

Schattenwurfprognose für  
zwei Windenergieanlagen  
am Standort  
**Sanem**  
(Esch-sur-Alzette)

Datum: 08.07.2022

Bericht Nr. 21-1-3087-000-SU

Auftraggeber:

ENECO Ingénieurs-Conseils S.A.

22, rue Edmond Reuter | 5326 Contern

Auftragsnummer: 352001925

Bearbeiter:

Ramboll Deutschland GmbH

Robin Umminger, M. Sc.

Elisabeth-Consbruch-Straße 3

DE-34131 Kassel

Tel +49 561 / 288 573-0



Die vorliegende Schattenwurfprognose für den Standort Sanem (Esch-sur-Alzette) wurde der Ramboll Deutschland GmbH im September 2021 von der ENECO Ingénieurs-Conseils S.A. 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	Beschreibung
000	08.07.2022	R. Umminger	Planung von zwei WEA des Typs Nordex N163/6.8

Kassel, 08.07.2022



Robin Umminger, M. Sc.  
(Bearbeiter)



Dipl.-Geogr. Marc Brüning  
(Prüfer)



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# 1 Zusammenfassung

Am Windparkstandort Sanem wurden für 125 Immissionsorte (IO) die Beschattungsdauern durch zwei neu geplante Windenergieanlagen (WEA) des Typs Nordex N163/6.8 mit 164 m Nabenhöhe 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 74 Immissionsorten überschritten (siehe Kapitel 3). Die WKA-Schattenwurfhinweise [2] sehen für diesen Fall vor, dass der Schattenwurf der WEA, die eine (weitere) Überschreitung verursachen, mittels einer Abschaltautomatik entsprechend den Richtwerten begrenzt wird. Im vorliegenden Fall betrifft dies beide geplanten WEA.**

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



## 2 Standort- und WEA-Daten

### 2.1 Aufgabenstellung

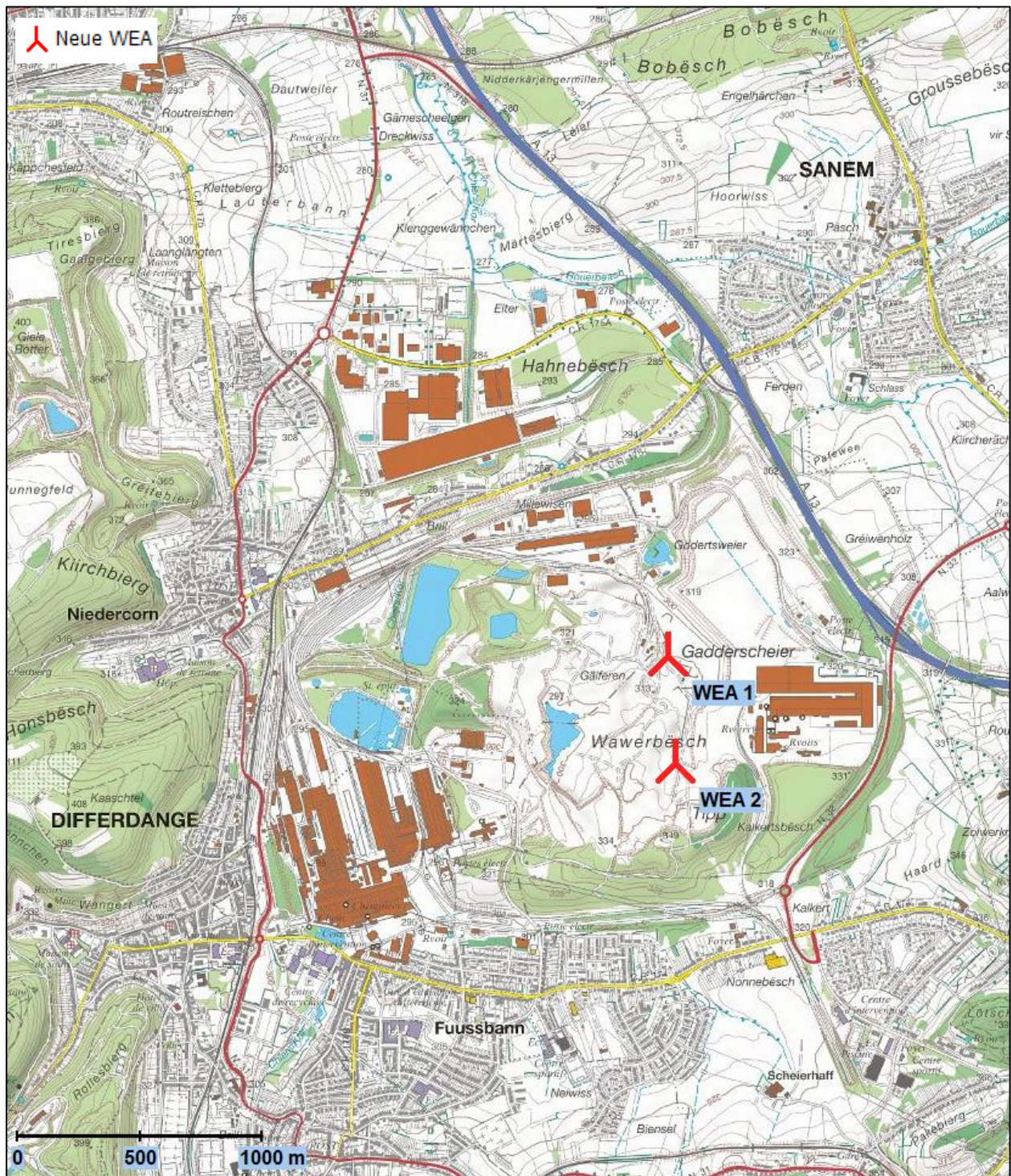
Der Auftraggeber plant am Standort Sanem innerhalb der „Zone Industrielle Gadderscheier“ zwischen Sanem im Nordosten, Soleuvre im Südosten, Differdange im Südwesten und Niederkorn im Nordwesten zwei Windenergieanlagen (WEA) des Typs Nordex N163/6.8 mit 164 m Nabenhöhe zu errichten (siehe Tabelle 1).

**Tabelle 1: Kenndaten der geplanten WEA**

WEA	WEA Hersteller / Typ	Nabenhöhe	Ost	Nord
		[m]	[LUREF (LU)]	
<b>WEA 1</b>	Nordex N163/6.8	164	61697	66525
<b>WEA 2</b>	Nordex N163/6.8	164	61724	66087

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 [5]**

Grundlage der Berechnung sind die vom Auftraggeber zur Verfügung gestellten Daten der geplanten WEA (Typ, Nabenhöhe, Koordinaten) sowie die bei der Standortbesichtigung am



05.07.2022 erhobenen Daten über relevante Immissionsorte und deren Umgebung. Das Höhenrelief basiert auf dem DGM 5 Luxembourg. Die Berechnung wurde mit der Software windPRO, Modul SHADOW [3] durchgeführt. Grundlagen zur Berechnung finden sich im Anhang.

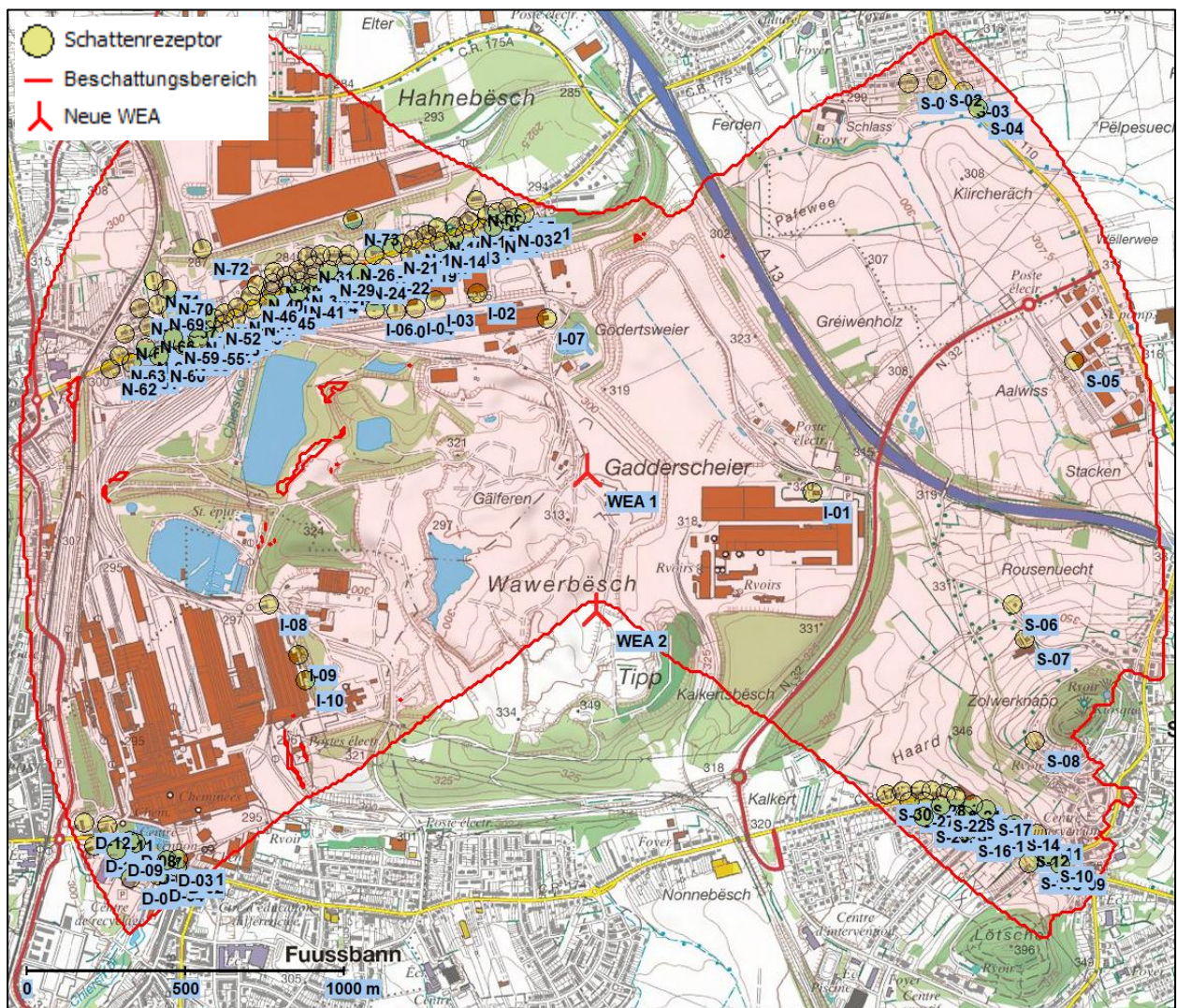
## 2.2 Immissionsorte

Die *Maßgeblichen Immissionsorte* sind nach den WKA-Schattenwurfhinweisen [2] 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 [2] der geplanten WEA (Zusatzbelastung, „ZB“) sind auf der Karte in Abbildung 2 als rote Linie dargestellt.





**Abbildung 2: Beschattungsbereich der Zusatzbelastung [5]**

Nach diesen Kriterien wurden jeweils in den am meisten betroffenen Baureihen exemplarisch ausgewählte Häuser als relevante Immissionsorte gewählt. Bei der Standortbesichtigung am 05.07.2022 wurden diese Immissionsorte in Augenschein genommen und dokumentiert.

Die Immissionsorte werden entsprechend den WKA-Schattenwurfhinweisen [2] 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.



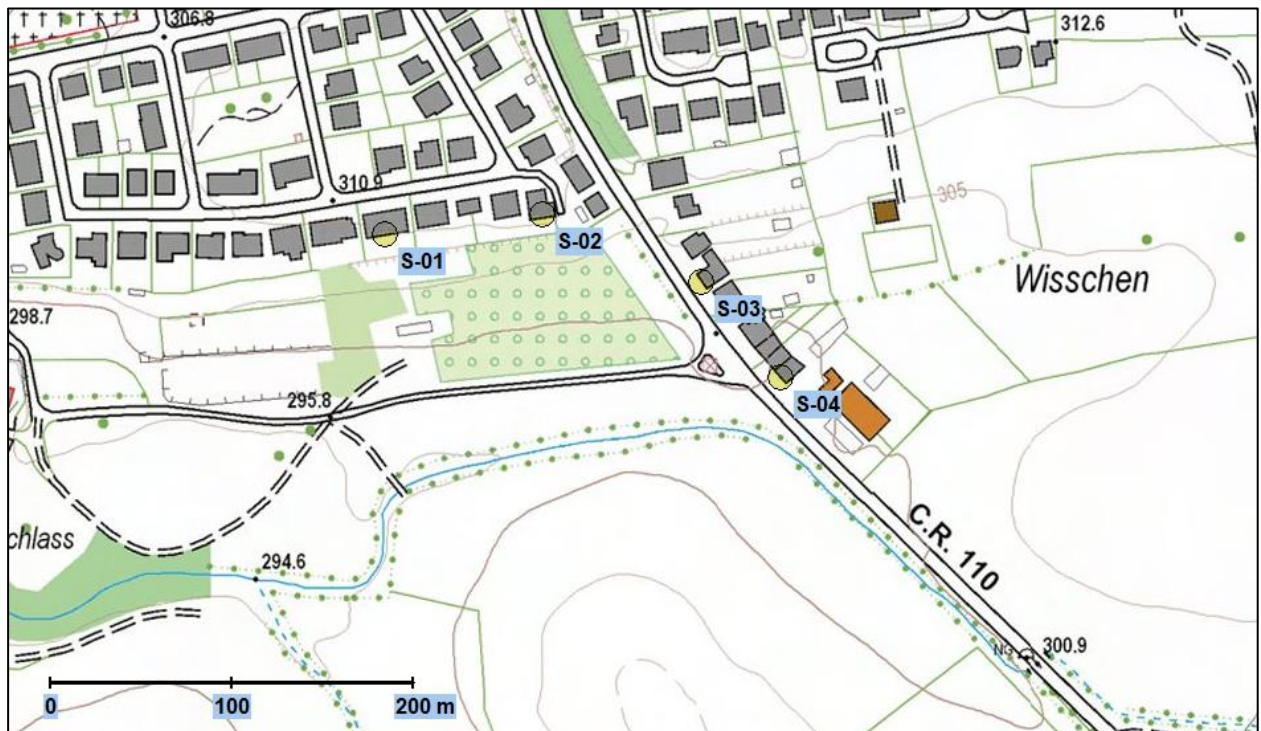


Abbildung 3: Lage der Immissionsorte S-01 bis S-04 [5]

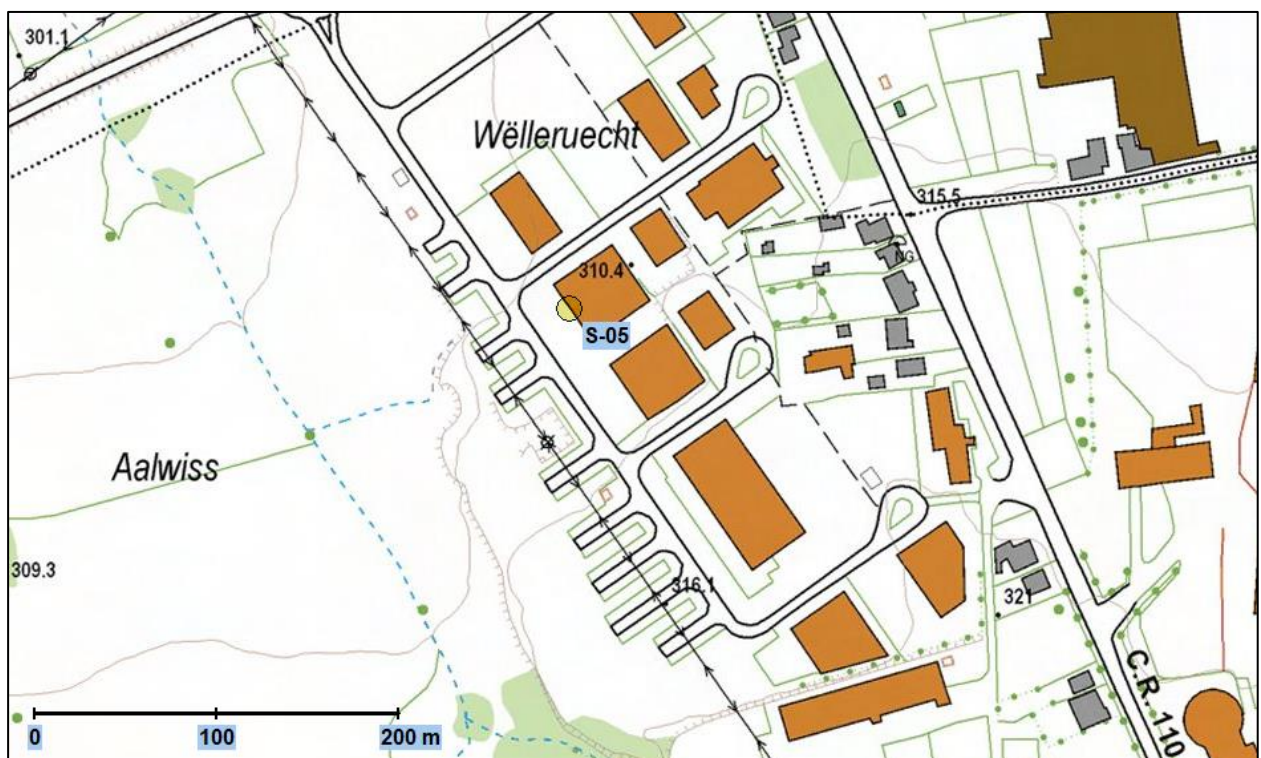


Abbildung 4: Lage des Immissionsortes S-05 [5]





