterhin ist die WEA nicht ständig in Betrieb, wodurch sich die Wahrscheinlichkeit eines Schattenwurfs durch den sich drehenden Rotor zusätzlich reduziert. Erst wenn die Windgeschwindigkeit einen Wert über der Anlaufwindgeschwindigkeit erreicht, beginnt sich die WEA zu drehen. Die Stillstandshäufigkeit kann mit Hilfe der Windgeschwindigkeits-Häufigkeitsverteilung am Standort (zum Beispiel als Weibull-Funktion auf Nabenhöhe aus einem Windgutachten) und der Anlaufwindgeschwindigkeit der WEA ermittelt werden. Die "In-Betrieb"-Häufigkeit bezeichnet so das Verhältnis von Betriebsstunden der Anlage und der Stundenzahl eines Jahres (8.760 h).

3 LITERATURVERZEICHNIS – THEORETISCHE GRUNDLAGEN

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