Abbildung 5: Lage der Immissionsorte S-06 bis S-07 [5]

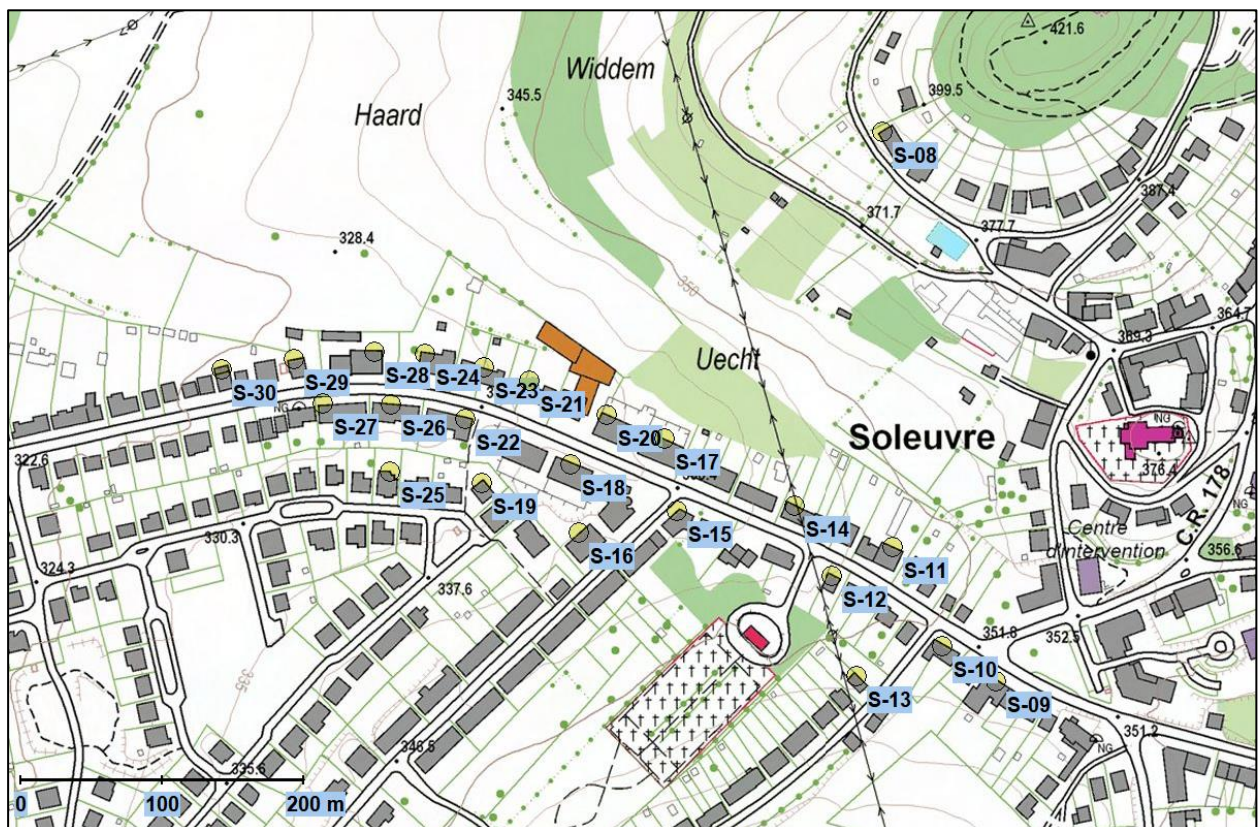


Abbildung 6: Lage der Immissionsorte S-08 bis S-30 [5]



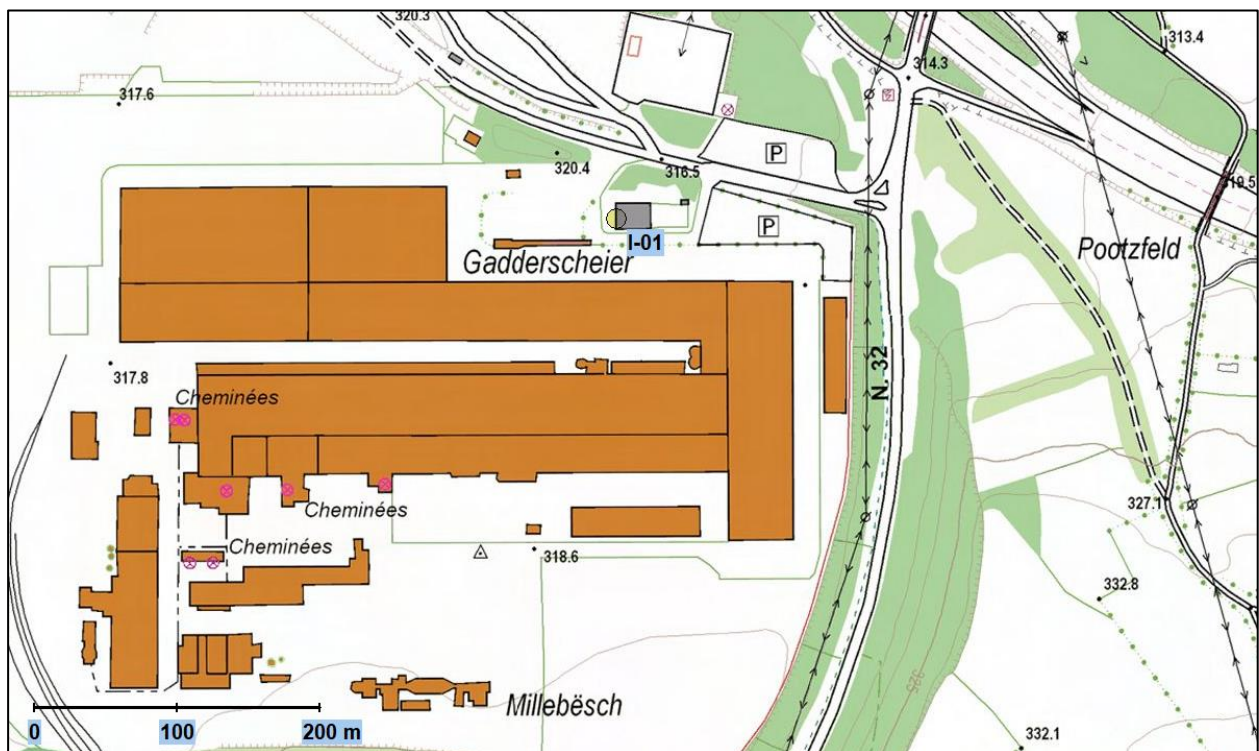


Abbildung 7: Lage des Immissionsortes I-01 [5]

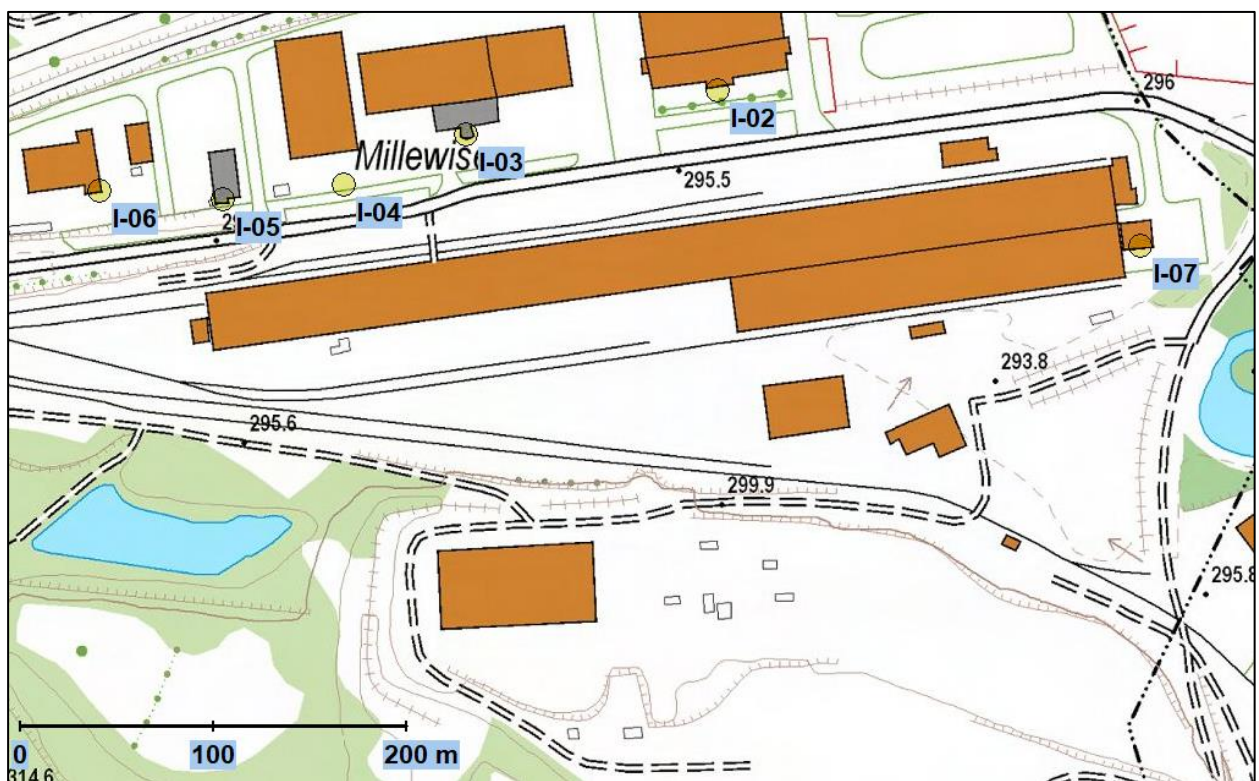


Abbildung 8: Lage der Immissionsorte I-02 bis I-07 [5]



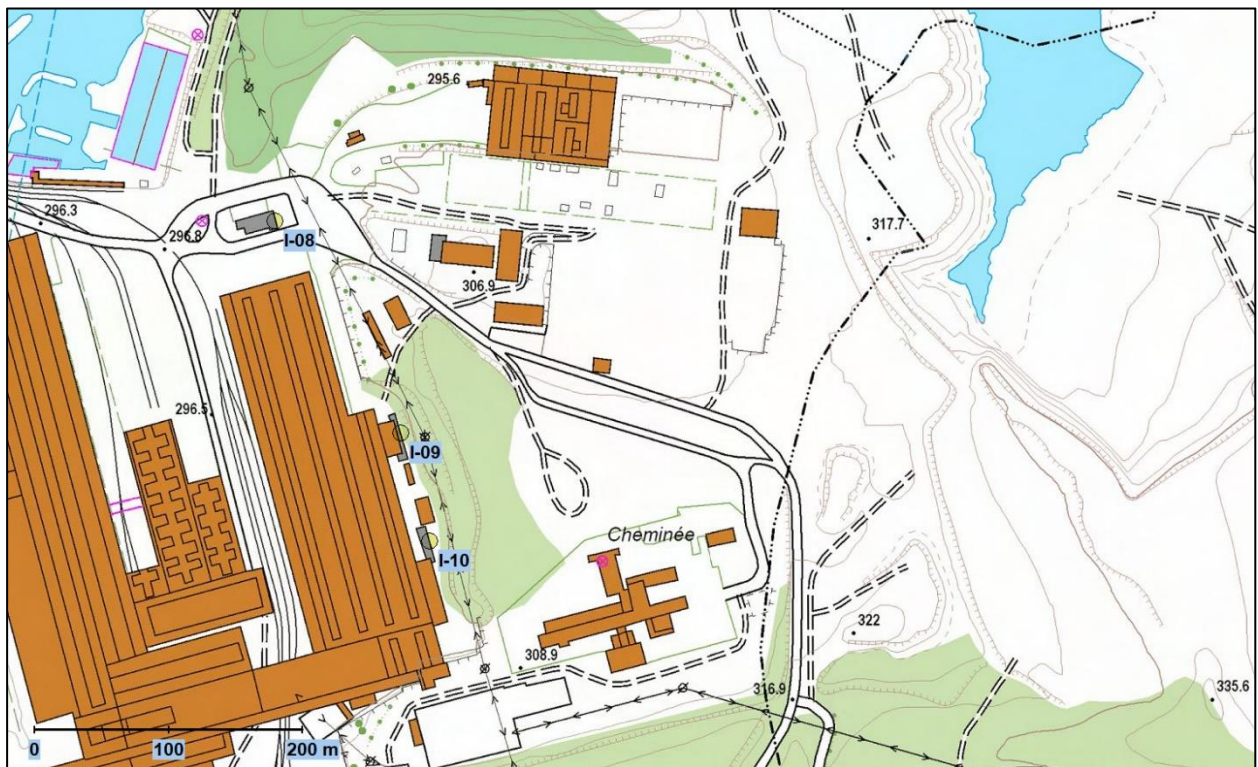


Abbildung 9: Lage der Immissionsorte I-08 bis I-10 [5]

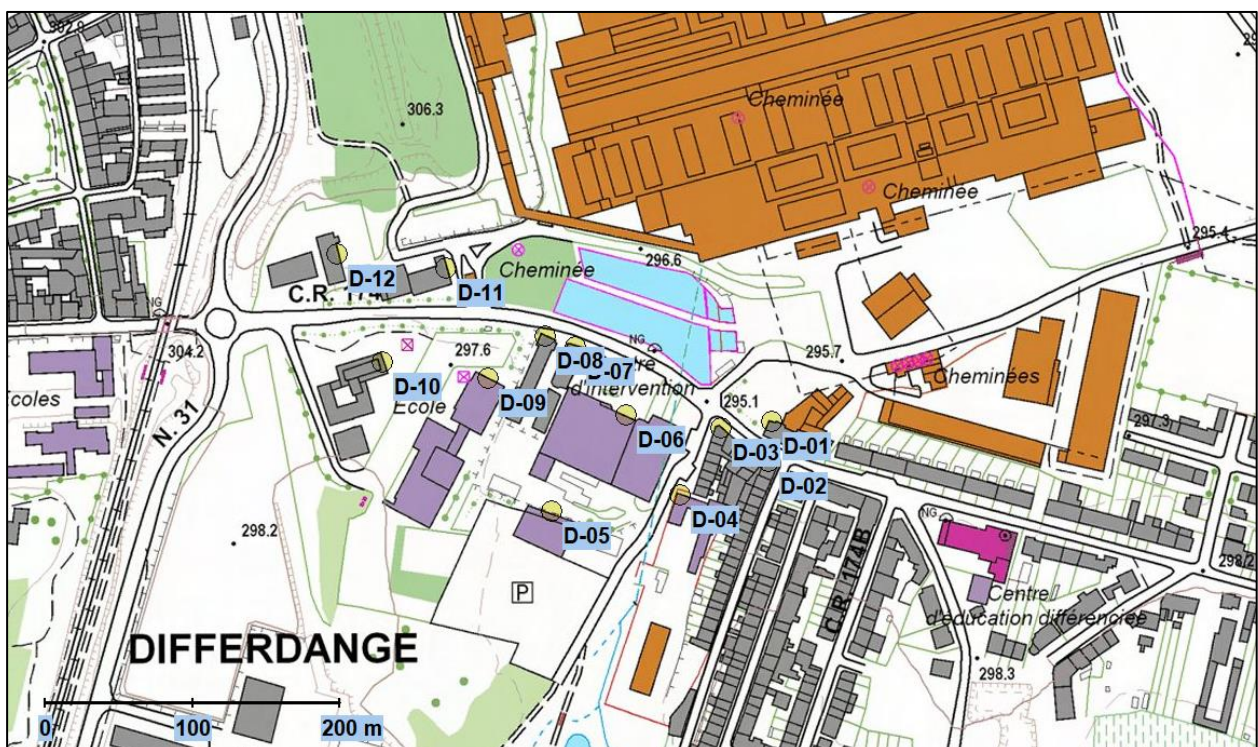
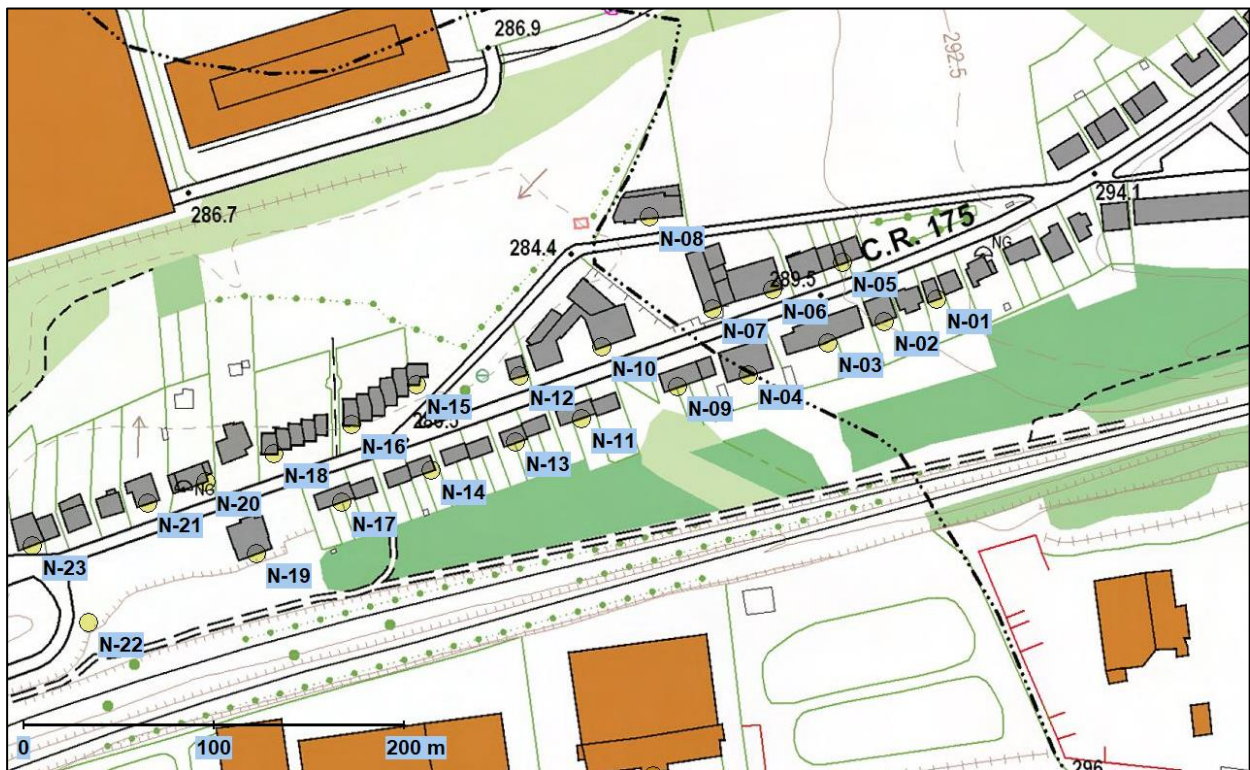
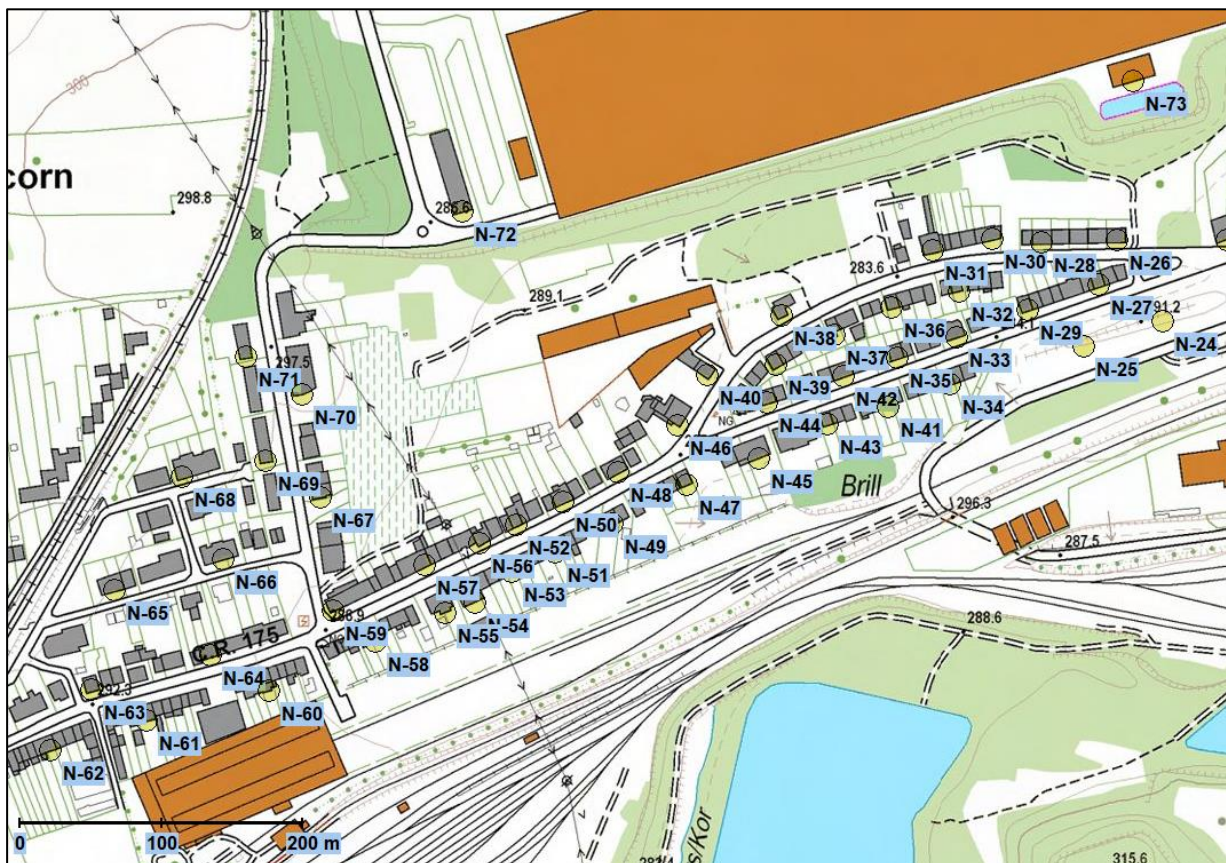


Abbildung 10: Lage der Immissionsorte D-01 bis D-12 [5]





Lage der Immissionsorte N-01 bis N-23 [5]



Lage der Immissionsorte N-24 bis N-73 [5]



## 2.3 Immissionsrichtwerte

Für die Beurteilung der Erheblichkeit der Belästigung durch Schattenwurf [8] [9] wurden in den WKA-Schattenwurfinweisen [2] 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 der Richtwerte 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 Sanem die Errichtung von zwei Windenergieanlagen. Die wesentlichen Kenndaten der neu geplanten WEA-Typen sind Tabelle 2 zu entnehmen. Der Beschattungsbereich wurde nach dem 20%-Kriterium [2] [10] aus den Rotorblattdaten und der Nabenhöhe ermittelt.

**Tabelle 2: Kenndaten geplante WEA**

WEA-Nr.	WEA Typ	NH	RD	max. BT	min. BT	Ø BT	BB
		[m]	[m]	[m]	[m]	[m]	[m]
<b>WEA 1</b>	N163/6.8	164,0	163,0	4,15	1,11	2,63	1.784
<b>WEA 2</b>	N163/6.8	164,0	163,0	4,15	1,11	2,63	1.784

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



### 3 Schattenwurfberechnungen

#### 3.1 Astronomisch maximal mögliche Beschattungsdauer

Für die geplanten 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:

- Zusatzbelastung (ZB) durch die neu geplanten WEA.

Die Ergebnisse der Berechnungen können der Tabelle 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.

**Tabelle 3: Astronomisch maximal mögliche Beschattungsdauern pro Jahr**

IO	Name	Astron. max. mögl. Beschattungsdauer	
		Std. / Jahr	Std. / Tag
<b>D-01</b>	61, Rue Emile Mark, 4620 Differdange	16:41	0:25
<b>D-02</b>	76, Rue Emile Mark, 4620 Differdange	13:14	0:23
<b>D-03</b>	68, Rue Emile Mark, 4620 Differdange	18:57	0:26
<b>D-04</b>	19, Rue du Gaz, 4573 Differdange	15:17	0:24
<b>D-05</b>	3, Rue John Ernest Dolibois, 4573 Differdange	19:38	0:24
<b>D-06</b>	2, Rue du Gaz, 4573 Differdange	23:12	0:25
<b>D-07</b>	62A, Rue Emile Mark, 4620 Differdange	26:22	0:25
<b>D-08</b>	62, Rue Emile Mark, 4620 Differdange	25:55	0:25
<b>D-09</b>	60, Rue Emile Mark, 4620 Differdange	24:51	0:24
<b>D-10</b>	40, Rue Emile Mark, 4620 Differdange	17:50	0:23
<b>D-11</b>	Rue Emile Mark, 4620 Differdange	16:44	0:24



IO	Name	Astron. max. mögl. Beschattungsdauer	
		Std. / Jahr	Std. / Tag
<b>D-12</b>	53, Rue Emile Mark, 4620 Differdange	13:37	0:23
<b>I-01</b>	Z.I. Gadderscheier	<b>92:29</b>	<b>0:52</b>
<b>I-02</b>	3, Z.A. Gadderscheier, 4570 Niederkorn	<b>89:12</b>	<b>0:59</b>
<b>I-03</b>	3, Z.A. Gadderscheier, 4570 Niederkorn	<b>86:45</b>	<b>0:53</b>
<b>I-04</b>	3, Z.A. Gadderscheier, 4570 Niederkorn	<b>75:50</b>	<b>0:51</b>
<b>I-05</b>	1, Z.A. Gadderscheier, 4570 Niederkorn	<b>72:17</b>	<b>0:48</b>
<b>I-06</b>	1, Z.A. Gadderscheier, 4570 Niederkorn	<b>68:50</b>	<b>0:45</b>
<b>I-07</b>	1, Z.A. Gadderscheier, 4570 Niederkorn	<b>125:21</b>	<b>1:16</b>
<b>I-08</b>	Z.I. Gadderscheier	<b>69:46</b>	<b>0:37</b>
<b>I-09</b>	Z.I. Gadderscheier	<b>38:15</b>	<b>0:40</b>
<b>I-10</b>	Z.I. Gadderscheier	<b>38:15</b>	<b>0:41</b>
<b>N-01</b>	189, Rue de Niederkorn, 4991 Sanem	11:11	0:28
<b>N-02</b>	193, Rue de Niederkorn, 4991 Sanem	17:33	<b>0:34</b>
<b>N-03</b>	197, Rue de Niederkorn, 4991 Sanem	23:05	<b>0:39</b>
<b>N-04</b>	203, Rue de Niederkorn, 4991 Sanem	<b>31:43</b>	<b>0:43</b>
<b>N-05</b>	194, Rue de Niederkorn, 4991 Sanem	11:55	0:28
<b>N-06</b>	200, Rue de Niederkorn, 4991 Sanem	19:36	<b>0:35</b>
<b>N-07</b>	200, Rue de Niederkorn, 4991 Sanem	25:38	<b>0:39</b>
<b>N-08</b>	36, Rue de l'Industrie, 4991 Sanem	18:06	<b>0:33</b>
<b>N-09</b>	246, Rue Pierre Gansen, 4570 Niederkorn	<b>37:29</b>	<b>0:46</b>
<b>N-10</b>	241, Rue Pierre Gansen, 4570 Niederkorn	<b>36:00</b>	<b>0:44</b>
<b>N-11</b>	236, Rue Pierre Gansen, 4570 Niederkorn	<b>45:06</b>	<b>0:47</b>
<b>N-12</b>	239, Rue Pierre Gansen, 4570 Niederkorn	<b>42:48</b>	<b>0:45</b>
<b>N-13</b>	228, Rue Pierre Gansen, 4570 Niederkorn	<b>50:11</b>	<b>0:47</b>
<b>N-14</b>	216, Rue Pierre Gansen, 4570 Niederkorn	<b>55:12</b>	<b>0:47</b>
<b>N-15</b>	237A, Rue Pierre Gansen, 4570 Niederkorn	<b>47:07</b>	<b>0:45</b>
<b>N-16</b>	231A, Rue Pierre Gansen, 4570 Niederkorn	<b>52:25</b>	<b>0:44</b>
<b>N-17</b>	202, Rue Pierre Gansen, 4570 Niederkorn	<b>58:58</b>	<b>0:45</b>
<b>N-18</b>	229, Rue Pierre Gansen, 4570 Niederkorn	<b>55:13</b>	<b>0:43</b>



IO	Name	Astron. max. mögl. Beschattungsdauer	
		Std. / Jahr	Std. / Tag
N-19	198K, Rue Pierre Gansen, 4570 Niederkorn	61:07	0:45
N-20	223, Rue Pierre Gansen, 4570 Niederkorn	56:29	0:43
N-21	219, Rue Pierre Gansen, 4570 Niederkorn	55:49	0:42
N-22	198F, Rue Pierre Gansen, 4570 Niederkorn	56:54	0:43
N-23	211, Rue Pierre Gansen, 4570 Niederkorn	53:13	0:41
N-24	198E, Rue Pierre Gansen, 4570 Niederkorn	54:24	0:40
N-25	198C, Rue Pierre Gansen, 4570 Niederkorn	55:06	0:39
N-26	89, Rue de Sanem, 4664 Niederkorn	48:57	0:38
N-27	203, Rue Pierre Gansen, 4570 Niederkorn	51:41	0:38
N-28	73, Rue de Sanem, 4664 Niederkorn	48:11	0:37
N-29	189, Rue Pierre Gansen, 4570 Niederkorn	52:29	0:37
N-30	65, Rue de Sanem, 4664 Niederkorn	47:27	0:36
N-31	53, Rue de Sanem, 4664 Niederkorn	47:51	0:35
N-32	38, Rue de Sanem, 4664 Niederkorn	50:25	0:36
N-33	183, Rue Pierre Gansen, 4570 Niederkorn	53:05	0:36
N-34	194, Rue Pierre Gansen, 4570 Niederkorn	55:36	0:36
N-35	173, Rue Pierre Gansen, 4570 Niederkorn	52:59	0:35
N-36	28, Rue de Sanem, 4664 Niederkorn	50:33	0:35
N-37	18, Rue de Sanem, 4664 Niederkorn	50:15	0:34
N-38	18, Rue de Sanem, 4664 Niederkorn	48:28	0:33
N-39	8, Rue de Sanem, 4664 Niederkorn	48:56	0:33
N-40	7, Rue de Sanem, 4664 Niederkorn	44:24	0:32
N-41	184, Rue Pierre Gansen, 4570 Niederkorn	54:23	0:35
N-42	165, Rue Pierre Gansen, 4570 Niederkorn	51:50	0:34
N-43	174, Rue Pierre Gansen, 4570 Niederkorn	51:45	0:34
N-44	151, Rue Pierre Gansen, 4570 Niederkorn	47:54	0:33
N-45	160, Rue Pierre Gansen, 4570 Niederkorn	43:09	0:33
N-46	1, Rue de Sanem, 4664 Niederkorn	38:30	0:32
N-47	146, Rue Pierre Gansen, 4570 Niederkorn	37:42	0:32



IO	Name	Astron. max. mögl. Beschattungsdauer	
		Std. / Jahr	Std. / Tag
N-48	127, Rue Pierre Gansen, 4570 Niederkorn	34:29	0:31
N-49	134, Rue Pierre Gansen, 4570 Niederkorn	33:43	0:31
N-50	103, Rue Pierre Gansen, 4570 Niederkorn	31:50	0:30
N-51	120, Rue Pierre Gansen, 4570 Niederkorn	31:16	0:31
N-52	95, Rue Pierre Gansen, 4570 Niederkorn	30:07	0:30
N-53	114, Rue Pierre Gansen, 4570 Niederkorn	29:38	0:30
N-54	108B, Rue Pierre Gansen, 4570 Niederkorn	28:20	0:29
N-55	108, Rue Pierre Gansen, 4570 Niederkorn	27:23	0:29
N-56	87, Rue Pierre Gansen, 4570 Niederkorn	28:45	0:29
N-57	77, Rue Pierre Gansen, 4570 Niederkorn	26:56	0:28
N-58	98, Rue Pierre Gansen, 4570 Niederkorn	25:28	0:28
N-59	57, Rue Pierre Gansen, 4570 Niederkorn	24:27	0:28
N-60	76, Rue Pierre Gansen, 4570 Niederkorn	23:02	0:27
N-61	52A, Rue Pierre Gansen, 4570 Niederkorn	20:22	0:25
N-62	36, Rue Pierre Gansen, 4570 Niederkorn	18:50	0:24
N-63	17A, Rue Pierre Gansen, 4570 Niederkorn	19:31	0:25
N-64	35, Rue Pierre Gansen, 4570 Niederkorn	21:30	0:25
N-65	18, Rue des Celtes, 4526 Niederkorn	19:48	0:25
N-66	10, Rue des Celtes, 4526 Niederkorn	22:05	0:26
N-67	10, Rue des Ligures, 4609 Niederkorn	24:24	0:27
N-68	7, Rue des Trévires, 4680 Niederkorn	21:24	0:25
N-69	19, Rue des Ligures, 4609 Niederkorn	23:11	0:26
N-70	32, Rue des Ligures, 4609 Niederkorn	24:33	0:26
N-71	39, Rue des Ligures, 4609 Niederkorn	23:25	0:26
N-72	Z.I. Hahneboesch, 4562 Niederkorn	34:56	0:27
N-73	Z.I. Hahneboesch, 4562 Niederkorn	44:53	0:37
S-01	39, Rue Ermesinde, 4992 Sanem	9:55	0:21
S-02	37, Rue Ermesinde, 4992 Sanem	14:05	0:23
S-03	79, Rue d'Esch, 4985 Sanem	21:18	0:24



IO	Name	Astron. max. mögl. Beschattungsdauer	
		Std. / Jahr	Std. / Tag
<b>S-04</b>	89, Rue d'Esch, 4985 Sanem	22:57	0:24
<b>S-05</b>	10, Um Woeller, 4410 Soleuvre	18:09	0:24
<b>S-06</b>	80, Rue des Champs, 4432 Soleuvre	26:27	0:28
<b>S-07</b>	75, Rue des Champs, 4432 Soleuvre	23:11	0:27
<b>S-08</b>	22A, Rue Belle-Vue, 4417 Soleuvre	20:54	0:22
<b>S-09</b>	9, Rue de Differdange, Soleuvre	20:40	0:23
<b>S-10</b>	17, Rue de Differdange, Soleuvre	22:18	0:24
<b>S-11</b>	16, Rue de Differdange, 4437 Soleuvre	22:32	0:26
<b>S-12</b>	31, Rue de Differdange, 4437 Soleuvre	25:53	0:27
<b>S-13</b>	6, Rue du Bois, 4421 Soleuvre	20:54	0:25
<b>S-14</b>	32, Rue de Differdange, 4421 Soleuvre	27:38	0:27
<b>S-15</b>	1, Rue Emile Mayrisch, 4470 Soleuvre	28:47	0:29
<b>S-16</b>	4, Rue Emile Mayrisch, 4470 Soleuvre	23:37	0:30
<b>S-17</b>	62, Rue de Differdange, Soleuvre	<b>32:16</b>	0:29
<b>S-18</b>	69, Rue de Differdange, Soleuvre	29:48	<b>0:31</b>
<b>S-19</b>	35, Rue des Erables, 4423 Soleuvre	23:24	<b>0:31</b>
<b>S-20</b>	69, Rue de Differdange, 4437 Soleuvre	<b>33:48</b>	0:30
<b>S-21</b>	74, Rue de Differdange, 4437 Soleuvre	<b>35:30</b>	<b>0:32</b>
<b>S-22</b>	73, Rue de Differdange, 4437 Soleuvre	29:46	<b>0:33</b>
<b>S-23</b>	80, Rue de Differdange, 4437 Soleuvre	<b>35:39</b>	<b>0:33</b>
<b>S-24</b>	90, Rue de Differdange, 4437 Soleuvre	<b>35:03</b>	<b>0:34</b>
<b>S-25</b>	25, Rue des Erables, 4423 Soleuvre	17:45	0:29
<b>S-26</b>	85, Rue de Differdange, 4437 Soleuvre	27:04	<b>0:33</b>
<b>S-27</b>	95, Rue de Differdange, 4437 Soleuvre	21:08	<b>0:31</b>
<b>S-28</b>	100, Rue de Differdange, 4437 Soleuvre	<b>32:45</b>	<b>0:35</b>
<b>S-29</b>	106, Rue de Differdange, 4437 Soleuvre	25:03	<b>0:34</b>
<b>S-30</b>	112, Rue de Differdange, 4437 Soleuvre	14:17	0:27



## 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 (nach [2], [11]) steuerungstechnisch umgesetzt wird. Sie berücksichtigt statistische Daten zu

- Sonnenscheinwahrscheinlichkeit (mittlere tägliche Sonnenscheinstunden) pro Monat, nach Angaben der Sonnenschein-Datenbank für die Station Perl-Nennig,
- Betriebsstunden bzw. Stillstandszeiten der WEA je Richtungssektor, ermittelt aus der Windstatistik der DWD-Station Deuselbach und der Anlaufgeschwindigkeit der WEA,
- Variable Schattengröße des Rotors, ermittelt aus der Windrichtungsverteilung der Windstatistik der DWD-Station Deuselbach und der 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.

**Tabelle 4: Meteorologisch wahrscheinliche Beschattungsdauern pro Jahr**

IO	Lage	Meteorologisch wahrscheinlich [Std./Jahr]
D-01	61, Rue Emile Mark, 4620 Differdange	5:18
D-02	76, Rue Emile Mark, 4620 Differdange	4:12
D-03	68, Rue Emile Mark, 4620 Differdange	6:01
D-04	19, Rue du Gaz, 4573 Differdange	4:51
D-05	3, Rue John Ernest Dolibois, 4573 Differdange	6:14
D-06	2, Rue du Gaz, 4573 Differdange	7:21
D-07	62A, Rue Emile Mark, 4620 Differdange	8:19
D-08	62, Rue Emile Mark, 4620 Differdange	8:10
D-09	60, Rue Emile Mark, 4620 Differdange	7:50
D-10	40, Rue Emile Mark, 4620 Differdange	5:36



IO	Lage	Meteorologisch wahrscheinlich [Std./Jahr]
D-11	Rue Emile Mark, 4620 Differdange	5:13
D-12	53, Rue Emile Mark, 4620 Differdange	4:14
I-01	Z.I. Gadderscheier	22:29
I-02	3, Z.A. Gadderscheier, 4570 Niederkorn	6:37
I-03	3, Z.A. Gadderscheier, 4570 Niederkorn	6:38
I-04	3, Z.A. Gadderscheier, 4570 Niederkorn	6:31
I-05	1, Z.A. Gadderscheier, 4570 Niederkorn	6:30
I-06	1, Z.A. Gadderscheier, 4570 Niederkorn	6:16
I-07	1, Z.A. Gadderscheier, 4570 Niederkorn	9:53
I-08	Z.I. Gadderscheier	20:45
I-09	Z.I. Gadderscheier	11:32
I-10	Z.I. Gadderscheier	11:26
N-01	189, Rue de Niederkorn, 4991 Sanem	0:44
N-02	193, Rue de Niederkorn, 4991 Sanem	1:10
N-03	197, Rue de Niederkorn, 4991 Sanem	1:33
N-04	203, Rue de Niederkorn, 4991 Sanem	2:10
N-05	194, Rue de Niederkorn, 4991 Sanem	0:47
N-06	200, Rue de Niederkorn, 4991 Sanem	1:19
N-07	200, Rue de Niederkorn, 4991 Sanem	1:44
N-08	36, Rue de l'Industrie, 4991 Sanem	1:12
N-09	246, Rue Pierre Gansen, 4570 Niederkorn	2:35
N-10	241, Rue Pierre Gansen, 4570 Niederkorn	2:28
N-11	236, Rue Pierre Gansen, 4570 Niederkorn	3:08
N-12	239, Rue Pierre Gansen, 4570 Niederkorn	2:57
N-13	228, Rue Pierre Gansen, 4570 Niederkorn	3:29
N-14	216, Rue Pierre Gansen, 4570 Niederkorn	3:48
N-15	237A, Rue Pierre Gansen, 4570 Niederkorn	3:14
N-16	231A, Rue Pierre Gansen, 4570 Niederkorn	3:35
N-17	202, Rue Pierre Gansen, 4570 Niederkorn	4:04
N-18	229, Rue Pierre Gansen, 4570 Niederkorn	3:46



IO	Lage	Meteorologisch wahrscheinlich [Std./Jahr]
N-19	198K, Rue Pierre Gansen, 4570 Niederkorn	4:16
N-20	223, Rue Pierre Gansen, 4570 Niederkorn	3:53
N-21	219, Rue Pierre Gansen, 4570 Niederkorn	3:51
N-22	198F, Rue Pierre Gansen, 4570 Niederkorn	4:18
N-23	211, Rue Pierre Gansen, 4570 Niederkorn	3:53
N-24	198E, Rue Pierre Gansen, 4570 Niederkorn	4:26
N-25	198C, Rue Pierre Gansen, 4570 Niederkorn	4:40
N-26	89, Rue de Sanem, 4664 Niederkorn	3:47
N-27	203, Rue Pierre Gansen, 4570 Niederkorn	4:11
N-28	73, Rue de Sanem, 4664 Niederkorn	3:49
N-29	189, Rue Pierre Gansen, 4570 Niederkorn	4:24
N-30	65, Rue de Sanem, 4664 Niederkorn	3:48
N-31	53, Rue de Sanem, 4664 Niederkorn	3:55
N-32	38, Rue de Sanem, 4664 Niederkorn	4:13
N-33	183, Rue Pierre Gansen, 4570 Niederkorn	4:34
N-34	194, Rue Pierre Gansen, 4570 Niederkorn	4:55
N-35	173, Rue Pierre Gansen, 4570 Niederkorn	4:38
N-36	28, Rue de Sanem, 4664 Niederkorn	4:19
N-37	18, Rue de Sanem, 4664 Niederkorn	4:22
N-38	18, Rue de Sanem, 4664 Niederkorn	4:12
N-39	8, Rue de Sanem, 4664 Niederkorn	4:23
N-40	7, Rue de Sanem, 4664 Niederkorn	4:07
N-41	184, Rue Pierre Gansen, 4570 Niederkorn	4:51
N-42	165, Rue Pierre Gansen, 4570 Niederkorn	4:36
N-43	174, Rue Pierre Gansen, 4570 Niederkorn	4:45
N-44	151, Rue Pierre Gansen, 4570 Niederkorn	4:25
N-45	160, Rue Pierre Gansen, 4570 Niederkorn	4:19
N-46	1, Rue de Sanem, 4664 Niederkorn	3:53
N-47	146, Rue Pierre Gansen, 4570 Niederkorn	4:01
N-48	127, Rue Pierre Gansen, 4570 Niederkorn	3:43



IO	Lage	Meteorologisch wahrscheinlich [Std./Jahr]
N-49	134, Rue Pierre Gansen, 4570 Niederkorn	3:48
N-50	103, Rue Pierre Gansen, 4570 Niederkorn	3:35
N-51	120, Rue Pierre Gansen, 4570 Niederkorn	3:40
N-52	95, Rue Pierre Gansen, 4570 Niederkorn	3:30
N-53	114, Rue Pierre Gansen, 4570 Niederkorn	3:35
N-54	108B, Rue Pierre Gansen, 4570 Niederkorn	3:35
N-55	108, Rue Pierre Gansen, 4570 Niederkorn	3:33
N-56	87, Rue Pierre Gansen, 4570 Niederkorn	3:25
N-57	77, Rue Pierre Gansen, 4570 Niederkorn	3:20
N-58	98, Rue Pierre Gansen, 4570 Niederkorn	3:30
N-59	57, Rue Pierre Gansen, 4570 Niederkorn	3:17
N-60	76, Rue Pierre Gansen, 4570 Niederkorn	3:28
N-61	52A, Rue Pierre Gansen, 4570 Niederkorn	3:14
N-62	36, Rue Pierre Gansen, 4570 Niederkorn	3:06
N-63	17A, Rue Pierre Gansen, 4570 Niederkorn	3:02
N-64	35, Rue Pierre Gansen, 4570 Niederkorn	3:10
N-65	18, Rue des Celtes, 4526 Niederkorn	2:47
N-66	10, Rue des Celtes, 4526 Niederkorn	2:55
N-67	10, Rue des Ligures, 4609 Niederkorn	2:55
N-68	7, Rue des Trévires, 4680 Niederkorn	2:37
N-69	19, Rue des Ligures, 4609 Niederkorn	2:43
N-70	32, Rue des Ligures, 4609 Niederkorn	2:42
N-71	39, Rue des Ligures, 4609 Niederkorn	2:33
N-72	Z.I. Hahneboesch, 4562 Niederkorn	3:08
N-73	Z.I. Hahneboesch, 4562 Niederkorn	2:59
S-01	39, Rue Ermesinde, 4992 Sanem	0:52
S-02	37, Rue Ermesinde, 4992 Sanem	1:15
S-03	79, Rue d'Esch, 4985 Sanem	1:57
S-04	89, Rue d'Esch, 4985 Sanem	2:09
S-05	10, Um Woeller, 4410 Soleuvre	3:28



IO	Lage	Meteorologisch wahrscheinlich [Std./Jahr]
S-06	80, Rue des Champs, 4432 Soleuvre	6:39
S-07	75, Rue des Champs, 4432 Soleuvre	5:55
S-08	22A, Rue Belle-Vue, 4417 Soleuvre	5:06
S-09	9, Rue de Differdange, Soleuvre	5:00
S-10	17, Rue de Differdange, Soleuvre	5:24
S-11	16, Rue de Differdange, 4437 Soleuvre	5:29
S-12	31, Rue de Differdange, 4437 Soleuvre	6:16
S-13	6, Rue du Bois, 4421 Soleuvre	5:02
S-14	32, Rue de Differdange, 4421 Soleuvre	6:43
S-15	1, Rue Emile Mayrisch, 4470 Soleuvre	6:58
S-16	4, Rue Emile Mayrisch, 4470 Soleuvre	5:41
S-17	62, Rue de Differdange, Soleuvre	7:50
S-18	69, Rue de Differdange, Soleuvre	7:12
S-19	35, Rue des Erables, 4423 Soleuvre	5:37
S-20	69, Rue de Differdange, 4437 Soleuvre	8:13
S-21	74, Rue de Differdange, 4437 Soleuvre	8:37
S-22	73, Rue de Differdange, 4437 Soleuvre	7:11
S-23	80, Rue de Differdange, 4437 Soleuvre	8:39
S-24	90, Rue de Differdange, 4437 Soleuvre	8:30
S-25	25, Rue des Erables, 4423 Soleuvre	4:15
S-26	85, Rue de Differdange, 4437 Soleuvre	6:31
S-27	95, Rue de Differdange, 4437 Soleuvre	5:04
S-28	100, Rue de Differdange, 4437 Soleuvre	7:55
S-29	106, Rue de Differdange, 4437 Soleuvre	6:02
S-30	112, Rue de Differdange, 4437 Soleuvre	3:24



## 4 Bewertung der Ergebnisse

### 4.1 Beurteilung der Berechnungen

Am Windparkstandort Sanem wurden für 125 Immissionsorte die Beschattungsdauern durch zwei neu geplante WEA entsprechend den WKA-Schattenwurfhinweisen [2] berechnet. Die Immissionsrichtwerte der Beschattungsdauern betragen maximal 30 Stunden im Jahr und maximal 30 Minuten am Tag.

**IO D-01 bis D-12, N-01, N-05, N-53 bis N-71, S-01 bis S-16, S-25 und S-30: An diesen Immissionsorten werden alle Richtwerte eingehalten.**

**IO I-01 bis I-10, N-02 bis N-04, N-06 bis N-52, N-72, N-73, S-17 bis S-24 und S-26 bis S-29: An diesen Immissionsorten wird der Immissionsrichtwert für die astronomisch maximal mögliche Beschattungsdauer pro Jahr um maximal 95 Std. überschritten. Der Tagesrichtwert von 30 Min. wird um maximal 46 Min./Tag überschritten.**

**Aufgrund der berechneten Überschreitungen empfehlen wir die Abschaltung der neu geplanten WEA 1 und 2 über eine Abschaltautomatik zu steuern (siehe tabellarische und grafische Schattenwurfkalender im Anhang).**

**Da die in diesem Gutachten betrachteten Immissionsorte exemplarisch ausgewählt wurden, sollten bei Programmierung der Abschaltautomatik alle Wohnhäuser im schattenkritischen Bereich berücksichtigt werden.**

### 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 [2], 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 [2] 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 [5]. Das zugrunde gelegte Höhenmodell basiert auf dem DGM 5 Luxembourg. Damit ist eine Grundgenauigkeit der in eine Prognose eingehenden geometrischen Parameter von mindestens  $\pm 5 \text{ m}$  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 [2]) entsprochen. Basierend auf der Grundgenauigkeit der Eingangsdaten kann die Unsicherheit bei der Berechnung der Beschattungszeiten mit durchschnittlich  $\pm 1 \%$  angegeben werden [12].



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## 6 Anhang

- Schattenkarten für den Windparkstandort Sanem (Zusatzbelastung)
  - Stunden pro Jahr (maximal)
  - Minuten pro Tag (maximal)
- Berechnungsergebnisse der Beschattungsdauern an den Immissionsorten
  - Zusatzbelastung:
    - Hauptergebnis
    - tabellarische Kalender
    - grafische Kalender
- Akkreditierung
- Theoretische Grundlagen



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## Projekt:

21-1-3087-000  
ENECO  
Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

## Beschreibung:

Windpark Sanem, Gemeinde Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

## Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## 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  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

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

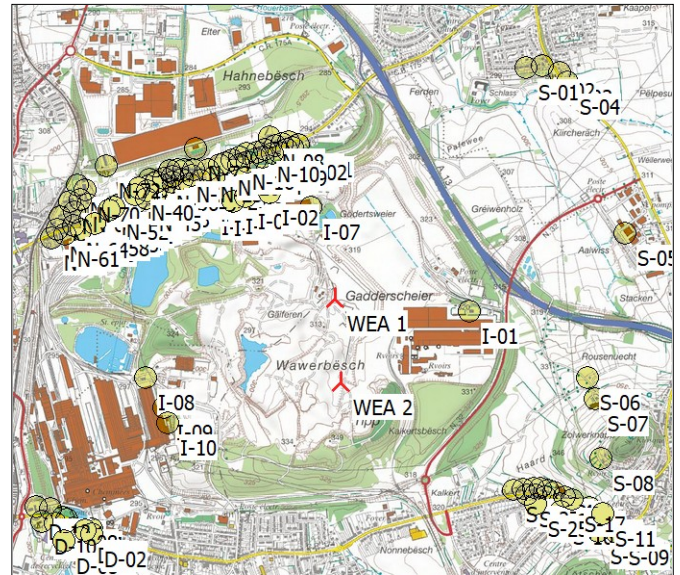
Verwendete Höhenlinien: Höhenlinien

Hindernisse in Berechnung nicht verwendet

Rasterauflösung: 1,0 m

Alle Koordinatenangaben in:

Luxemburgian TM-LUREF (LU)



Maßstab 1:40.000

Neue WEA

Schattenrezeptor

## WEA

	X	Y	Z	Beschreibung	WEA-Typ	Ak- tu- ell	Hersteller	Typ	Nenn- leistung	Rotor- durch- messer	Naben- höhe	Schattendaten Beschatt.- Bereich	U/min
			[m]						[kW]	[m]	[m]	[m]	[U/min]
WEA 1	61.697	66.525	300,0	NORDEX N163/6.8 6800 163.0	IO...	Ja	NORDEX	N163/6.8-6.800	6.800	163,0	164,0	1.784	10,9
WEA 2	61.724	66.087	311,4	NORDEX N163/6.8 6800 163.0	IO...	Ja	NORDEX	N163/6.8-6.800	6.800	163,0	164,0	1.784	10,9

## Schattenrezeptor-Eingabe

Nr.	Name	X	Y	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
D-01	61, Rue Emile Mark, 4620 Differdange	60.403	65.315	297,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-02	76, Rue Emile Mark, 4620 Differdange	60.401	65.288	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-03	68, Rue Emile Mark, 4620 Differdange	60.368	65.311	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-04	19, Rue du Gaz, 4573 Differdange	60.341	65.266	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-05	3, Rue John Ernest Dolibois, 4573 Differdange	60.254	65.255	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-06	2, Rue du Gaz, 4573 Differdange	60.304	65.320	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-07	62A, Rue Emile Mark, 4620 Differdange	60.270	65.366	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-08	62, Rue Emile Mark, 4620 Differdange	60.250	65.373	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-09	60, Rue Emile Mark, 4620 Differdange	60.211	65.344	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-10	40, Rue Emile Mark, 4620 Differdange	60.139	65.356	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-11	Rue Emile Mark, 4620 Differdange	60.182	65.419	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
D-12	53, Rue Emile Mark, 4620 Differdange	60.109	65.429	298,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-01	Z.I. Gadderscheier	62.407	66.460	319,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-02	3, Z.A. Gadderscheier, 4570 Niederkorn	61.352	67.089	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-03	3, Z.A. Gadderscheier, 4570 Niederkorn	61.222	67.067	297,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-04	3, Z.A. Gadderscheier, 4570 Niederkorn	61.159	67.042	296,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-05	1, Z.A. Gadderscheier, 4570 Niederkorn	61.096	67.034	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-06	1, Z.A. Gadderscheier, 4570 Niederkorn	61.032	67.039	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-07	1, Z.A. Gadderscheier, 4570 Niederkorn	61.570	67.009	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-08	Z.I. Gadderscheier	60.692	66.113	299,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-09	Z.I. Gadderscheier	60.785	65.955	300,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
I-10	Z.I. Gadderscheier	60.806	65.875	300,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-01	189, Rue de Niederkorn, 4991 Sanem	61.502	67.338	291,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-02	193, Rue de Niederkorn, 4991 Sanem	61.474	67.327	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-03	197, Rue de Niederkorn, 4991 Sanem	61.444	67.316	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-04	203, Rue de Niederkorn, 4991 Sanem	61.403	67.299	289,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

(Fortsetzung nächste Seite)...



Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Hauptergebnis

## Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	X	Y	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
N-05	194, Rue de Niederkorn, 4991 Sanem	61.452	67.358	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-06	200, Rue de Niederkorn, 4991 Sanem	61.415	67.344	288,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-07	200, Rue de Niederkorn, 4991 Sanem	61.384	67.334	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-08	36, Rue de l'Industrie, 4991 Sanem	61.351	67.382	286,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-09	246, Rue Pierre Gansen, 4570 Niederkorn	61.365	67.293	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-10	241, Rue Pierre Gansen, 4570 Niederkorn	61.326	67.314	286,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-11	236, Rue Pierre Gansen, 4570 Niederkorn	61.315	67.277	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-12	239, Rue Pierre Gansen, 4570 Niederkorn	61.282	67.299	285,7	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-13	228, Rue Pierre Gansen, 4570 Niederkorn	61.281	67.264	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-14	216, Rue Pierre Gansen, 4570 Niederkorn	61.236	67.250	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-15	237A, Rue Pierre Gansen, 4570 Niederkorn	61.229	67.295	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-16	231A, Rue Pierre Gansen, 4570 Niederkorn	61.194	67.274	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-17	202, Rue Pierre Gansen, 4570 Niederkorn	61.189	67.233	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-18	229, Rue Pierre Gansen, 4570 Niederkorn	61.153	67.259	286,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-19	198K, Rue Pierre Gansen, 4570 Niederkorn	61.144	67.207	288,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-20	223, Rue Pierre Gansen, 4570 Niederkorn	61.117	67.244	286,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-21	219, Rue Pierre Gansen, 4570 Niederkorn	61.087	67.233	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-22	198F, Rue Pierre Gansen, 4570 Niederkorn	61.056	67.171	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-23	211, Rue Pierre Gansen, 4570 Niederkorn	61.027	67.211	285,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-24	198E, Rue Pierre Gansen, 4570 Niederkorn	60.982	67.154	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-25	198C, Rue Pierre Gansen, 4570 Niederkorn	60.926	67.136	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-26	89, Rue de Sanem, 4664 Niederkorn	60.949	67.210	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-27	203, Rue Pierre Gansen, 4570 Niederkorn	60.937	67.179	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-28	73, Rue de Sanem, 4664 Niederkorn	60.896	67.209	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-29	189, Rue Pierre Gansen, 4570 Niederkorn	60.886	67.162	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-30	65, Rue de Sanem, 4664 Niederkorn	60.861	67.212	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-31	53, Rue de Sanem, 4664 Niederkorn	60.819	67.204	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-32	38, Rue de Sanem, 4664 Niederkorn	60.838	67.175	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-33	183, Rue Pierre Gansen, 4570 Niederkorn	60.836	67.143	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-34	194, Rue Pierre Gansen, 4570 Niederkorn	60.831	67.110	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-35	173, Rue Pierre Gansen, 4570 Niederkorn	60.794	67.129	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-36	28, Rue de Sanem, 4664 Niederkorn	60.790	67.164	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-37	18, Rue de Sanem, 4664 Niederkorn	60.750	67.145	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-38	18, Rue de Sanem, 4664 Niederkorn	60.712	67.159	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-39	8, Rue de Sanem, 4664 Niederkorn	60.708	67.124	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-40	7, Rue de Sanem, 4664 Niederkorn	60.660	67.116	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-41	184, Rue Pierre Gansen, 4570 Niederkorn	60.788	67.094	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-42	165, Rue Pierre Gansen, 4570 Niederkorn	60.756	67.116	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-43	174, Rue Pierre Gansen, 4570 Niederkorn	60.744	67.082	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-44	151, Rue Pierre Gansen, 4570 Niederkorn	60.702	67.097	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-45	160, Rue Pierre Gansen, 4570 Niederkorn	60.696	67.058	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-46	1, Rue de Sanem, 4664 Niederkorn	60.638	67.082	285,5	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-47	146, Rue Pierre Gansen, 4570 Niederkorn	60.645	67.040	285,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-48	127, Rue Pierre Gansen, 4570 Niederkorn	60.596	67.048	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-49	134, Rue Pierre Gansen, 4570 Niederkorn	60.593	67.012	286,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-50	103, Rue Pierre Gansen, 4570 Niederkorn	60.558	67.028	287,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-51	120, Rue Pierre Gansen, 4570 Niederkorn	60.552	66.992	288,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-52	95, Rue Pierre Gansen, 4570 Niederkorn	60.524	67.012	289,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-53	114, Rue Pierre Gansen, 4570 Niederkorn	60.521	66.979	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-54	108B, Rue Pierre Gansen, 4570 Niederkorn	60.495	66.957	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-55	108, Rue Pierre Gansen, 4570 Niederkorn	60.474	66.950	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-56	87, Rue Pierre Gansen, 4570 Niederkorn	60.499	66.999	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-57	77, Rue Pierre Gansen, 4570 Niederkorn	60.460	66.984	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-58	98, Rue Pierre Gansen, 4570 Niederkorn	60.425	66.930	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-59	57, Rue Pierre Gansen, 4570 Niederkorn	60.395	66.952	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-60	76, Rue Pierre Gansen, 4570 Niederkorn	60.349	66.896	291,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-61	52A, Rue Pierre Gansen, 4570 Niederkorn	60.263	66.875	293,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-62	36, Rue Pierre Gansen, 4570 Niederkorn	60.195	66.854	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-63	17A, Rue Pierre Gansen, 4570 Niederkorn	60.224	66.897	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-64	35, Rue Pierre Gansen, 4570 Niederkorn	60.308	66.920	291,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-65	18, Rue des Celtes, 4526 Niederkorn	60.241	66.967	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-66	10, Rue des Celtes, 4526 Niederkorn	60.318	66.988	293,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-67	10, Rue des Lignes, 4609 Niederkorn	60.387	67.032	292,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0

(Fortsetzung nächste Seite)...



## Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

## Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

## Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Hauptergebnis

## Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

Nr.	Name	X	Y	Z	Breite	Höhe	Höhe ü.Gr.	Neigung des Fensters	Ausrichtungsmodus	Augenhöhe (ZVI) ü.Gr.
				[m]	[m]	[m]	[m]	[°]		[m]
N-68	7, Rue des Trévires, 4680 Niederkorn	60.289	67.046	296,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-69	19, Rue des Lignes, 4609 Niederkorn	60.348	67.057	294,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-70	32, Rue des Lignes, 4609 Niederkorn	60.374	67.105	295,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-71	39, Rue des Lignes, 4609 Niederkorn	60.334	67.131	297,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-72	Z.I. Hahneboesch, 4562 Niederkorn	60.487	67.232	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
N-73	Z.I. Hahneboesch, 4562 Niederkorn	60.961	67.323	290,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-01	39, Rue Ermesinde, 4992 Sanem	62.715	67.744	309,8	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-02	37, Rue Ermesinde, 4992 Sanem	62.801	67.755	310,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-03	79, Rue d'Esch, 4985 Sanem	62.889	67.718	302,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-04	89, Rue d'Esch, 4985 Sanem	62.933	67.665	300,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-05	10, Um Woeller, 4410 Soleuvre	63.233	66.870	312,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-06	80, Rue des Champs, 4432 Soleuvre	63.036	66.107	340,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-07	75, Rue des Champs, 4432 Soleuvre	63.075	65.997	353,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-08	22A, Rue Belle-Vue, 4417 Soleuvre	63.105	65.678	387,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-09	9, Rue de Differdange, Soleuvre	63.184	65.290	354,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-10	17, Rue de Differdange, Soleuvre	63.146	65.315	351,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-11	16, Rue de Differdange, 4437 Soleuvre	63.112	65.385	348,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-12	31, Rue de Differdange, 4437 Soleuvre	63.068	65.365	345,1	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-13	6, Rue du Bois, 4421 Soleuvre	63.086	65.294	354,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-14	32, Rue de Differdange, 4421 Soleuvre	63.042	65.414	342,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-15	1, Rue Emile Mayrisch, 4470 Soleuvre	62.959	65.411	338,6	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-16	4, Rue Emile Mayrisch, 4470 Soleuvre	62.889	65.396	340,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-17	62, Rue de Differdange, Soleuvre	62.950	65.462	337,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-18	69, Rue de Differdange, Soleuvre	62.884	65.444	335,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-19	35, Rue des Erables, 4423 Soleuvre	62.821	65.431	333,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-20	69, Rue de Differdange, 4437 Soleuvre	62.909	65.479	335,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-21	74, Rue de Differdange, 4437 Soleuvre	62.855	65.503	331,4	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-22	73, Rue de Differdange, 4437 Soleuvre	62.809	65.477	330,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-23	80, Rue de Differdange, 4437 Soleuvre	62.823	65.513	330,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-24	90, Rue de Differdange, 4437 Soleuvre	62.781	65.522	330,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-25	25, Rue des Erables, 4423 Soleuvre	62.756	65.440	332,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-26	85, Rue de Differdange, 4437 Soleuvre	62.757	65.487	330,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-27	95, Rue de Differdange, 4437 Soleuvre	62.708	65.488	328,3	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-28	100, Rue de Differdange, 4437 Soleuvre	62.745	65.524	329,0	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-29	106, Rue de Differdange, 4437 Soleuvre	62.688	65.519	326,9	0,1	0,1	2,0	0,0	"Gewächshaus-Modus"	2,0
S-30	112, Rue de Differdange, 4437 Soleuvre	62.636	65.512	325,0	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]	
D-01	61, Rue Emile Mark, 4620 Differdange	16:41	48	0:25	5:18	
D-02	76, Rue Emile Mark, 4620 Differdange	13:14	42	0:23	4:12	
D-03	68, Rue Emile Mark, 4620 Differdange	18:57	53	0:26	6:01	
D-04	19, Rue du Gaz, 4573 Differdange	15:17	47	0:24	4:51	
D-05	3, Rue John Ernest Dolibois, 4573 Differdange	19:38	57	0:24	6:14	
D-06	2, Rue du Gaz, 4573 Differdange	23:12	63	0:25	7:21	
D-07	62A, Rue Emile Mark, 4620 Differdange	26:22	74	0:25	8:19	
D-08	62, Rue Emile Mark, 4620 Differdange	25:55	77	0:25	8:10	
D-09	60, Rue Emile Mark, 4620 Differdange	24:51	76	0:24	7:50	
D-10	40, Rue Emile Mark, 4620 Differdange	17:50	63	0:23	5:36	
D-11	Rue Emile Mark, 4620 Differdange	16:44	57	0:24	5:13	
D-12	53, Rue Emile Mark, 4620 Differdange	13:37	47	0:23	4:14	
I-01	Z.I. Gadderscheier	92:29	142	0:52	22:29	
I-02	3, Z.A. Gadderscheier, 4570 Niederkorn	89:12	104	0:59	6:37	
I-03	3, Z.A. Gadderscheier, 4570 Niederkorn	86:45	117	0:53	6:38	
I-04	3, Z.A. Gadderscheier, 4570 Niederkorn	75:50	127	0:51	6:31	
I-05	1, Z.A. Gadderscheier, 4570 Niederkorn	72:17	129	0:48	6:30	
I-06	1, Z.A. Gadderscheier, 4570 Niederkorn	68:50	128	0:45	6:16	
I-07	1, Z.A. Gadderscheier, 4570 Niederkorn	125:21	111	1:16	9:53	
I-08	Z.I. Gadderscheier	69:46	139	0:37	20:45	

(Fortsetzung nächste Seite)...



## Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

## Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

## Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Hauptergebnis

## Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

		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]
I-09	Z.I. Gadderscheier	38:15	87	0:40	11:32
I-10	Z.I. Gadderscheier	38:15	74	0:41	11:26
N-01	189, Rue de Niederkorn, 4991 Sanem	11:11	30	0:28	0:44
N-02	193, Rue de Niederkorn, 4991 Sanem	17:33	39	0:34	1:10
N-03	197, Rue de Niederkorn, 4991 Sanem	23:05	46	0:39	1:33
N-04	203, Rue de Niederkorn, 4991 Sanem	31:43	54	0:43	2:10
N-05	194, Rue de Niederkorn, 4991 Sanem	11:55	32	0:28	0:47
N-06	200, Rue de Niederkorn, 4991 Sanem	19:36	42	0:35	1:19
N-07	200, Rue de Niederkorn, 4991 Sanem	25:38	48	0:39	1:44
N-08	36, Rue de l'Industrie, 4991 Sanem	18:06	41	0:33	1:12
N-09	246, Rue Pierre Gansen, 4570 Niederkorn	37:29	60	0:46	2:35
N-10	241, Rue Pierre Gansen, 4570 Niederkorn	36:00	60	0:44	2:28
N-11	236, Rue Pierre Gansen, 4570 Niederkorn	45:06	68	0:47	3:08
N-12	239, Rue Pierre Gansen, 4570 Niederkorn	42:48	68	0:45	2:57
N-13	228, Rue Pierre Gansen, 4570 Niederkorn	50:11	74	0:47	3:29
N-14	216, Rue Pierre Gansen, 4570 Niederkorn	55:12	81	0:47	3:48
N-15	237A, Rue Pierre Gansen, 4570 Niederkorn	47:07	74	0:45	3:14
N-16	231A, Rue Pierre Gansen, 4570 Niederkorn	52:25	80	0:44	3:35
N-17	202, Rue Pierre Gansen, 4570 Niederkorn	58:58	88	0:45	4:04
N-18	229, Rue Pierre Gansen, 4570 Niederkorn	55:13	86	0:43	3:46
N-19	198K, Rue Pierre Gansen, 4570 Niederkorn	61:07	96	0:45	4:16
N-20	223, Rue Pierre Gansen, 4570 Niederkorn	56:29	92	0:43	3:53
N-21	219, Rue Pierre Gansen, 4570 Niederkorn	55:49	96	0:42	3:51
N-22	198F, Rue Pierre Gansen, 4570 Niederkorn	56:54	109	0:43	4:18
N-23	211, Rue Pierre Gansen, 4570 Niederkorn	53:13	104	0:41	3:53
N-24	198E, Rue Pierre Gansen, 4570 Niederkorn	54:24	116	0:40	4:26
N-25	198C, Rue Pierre Gansen, 4570 Niederkorn	55:06	118	0:39	4:40
N-26	89, Rue de Sanem, 4664 Niederkorn	48:57	110	0:38	3:47
N-27	203, Rue Pierre Gansen, 4570 Niederkorn	51:41	116	0:38	4:11
N-28	73, Rue de Sanem, 4664 Niederkorn	48:11	110	0:37	3:49
N-29	189, Rue Pierre Gansen, 4570 Niederkorn	52:29	117	0:37	4:24
N-30	65, Rue de Sanem, 4664 Niederkorn	47:27	112	0:36	3:48
N-31	53, Rue de Sanem, 4664 Niederkorn	47:51	112	0:35	3:55
N-32	38, Rue de Sanem, 4664 Niederkorn	50:25	115	0:36	4:13
N-33	183, Rue Pierre Gansen, 4570 Niederkorn	53:05	118	0:36	4:34
N-34	194, Rue Pierre Gansen, 4570 Niederkorn	55:36	122	0:36	4:55
N-35	173, Rue Pierre Gansen, 4570 Niederkorn	52:59	121	0:35	4:38
N-36	28, Rue de Sanem, 4664 Niederkorn	50:33	118	0:35	4:19
N-37	18, Rue de Sanem, 4664 Niederkorn	50:15	122	0:34	4:22
N-38	18, Rue de Sanem, 4664 Niederkorn	48:28	119	0:33	4:12
N-39	8, Rue de Sanem, 4664 Niederkorn	48:56	124	0:33	4:23
N-40	7, Rue de Sanem, 4664 Niederkorn	44:24	127	0:32	4:07
N-41	184, Rue Pierre Gansen, 4570 Niederkorn	54:23	127	0:35	4:51
N-42	165, Rue Pierre Gansen, 4570 Niederkorn	51:50	122	0:34	4:36
N-43	174, Rue Pierre Gansen, 4570 Niederkorn	51:45	128	0:34	4:45
N-44	151, Rue Pierre Gansen, 4570 Niederkorn	47:54	126	0:33	4:25
N-45	160, Rue Pierre Gansen, 4570 Niederkorn	43:09	113	0:33	4:19
N-46	1, Rue de Sanem, 4664 Niederkorn	38:30	104	0:32	3:53
N-47	146, Rue Pierre Gansen, 4570 Niederkorn	37:42	100	0:32	4:01
N-48	127, Rue Pierre Gansen, 4570 Niederkorn	34:29	94	0:31	3:43
N-49	134, Rue Pierre Gansen, 4570 Niederkorn	33:43	91	0:31	3:48
N-50	103, Rue Pierre Gansen, 4570 Niederkorn	31:50	88	0:30	3:35
N-51	120, Rue Pierre Gansen, 4570 Niederkorn	31:16	86	0:31	3:40
N-52	95, Rue Pierre Gansen, 4570 Niederkorn	30:07	84	0:30	3:30
N-53	114, Rue Pierre Gansen, 4570 Niederkorn	29:38	83	0:30	3:35
N-54	108B, Rue Pierre Gansen, 4570 Niederkorn	28:20	80	0:29	3:35
N-55	108, Rue Pierre Gansen, 4570 Niederkorn	27:23	77	0:29	3:33
N-56	87, Rue Pierre Gansen, 4570 Niederkorn	28:45	81	0:29	3:25
N-57	77, Rue Pierre Gansen, 4570 Niederkorn	26:56	78	0:28	3:20
N-58	98, Rue Pierre Gansen, 4570 Niederkorn	25:28	75	0:28	3:30
N-59	57, Rue Pierre Gansen, 4570 Niederkorn	24:27	73	0:28	3:17
N-60	76, Rue Pierre Gansen, 4570 Niederkorn	23:02	70	0:27	3:28
N-61	52A, Rue Pierre Gansen, 4570 Niederkorn	20:22	64	0:25	3:14
N-62	36, Rue Pierre Gansen, 4570 Niederkorn	18:50	63	0:24	3:06

(Fortsetzung nächste Seite)...



## Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

## Beschreibung:

Windpark Sanem, Gemeinde  
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## Lizenzierter Anwender:

Ramboll Deutschland GmbH  
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 DE-34131 Kassel



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Hauptergebnis

## Berechnung: Zusatzbelastung

...(Fortsetzung von vorheriger Seite)

		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]	
N-63	17A, Rue Pierre Gansen, 4570 Niederkorn	19:31	64	0:25	3:02	
N-64	35, Rue Pierre Gansen, 4570 Niederkorn	21:30	67	0:25	3:10	
N-65	18, Rue des Celtes, 4526 Niederkorn	19:48	65	0:25	2:47	
N-66	10, Rue des Celtes, 4526 Niederkorn	22:05	69	0:26	2:55	
N-67	10, Rue des Lignes, 4609 Niederkorn	24:24	75	0:27	2:55	
N-68	7, Rue des Trévires, 4680 Niederkorn	21:24	69	0:25	2:37	
N-69	19, Rue des Lignes, 4609 Niederkorn	23:11	74	0:26	2:43	
N-70	32, Rue des Lignes, 4609 Niederkorn	24:33	77	0:26	2:42	
N-71	39, Rue des Lignes, 4609 Niederkorn	23:25	75	0:26	2:33	
N-72	Z.I. Hahneboesch, 4562 Niederkorn	34:56	116	0:27	3:08	
N-73	Z.I. Hahneboesch, 4562 Niederkorn	44:53	88	0:37	2:59	
S-01	39, Rue Ermesinde, 4992 Sanem	9:55	36	0:21	0:52	
S-02	37, Rue Ermesinde, 4992 Sanem	14:05	44	0:23	1:15	
S-03	79, Rue d'Esch, 4985 Sanem	21:18	60	0:24	1:57	
S-04	89, Rue d'Esch, 4985 Sanem	22:57	70	0:24	2:09	
S-05	10, Um Woeller, 4410 Soleuvre	18:09	63	0:24	3:28	
S-06	80, Rue des Champs, 4432 Soleuvre	26:27	82	0:28	6:39	
S-07	75, Rue des Champs, 4432 Soleuvre	23:11	79	0:27	5:55	
S-08	22A, Rue Belle-Vue, 4417 Soleuvre	20:54	96	0:22	5:06	
S-09	9, Rue de Differdange, Soleuvre	20:40	74	0:23	5:00	
S-10	17, Rue de Differdange, Soleuvre	22:18	75	0:24	5:24	
S-11	16, Rue de Differdange, 4437 Soleuvre	22:32	83	0:26	5:29	
S-12	31, Rue de Differdange, 4437 Soleuvre	25:53	76	0:27	6:16	
S-13	6, Rue du Bois, 4421 Soleuvre	20:54	66	0:25	5:02	
S-14	32, Rue de Differdange, 4421 Soleuvre	27:38	82	0:27	6:43	
S-15	1, Rue Emile Mayrisch, 4470 Soleuvre	28:47	72	0:29	6:58	
S-16	4, Rue Emile Mayrisch, 4470 Soleuvre	23:37	61	0:30	5:41	
S-17	62, Rue de Differdange, Soleuvre	32:16	80	0:29	7:50	
S-18	69, Rue de Differdange, Soleuvre	29:48	69	0:31	7:12	
S-19	35, Rue des Erables, 4423 Soleuvre	23:24	57	0:31	5:37	
S-20	69, Rue de Differdange, 4437 Soleuvre	33:48	79	0:30	8:13	
S-21	74, Rue de Differdange, 4437 Soleuvre	35:30	77	0:32	8:37	
S-22	73, Rue de Differdange, 4437 Soleuvre	29:46	65	0:33	7:11	
S-23	80, Rue de Differdange, 4437 Soleuvre	35:39	75	0:33	8:39	
S-24	90, Rue de Differdange, 4437 Soleuvre	35:03	71	0:34	8:30	
S-25	25, Rue des Erables, 4423 Soleuvre	17:45	47	0:29	4:15	
S-26	85, Rue de Differdange, 4437 Soleuvre	27:04	59	0:33	6:31	
S-27	95, Rue de Differdange, 4437 Soleuvre	21:08	50	0:31	5:04	
S-28	100, Rue de Differdange, 4437 Soleuvre	32:45	66	0:35	7:55	
S-29	106, Rue de Differdange, 4437 Soleuvre	25:03	55	0:34	6:02	
S-30	112, Rue de Differdange, 4437 Soleuvre	14:17	39	0:27	3:24	

## Gesamtdauer Beschattung an Rezeptoren pro WEA

Nr.	Name	Maximal	Erwartet
		[h/a]	[h/a]
WEA 1	NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)	608:25	83:27
WEA 2	NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)	398:05	77:23

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.



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-01 - 61, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:06 (WEA 2) 21:47	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:17	08:11 16:41
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:05 (WEA 2) 21:47	06:09 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:05 (WEA 2) 21:47	06:09 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:04 (WEA 2) 21:46	06:09 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12	08:14 16:39
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:05 (WEA 2) 21:46	06:10 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10	08:16 16:39
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:04 (WEA 2) 21:46	06:10 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:04 (WEA 2) 21:45	06:11 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:04 (WEA 2) 21:44	06:11 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:04 (WEA 2) 21:44	06:12 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:04 (WEA 2) 21:43	06:13 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:04 (WEA 2) 21:43	06:14 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:04 (WEA 2) 21:42	06:14 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:23 16:37
13	08:30 17:02	07:52 17:52	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	06:04 (WEA 2) 21:41	06:15 (WEA 2) 21:09	07:09 19:57	07:54 18:52	07:43 16:58	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:04 (WEA 2) 21:40	06:17 (WEA 2) 21:08	07:10 19:54	07:55 18:50	07:45 16:57	08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:04 (WEA 2) 21:39	06:19 (WEA 2) 21:06	07:12 19:52	07:57 18:48	07:47 16:56	08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:04 (WEA 2) 21:39	06:28 (WEA 2) 21:04	07:13 19:50	07:58 18:46	07:48 16:54	08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:04 (WEA 2) 21:38	06:29 (WEA 2) 21:02	07:15 19:48	08:00 18:44	07:50 16:53	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:04 (WEA 2) 21:37	06:31 (WEA 2) 21:00	07:16 19:46	08:01 18:42	07:51 16:52	08:28 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:04 (WEA 2) 21:36	06:32 (WEA 2) 21:04	07:17 19:44	08:03 18:40	07:53 16:51	08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:05 (WEA 2) 21:35	06:34 (WEA 2) 21:03	07:19 19:41	08:05 18:38	07:55 16:50	08:30 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:05 (WEA 2) 21:33	06:35 (WEA 2) 21:04	07:20 19:39	08:06 18:36	07:56 16:49	08:30 16:39
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:05 (WEA 2) 21:32	06:37 (WEA 2) 21:02	07:22 19:37	08:08 18:35	07:58 16:48	08:31 16:40
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:05 (WEA 2) 21:31	06:38 (WEA 2) 21:00	07:23 19:35	08:09 18:33	07:59 16:47	08:31 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:06 (WEA 2) 21:30	06:40 (WEA 2) 21:03	07:25 19:33	08:11 18:31	08:01 16:46	08:32 16:41
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:06 (WEA 2) 21:29	06:41 (WEA 2) 21:02	07:26 19:31	08:13 17:29	08:02 16:45	08:32 16:41
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:06 (WEA 2) 21:27	06:42 (WEA 2) 21:01	07:28 19:28	08:14 17:27	08:04 16:44	08:32 16:42
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:07 (WEA 2) 21:26	06:44 (WEA 2) 21:03	07:29 19:26	08:16 17:25	08:05 16:43	08:33 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:07 (WEA 2) 21:25	06:45 (WEA 2) 21:04	07:31 19:24	08:17 17:23	08:06 16:43	08:33 16:43
29	08:14 17:26	07:23 20:02	06:20 20:50	05:38 21:31	05:38 21:31	05:33 21:48	06:08 (WEA 2) 21:23	06:47 (WEA 2) 21:06	07:32 19:22	08:18 17:22	08:08 16:42	08:33 16:44
30	08:13 17:28	07:20 20:04	06:18 20:51	05:37 21:32	05:37 21:32	05:33 21:47	06:07 (WEA 2) 21:22	06:48 (WEA 2) 21:06	07:34 19:20	08:19 17:20	08:09 16:41	08:33 16:45
31	08:12 17:30	07:18 20:05	06:18 20:55	05:36 21:33	05:36 21:33	05:34 21:48	06:07 (WEA 2) 21:21	06:50 (WEA 2) 21:04	07:22 19:24	08:19 17:18	08:09 16:46	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					34	694	273					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					10	218	90					

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:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-02 - 76, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:07 (WEA 2) 21:47	06:06 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17	08:11 16:41
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:05 (WEA 2) 21:47	06:07 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:05 (WEA 2) 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:03 (WEA 2) 21:46	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:12	08:14 16:39
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:03 (WEA 2) 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10	08:16 16:39
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:03 (WEA 2) 21:46	06:14 21:11	06:59 20:12	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:03 (WEA 2) 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:03 (WEA 2) 21:44	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:02 (WEA 2) 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:02 (WEA 2) 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:02 (WEA 2) 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:02 (WEA 2) 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:23 16:37
13	08:30 17:02	07:52 17:52	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	06:02 (WEA 2) 21:41	06:24 20:59	07:09 19:57	07:54 18:52	07:43 16:58	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:02 (WEA 2) 21:40	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57	08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:02 (WEA 2) 21:39	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56	08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:02 (WEA 2) 21:39	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54	08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:02 (WEA 2) 21:38	06:29 20:52	07:15 19:48	08:00 18:44	07:50 16:53	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:02 (WEA 2) 21:37	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52	08:28 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:02 (WEA 2) 21:36	06:32 20:48	07:17 19:44	08:03 18:40	07:53 16:51	08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:03 (WEA 2) 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 16:50	08:30 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:03 (WEA 2) 21:33	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49	08:30 16:39
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:03 (WEA 2) 21:32	06:37 20:42	07:22 19:37	08:08 18:35	07:58 16:48	08:31 16:40
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:03 (WEA 2) 21:31	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47	08:31 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:04 (WEA 2) 21:30	06:40 20:38	07:25 19:33	08:11 18:31	08:01 16:46	08:32 16:41
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:04 (WEA 2) 21:29	06:41 20:36	07:26 19:31	07:13 17:29	08:02 16:45	08:32 16:41
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:04 (WEA 2) 21:27	06:42 20:34	07:28 19:28	07:14 17:27	08:04 16:44	08:32 16:42
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:05 (WEA 2) 21:26	06:44 20:32	07:29 19:26	07:16 17:25	08:05 16:43	08:33 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:05 (WEA 2) 21:25	06:45 20:30	07:31 19:24	07:17 17:23	08:06 16:43	08:33 16:43
29	08:14 17:26		07:23 20:02	06:20 20:50	05:38 21:31	05:33 21:48	06:06 (WEA 2) 21:23	06:47 20:28	07:32 19:22	07:19 17:22	08:08 16:42	08:33 16:44
30	08:13 17:28		07:20 20:04	06:18 20:51	05:37 21:32	05:33 21:47	06:05 (WEA 2) 21:22	06:48 20:26	07:34 19:20	07:21 17:21	08:09 16:41	08:33 16:45
31	08:12 17:30		07:18 20:05	07:18 20:05	05:36 21:33	05:36 21:33	06:05 21:21	06:50 20:24		07:22 17:18	08:33 16:46	
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung						605	189					
Red. Sonnenscheinwahrsch.						0,45	0,48					
Reduktion Betriebsdauer						0,93	0,93					
Reduktion Windrichtung						0,74	0,74					
Gesamte Reduktion						0,31	0,33					
Met. wahrsch. Beschattung						190	62					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-03 - 68, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:05 (WEA 2) 20 06:25 (WEA 2)	05:34 25 06:34 (WEA 2)	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:05 (WEA 2) 21 06:25 (WEA 2)	05:34 24 06:34 (WEA 2)	06:08 21:18	06:53 20:20	07:37 19:15	07:26 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:05 (WEA 2) 20 06:26 (WEA 2)	05:35 24 06:33 (WEA 2)	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:04 (WEA 2) 22 06:26 (WEA 2)	05:36 24 06:34 (WEA 2)	06:10 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:05 (WEA 2) 22 06:27 (WEA 2)	05:36 23 06:34 (WEA 2)	06:11 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:04 (WEA 2) 23 06:27 (WEA 2)	05:37 23 06:33 (WEA 2)	06:10 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:04 (WEA 2) 24 06:28 (WEA 2)	05:38 22 06:33 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:05 (WEA 2) 23 06:28 (WEA 2)	05:39 21 06:33 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:04 (WEA 2) 24 06:28 (WEA 2)	05:40 21 06:33 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:04 (WEA 2) 25 06:29 (WEA 2)	05:41 20 06:33 (WEA 2)	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:05 (WEA 2) 24 06:29 (WEA 2)	05:41 19 06:33 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:05 (WEA 2) 25 06:30 (WEA 2)	05:42 19 06:32 (WEA 2)	06:13 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:04 (WEA 2) 25 06:29 (WEA 2)	05:43 17 06:31 (WEA 2)	06:14 21:09	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:05 (WEA 2) 25 06:30 (WEA 2)	05:44 16 06:31 (WEA 2)	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:05 (WEA 2) 25 06:30 (WEA 2)	05:46 14 06:30 (WEA 2)	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:05 (WEA 2) 25 06:30 (WEA 2)	05:47 11 06:29 (WEA 2)	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:05 (WEA 2) 25 06:30 (WEA 2)	05:48 7 06:27 (WEA 2)	06:29 20:52	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:05 (WEA 2) 26 06:31 (WEA 2)	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:05 (WEA 2) 26 06:31 (WEA 2)	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:06 (WEA 2) 26 06:32 (WEA 2)	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:06 (WEA 2) 26 06:32 (WEA 2)	05:52 21:33	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:06 (WEA 2) 26 06:32 (WEA 2)	05:54 21:32	06:37 20:42	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:06 (WEA 2) 26 06:32 (WEA 2)	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:07 (WEA 2) 26 06:33 (WEA 2)	05:56 21:30	06:40 20:38	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:07 (WEA 2) 26 06:33 (WEA 2)	05:57 21:29	06:41 20:36	07:26 19:31	07:13 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:07 (WEA 2) 25 06:32 (WEA 2)	05:59 21:27	06:42 20:34	07:28 19:28	07:14 17:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:08 (WEA 2) 25 06:33 (WEA 2)	06:00 21:26	06:44 20:32	07:29 19:26	07:16 17:25	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:08 (WEA 2) 25 06:33 (WEA 2)	06:01 21:25	06:45 20:30	07:31 19:24	07:17 17:23	08:06 16:43
29	08:14 17:26	07:23 19:01	06:20 20:02	06:20 20:50	05:38 21:31	05:33 21:48	06:08 (WEA 2) 25 06:33 (WEA 2)	06:03 21:23	06:47 20:28	07:32 19:22	07:19 17:22	08:08 16:42
30	08:13 17:28	07:20 19:04	06:18 20:04	06:18 20:51	05:37 21:32	05:33 21:47	06:08 (WEA 2) 25 06:33 (WEA 2)	06:04 21:22	06:48 20:26	07:34 19:20	07:21 17:20	08:09 16:41
31	08:12 17:30	07:18 20:05	07:18 20:05	06:18 21:33	05:36 21:24	05:36 21:21	06:06 (WEA 2) 18 06:24 (WEA 2)	06:05 21:21	06:50 20:24	07:22 17:18	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					76	731	330					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					23	230	108					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-04 - 19, Rue du Gaz, 4573 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:04 (WEA 2) 21:47	05:34 21:19	06:06 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:03 (WEA 2) 21:47	05:34 21:18	06:07 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:04 (WEA 2) 21:47	05:35 21:22	06:07 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:03 (WEA 2) 21:46	05:36 21:21	06:08 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:03 (WEA 2) 21:46	05:36 21:21	06:08 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:02 (WEA 2) 21:46	05:37 21:20	06:08 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:02 (WEA 2) 21:45	05:38 21:19	06:09 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:03 (WEA 2) 21:44	05:39 21:18	06:10 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:02 (WEA 2) 21:44	05:40 21:17	06:11 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:02 (WEA 2) 21:43	05:41 21:17	06:11 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:02 (WEA 2) 21:43	05:41 21:15	06:12 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:03 (WEA 2) 21:42	05:42 21:12	06:13 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:02 (WEA 2) 21:41	05:43 21:10	06:14 (WEA 2) 21:05	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:02 (WEA 2) 21:40	05:44 21:07	06:16 (WEA 2) 20:58	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:02 (WEA 2) 21:39	05:46 21:06	06:23 (WEA 2) 20:56	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:02 (WEA 2) 21:39	05:47 21:06	06:28 (WEA 2) 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:02 (WEA 2) 21:38	05:48 21:05	06:29 (WEA 2) 20:52	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:03 (WEA 2) 21:37	05:49 21:05	06:31 (WEA 2) 20:50	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:03 (WEA 2) 21:36	05:50 21:04	06:32 (WEA 2) 20:48	07:17 19:44	08:02 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:04 (WEA 2) 21:35	05:51 21:03	06:34 (WEA 2) 20:46	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:04 (WEA 2) 21:33	05:52 21:03	06:35 (WEA 2) 20:44	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:04 (WEA 2) 21:32	05:54 21:03	06:37 (WEA 2) 20:42	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:04 (WEA 2) 21:31	05:55 21:03	06:38 (WEA 2) 20:40	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:05 (WEA 2) 21:30	05:56 21:03	06:40 (WEA 2) 20:38	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:05 (WEA 2) 21:29	05:57 21:03	06:41 (WEA 2) 20:36	07:26 19:31	07:13 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:04 (WEA 2) 21:27	05:59 21:03	06:42 (WEA 2) 20:34	07:28 19:28	07:14 17:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:05 (WEA 2) 21:26	06:00 21:03	06:44 (WEA 2) 20:32	07:29 19:26	07:16 17:25	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:05 (WEA 2) 21:25	06:01 21:03	06:45 (WEA 2) 20:30	07:31 19:24	07:17 17:23	08:06 16:43
29	08:14 17:26	07:23 19:01	06:20 20:02	06:18 20:50	05:38 21:31	05:33 21:48	06:06 (WEA 2) 21:23	06:03 21:03	06:47 (WEA 2) 20:28	07:32 19:22	07:19 17:22	08:08 16:42
30	08:13 17:28	07:20 19:04	06:18 20:04	06:16 20:51	05:37 21:32	05:33 21:47	06:06 (WEA 2) 21:22	06:04 21:03	06:48 (WEA 2) 20:26	07:34 19:20	07:21 17:20	08:09 16:41
31	08:12 17:30	07:18 20:05	06:18 20:05	06:16 21:33	05:36 12	05:36 21:33	06:06 (WEA 2) 21:21	06:05 21:03	06:50 (WEA 2) 20:24	07:22 17:18	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					25	648	244					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,74	0,74						
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					8	204	80					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-05 - 3, Rue John Ernest Dolibois, 4573 Differdange  
Annahmen für Schattenwurfberechnung Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:05 (WEA 2) 21:47	05:34 21:47	06:09 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:04 (WEA 2) 21:47	05:34 21:47	06:10 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:04 (WEA 2) 21:47	05:35 21:47	06:10 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:04 (WEA 2) 21:46	05:36 21:46	06:10 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:04 (WEA 2) 21:46	05:36 21:46	06:10 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:04 (WEA 2) 21:46	05:37 21:46	06:10 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:04 (WEA 2) 21:45	05:38 21:45	06:11 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:32 21:41	06:05 (WEA 2) 21:44	05:39 21:44	06:11 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:04 (WEA 2) 21:44	05:40 21:44	06:12 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:05 (WEA 2) 21:43	05:41 21:43	06:12 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:05 (WEA 2) 21:43	05:42 21:43	06:13 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:05 (WEA 2) 21:42	05:42 21:42	06:12 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:05 (WEA 2) 21:41	05:43 21:41	06:13 (WEA 2) 21:09	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:05 (WEA 2) 21:40	05:44 21:40	06:14 (WEA 2) 21:08	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:05 (WEA 2) 21:39	05:46 21:39	06:14 (WEA 2) 21:06	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:05 (WEA 2) 21:39	05:47 21:39	06:15 (WEA 2) 21:04	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:06 (WEA 2) 21:38	05:48 21:38	06:17 (WEA 2) 21:02	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:06 (WEA 2) 21:37	05:49 21:37	06:19 (WEA 2) 21:00	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:06 (WEA 2) 21:36	05:50 21:36	06:21 (WEA 2) 21:04	07:18 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:07 (WEA 2) 21:35	05:51 21:35	06:34 (WEA 2) 21:03	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:07 (WEA 2) 21:33	05:52 21:33	06:35 (WEA 2) 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:07 (WEA 2) 21:32	05:54 21:32	06:37 (WEA 2) 21:03	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:07 (WEA 2) 21:31	05:55 21:31	06:38 (WEA 2) 21:04	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:08 (WEA 2) 21:30	05:56 21:30	06:40 (WEA 2) 21:03	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:08 (WEA 2) 21:29	05:57 21:29	06:41 (WEA 2) 21:03	07:26 19:31	08:02 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	9 21:48	06:08 (WEA 2) 21:27	05:59 21:27	06:42 (WEA 2) 21:03	07:28 19:28	08:04 17:27	08:32 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	12 21:48	06:07 (WEA 2) 21:26	05:52 21:26	06:44 (WEA 2) 21:03	07:29 19:26	08:05 17:25	08:33 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	15 21:48	06:06 (WEA 2) 21:25	05:32 21:25	06:45 (WEA 2) 21:03	07:31 19:24	08:06 17:23	08:33 16:43
29	08:14 17:26	07:23 18:02	06:20 18:50	06:16 20:48	05:38 21:31	16 21:48	06:06 (WEA 2) 21:23	05:33 21:23	06:47 (WEA 2) 21:03	07:32 19:22	08:07 17:22	08:33 16:42
30	08:13 17:28	07:20 18:04	06:18 18:51	06:14 20:51	05:37 21:32	17 21:48	06:05 (WEA 2) 21:22	05:33 21:22	06:48 (WEA 2) 21:03	07:34 19:20	08:09 17:20	08:33 16:41
31	08:12 17:30	07:18 18:05	06:18 18:51	06:14 20:51	05:36 21:33	18 21:48	06:05 (WEA 2) 21:21	05:33 21:21	06:50 (WEA 2) 21:03	07:22 19:24	08:09 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					110	702	366					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					33	221	120					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-06 - 2, Rue du Gaz, 4573 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:08 (WEA 2) 21:47	05:34 21:19	06:13 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:07 (WEA 2) 21:47	05:34 21:18	06:14 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:08 (WEA 2) 21:47	05:35 21:16	06:13 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:07 (WEA 2) 21:46	05:36 21:15	06:14 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:08 (WEA 2) 21:46	05:36 21:13	06:14 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:07 (WEA 2) 21:46	05:37 21:11	06:14 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:08 (WEA 2) 21:45	05:38 21:10	06:14 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:08 (WEA 2) 21:44	05:39 21:08	06:15 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:08 (WEA 2) 21:44	05:40 21:06	06:15 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:08 (WEA 2) 21:43	05:41 21:05	06:15 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:09 (WEA 2) 21:43	05:41 21:03	06:16 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:09 (WEA 2) 21:42	05:42 21:01	06:15 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:09 (WEA 2) 21:41	05:43 21:02	06:16 (WEA 2) 21:02	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:09 (WEA 2) 21:40	05:44 21:00	06:16 (WEA 2) 21:00	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:09 (WEA 2) 21:39	05:46 21:01	06:17 (WEA 2) 21:01	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:09 (WEA 2) 21:39	05:47 21:01	06:17 (WEA 2) 21:01	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:10 (WEA 2) 21:38	05:48 21:01	06:19 (WEA 2) 21:01	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:10 (WEA 2) 21:37	05:49 21:01	06:20 (WEA 2) 21:01	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:10 (WEA 2) 21:36	05:50 21:01	06:20 (WEA 2) 21:01	07:17 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:11 (WEA 2) 21:35	05:51 21:01	06:21 (WEA 2) 21:01	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:11 (WEA 2) 21:33	05:52 21:01	06:23 (WEA 2) 21:01	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:11 (WEA 2) 21:32	05:54 21:01	06:25 (WEA 2) 21:01	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:11 (WEA 2) 21:31	05:55 21:01	06:26 (WEA 2) 21:01	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:12 (WEA 2) 21:30	05:56 21:01	06:27 (WEA 2) 21:01	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:12 (WEA 2) 21:29	05:57 21:01	06:28 (WEA 2) 21:01	07:26 19:31	08:12 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:12 (WEA 2) 21:27	05:59 21:01	06:29 (WEA 2) 21:01	07:28 19:28	08:14 17:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:12 (WEA 2) 21:26	06:00 21:01	06:30 (WEA 2) 21:01	07:29 19:26	08:16 17:25	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:12 (WEA 2) 21:25	06:01 21:01	06:31 (WEA 2) 21:01	07:31 19:24	08:17 17:23	08:06 16:43
29	08:14 17:26	07:23 18:02	06:20 18:50	06:16 20:48	05:38 21:31	05:33 21:48	06:13 (WEA 2) 21:23	06:03 21:01	06:32 (WEA 2) 21:01	07:32 19:22	08:18 17:22	08:08 16:42
30	08:13 17:28	07:20 18:04	06:18 18:51	06:15 20:51	05:37 21:32	05:33 21:47	06:12 (WEA 2) 21:22	06:04 21:01	06:33 (WEA 2) 21:01	07:34 19:20	08:19 17:20	08:09 16:41
31	08:12 17:30	07:18 18:05	06:18 18:52	06:15 20:55	05:36 21:33	05:33 21:48	06:12 (WEA 2) 21:21	06:05 21:01	06:34 (WEA 2) 21:01	07:35 19:24	08:20 17:21	08:10 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					187	741						
Red. Sonnenscheinwahrsch.					0,44	0,45						
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,74	0,74						
Gesamte Reduktion					0,30	0,31						
Met. wahrsch. Beschattung					57	232						

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-07 - 62A, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:14 (WEA 2) 21:47	05:34 22	06:21 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:14 (WEA 2) 21:47	05:34 22	06:22 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:16 20:56	05:34 21:36	06:14 (WEA 2) 21:47	05:35 22	06:21 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:14 (WEA 2) 21:46	05:36 23	06:21 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:15 (WEA 2) 21:46	05:36 23	06:22 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:15 (WEA 2) 21:46	05:37 23	06:21 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:15 (WEA 2) 21:45	05:38 24	06:21 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:16 (WEA 2) 21:44	05:39 24	06:21 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:16 (WEA 2) 21:44	05:40 24	06:22 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:16 (WEA 2) 21:43	05:41 24	06:22 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:17 (WEA 2) 21:43	05:41 24	06:22 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:18 (WEA 2) 21:42	05:42 25	06:21 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:17 (WEA 2) 21:41	05:43 25	06:21 (WEA 2) 21:01	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:18 (WEA 2) 21:40	05:44 24	06:22 (WEA 2) 20:58	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:18 (WEA 2) 21:39	05:46 24	06:22 (WEA 2) 20:56	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:19 (WEA 2) 21:39	05:47 24	06:22 (WEA 2) 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:19 (WEA 2) 21:38	05:48 24	06:23 (WEA 2) 20:52	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:19 (WEA 2) 21:37	05:49 24	06:23 (WEA 2) 20:50	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:19 (WEA 2) 21:36	05:50 23	06:24 (WEA 2) 20:48	07:17 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:20 (WEA 2) 21:35	05:51 22	06:24 (WEA 2) 20:46	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:20 (WEA 2) 21:33	05:52 22	06:24 (WEA 2) 20:44	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:20 (WEA 2) 21:32	05:54 22	06:24 (WEA 2) 20:42	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:21 (WEA 2) 21:31	05:55 20	06:25 (WEA 2) 20:40	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:21 (WEA 2) 21:30	05:56 19	06:25 (WEA 2) 20:38	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:21 (WEA 2) 21:29	05:57 17	06:27 (WEA 2) 20:36	07:26 19:31	08:12 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:20 (WEA 2) 21:27	05:59 15	06:28 (WEA 2) 20:34	07:28 19:28	08:14 17:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:21 (WEA 2) 21:26	06:00 12	06:29 (WEA 2) 20:32	07:29 19:26	08:16 17:25	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:21 (WEA 2) 21:25	06:01 6	06:32 (WEA 2) 20:30	07:31 19:24	08:17 17:23	08:06 16:43
29	08:14 17:26	07:23 18:02	06:20 18:50	06:16 20:50	05:38 21:31	05:33 21:48	06:21 (WEA 2) 21:23	06:03 21	06:38 (WEA 2) 20:28	07:32 19:22	08:19 17:22	08:08 16:42
30	08:13 17:28	07:20 18:04	06:18 18:51	06:13 20:51	05:37 21:32	05:33 21:47	06:21 (WEA 2) 21:22	06:04 21	06:48 (WEA 2) 20:26	07:34 19:20	08:21 17:20	08:09 16:41
31	08:12 17:30	07:18 18:05	06:18 18:50	06:13 20:50	05:36 21:33	05:36 21:48	06:14 (WEA 2) 21:21	06:05 21	06:50 (WEA 2) 20:24	07:22 17:18	08:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					334	645	603					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,96					
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					101	202	197					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-08 - 62, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:16 (WEA 2) 21:47	05:34 21:19	06:24 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:16 (WEA 2) 21:47	05:34 21:19	06:25 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:17 (WEA 2) 21:47	05:35 21:20	06:24 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:16 (WEA 2) 21:46	05:36 21:21	06:24 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:17 (WEA 2) 21:46	05:36 21:21	06:24 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:17 (WEA 2) 21:46	05:37 21:21	06:24 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:18 (WEA 2) 21:45	05:38 21:22	06:24 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	06:19 (WEA 2) 21:44	05:39 21:22	06:24 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:19 (WEA 2) 21:44	05:40 21:23	06:24 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:19 (WEA 2) 21:43	05:41 21:23	06:24 (WEA 2) 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:20 (WEA 2) 21:43	05:41 21:24	06:24 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:20 (WEA 2) 21:42	05:42 21:24	06:23 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:20 (WEA 2) 21:41	05:43 21:24	06:23 (WEA 2) 21:09	07:09 19:57	07:54 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:24 (WEA 2) 21:45	05:44 21:25	06:23 (WEA 2) 21:08	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:21 (WEA 2) 21:45	05:46 21:25	06:48 (WEA 2) 21:06	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:21 (WEA 2) 21:46	05:47 21:26	06:24 (WEA 2) 21:04	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:18 (WEA 2) 21:46	05:48 21:26	06:25 (WEA 2) 21:02	07:15 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:17 (WEA 2) 21:46	05:49 21:27	06:25 (WEA 2) 21:00	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:17 (WEA 2) 21:47	05:50 21:27	06:25 (WEA 2) 21:04	07:17 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:16 (WEA 2) 21:47	05:51 21:28	06:25 (WEA 2) 21:04	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:16 (WEA 2) 21:47	05:52 21:28	06:25 (WEA 2) 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:47	06:15 (WEA 2) 21:47	05:54 21:29	06:25 (WEA 2) 21:02	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:15 (WEA 2) 21:48	05:55 21:31	06:26 (WEA 2) 21:01	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:14 (WEA 2) 21:48	05:56 21:30	06:26 (WEA 2) 21:01	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:15 (WEA 2) 21:48	05:57 21:29	06:27 (WEA 2) 21:00	07:26 19:31	08:13 17:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:15 (WEA 2) 21:48	05:59 21:27	06:28 (WEA 2) 21:00	07:28 19:28	08:14 17:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:15 (WEA 2) 21:48	06:00 21:26	06:29 (WEA 2) 21:02	07:29 19:26	08:15 17:25	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:15 (WEA 2) 21:48	06:01 21:25	06:30 (WEA 2) 21:00	07:31 19:24	08:16 17:23	08:06 16:43
29	08:14 17:26	07:23 18:02	06:20 18:56	06:17 20:44	05:38 21:26	05:33 21:48	06:15 (WEA 2) 21:48	06:03 21:23	06:33 (WEA 2) 21:00	07:32 19:22	08:17 17:22	08:08 16:42
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31	08:12 17:30	07:18 18:05	06:18 18:52	06:15 20:36	05:36 21:23	05:33 21:48	06:16 (WEA 2) 21:48	06:05 21:21	06:50 20:24	07:22 17:18	08:33 16:46	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr.max.mögl.Beschattung					367	572	616					
Red.Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met.wahrsch.Beschattung					111	179	201					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-09 - 60, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:15 (WEA 2) 21:47	05:34 21:19	06:23 (WEA 2) 21:19	06:07 20:22	06:51 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:14 (WEA 2) 21:47	05:34 21:19	06:23 (WEA 2) 21:18	06:08 20:20	06:53 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:15 (WEA 2) 21:47	05:35 21:19	06:23 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:15 (WEA 2) 21:46	05:36 21:20	06:23 (WEA 2) 21:15	06:11 20:16	06:56 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:16 (WEA 2) 21:46	05:36 21:21	06:23 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:16 (WEA 2) 21:46	05:37 21:21	06:22 (WEA 2) 21:11	06:14 20:12	06:59 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:17 (WEA 2) 21:45	05:38 21:22	06:22 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:32 21:41	06:18 (WEA 2) 21:44	05:39 21:22	06:23 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:17 (WEA 2) 21:44	05:40 21:22	06:23 (WEA 2) 21:06	06:18 20:05	07:03 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:18 (WEA 2) 21:43	05:41 21:23	06:23 (WEA 2) 21:05	06:19 20:03	07:04 18:59	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:19 (WEA 2) 21:43	05:41 21:23	06:23 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:19 (WEA 2) 21:42	05:42 21:23	06:22 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:19 (WEA 2) 21:41	05:43 21:24	06:22 (WEA 2) 21:09	06:24 19:57	07:09 18:52	07:44 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:19 (WEA 2) 21:40	05:44 21:24	06:22 (WEA 2) 21:08	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:20 (WEA 2) 21:39	05:46 21:24	06:22 (WEA 2) 21:06	06:26 19:52	07:12 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	9 06:30 (WEA 2) 21:46	06:20 (WEA 2) 21:39	05:47 21:24	06:22 (WEA 2) 21:05	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	13 06:31 (WEA 2) 21:46	06:37 (WEA 2) 21:38	05:48 21:23	06:24 (WEA 2) 21:05	06:29 19:48	07:15 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	06:17 (WEA 2) 21:46	06:21 (WEA 2) 21:37	05:49 21:23	06:24 (WEA 2) 21:05	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	17 06:34 (WEA 2) 21:47	06:21 (WEA 2) 21:36	05:50 21:23	06:24 (WEA 2) 21:05	06:32 19:44	07:18 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	19 06:35 (WEA 2) 21:47	06:22 (WEA 2) 21:35	05:51 21:23	06:24 (WEA 2) 21:04	06:34 19:41	07:19 18:38	08:05 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	20 06:35 (WEA 2) 21:47	06:22 (WEA 2) 21:33	05:52 21:22	06:24 (WEA 2) 21:04	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	21 06:36 (WEA 2) 21:47	06:22 (WEA 2) 21:32	05:54 21:22	06:24 (WEA 2) 21:04	06:37 19:37	07:22 18:35	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	22 06:36 (WEA 2) 21:48	06:22 (WEA 2) 21:31	05:55 21:20	06:25 (WEA 2) 21:04	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	22 06:36 (WEA 2) 21:48	06:23 (WEA 2) 21:30	05:56 21:20	06:25 (WEA 2) 21:04	06:40 19:35	07:25 18:31	08:11 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	23 06:37 (WEA 2) 21:48	06:23 (WEA 2) 21:29	05:57 21:18	06:27 (WEA 2) 21:04	06:41 19:31	07:26 17:29	08:12 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	23 06:37 (WEA 2) 21:48	06:22 (WEA 2) 21:27	05:59 21:17	06:27 (WEA 2) 21:04	06:42 19:28	07:28 17:27	08:14 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	24 06:38 (WEA 2) 21:49	06:23 (WEA 2) 21:26	06:00 21:14	06:28 (WEA 2) 21:04	06:44 19:26	07:29 17:25	08:15 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	24 06:38 (WEA 2) 21:49	06:23 (WEA 2) 21:25	06:01 21:11	06:30 (WEA 2) 21:04	06:45 19:24	07:31 17:23	08:16 16:43
29	08:14 17:26	07:23 18:02	06:20 18:50	06:16 20:50	05:38 21:31	24 06:38 (WEA 2) 21:49	06:23 (WEA 2) 21:23	06:03 21:06	06:33 (WEA 2) 21:04	06:47 19:22	07:32 17:22	08:18 16:42
30	08:13 17:28	07:20 18:04	06:18 18:51	06:14 20:51	05:37 21:32	23 06:37 (WEA 2) 21:48	06:22 (WEA 2) 21:22	06:04 21:04	06:39 (WEA 2) 21:04	06:48 19:20	07:34 17:20	08:19 16:41
31	08:12 17:30	07:18 18:06	06:17 18:52	06:13 20:56	05:36 21:33	23 06:38 (WEA 2) 21:49	06:21 (WEA 2) 21:21	06:05 21:04	06:38 (WEA 2) 21:04	06:50 19:22	07:35 17:18	08:20 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					345	554	592					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,74	0,74	0,74					
Gesamte Reduktion					0,30	0,31	0,33					
Met. wahrsch. Beschattung					104	173	193					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-10 - 40, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:21 (WEA 2) 06:39 (WEA 2)	05:34 21:47	06:07 21:19	06:34 (WEA 2) 06:44 (WEA 2)	06:51 19:18	07:35 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:21 (WEA 2) 06:38 (WEA 2)	05:34 21:47	06:08 21:18	06:38 (WEA 2) 06:41 (WEA 2)	06:53 19:15	07:37 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:23 (WEA 2) 06:39 (WEA 2)	05:35 21:47	06:09 21:16	06:33 (WEA 2) 06:39 (WEA 2)	06:54 19:13	07:38 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:23 (WEA 2) 06:38 (WEA 2)	05:36 21:46	06:11 21:15	06:33 (WEA 2) 06:41 (WEA 2)	06:56 19:11	07:40 17:12
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:24 (WEA 2) 06:38 (WEA 2)	05:36 21:46	06:12 21:14	06:32 (WEA 2) 06:42 (WEA 2)	06:57 19:09	07:41 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	06:24 (WEA 2) 06:37 (WEA 2)	05:37 21:46	06:14 21:11	06:31 (WEA 2) 06:43 (WEA 2)	06:59 19:07	07:43 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	06:26 (WEA 2) 06:36 (WEA 2)	05:38 21:45	06:15 21:10	06:31 (WEA 2) 06:44 (WEA 2)	07:00 19:05	07:44 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:32 21:41	06:27 (WEA 2) 06:36 (WEA 2)	05:39 21:44	06:16 21:08	06:30 (WEA 2) 06:45 (WEA 2)	07:01 19:03	07:46 17:05
9	08:32 16:56	07:58 17:45	07:05 18:37	06:59 20:19	06:03 21:05	05:31 21:41	06:28 (WEA 2) 06:35 (WEA 2)	05:40 21:44	06:18 21:06	06:30 (WEA 2) 06:46 (WEA 2)	07:03 19:01	07:47 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:30 (WEA 2) 06:34 (WEA 2)	05:41 21:43	06:19 21:05	06:30 (WEA 2) 06:46 (WEA 2)	07:04 18:59	07:49 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:34 (WEA 2) 06:33 (WEA 2)	05:42 21:43	06:21 21:03	06:30 (WEA 2) 06:47 (WEA 2)	07:06 18:56	07:50 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:23 (WEA 2) 06:34 (WEA 2)	05:42 21:42	06:22 21:01	06:29 (WEA 2) 06:47 (WEA 2)	07:07 18:54	07:52 17:00
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:22 (WEA 2) 06:36 (WEA 2)	05:43 21:41	06:24 20:59	06:28 (WEA 2) 06:47 (WEA 2)	07:09 18:52	07:54 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:21 (WEA 2) 06:37 (WEA 2)	05:44 21:40	06:25 20:58	06:28 (WEA 2) 06:48 (WEA 2)	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:20 (WEA 2) 06:39 (WEA 2)	05:46 21:39	06:26 20:56	06:28 (WEA 2) 06:48 (WEA 2)	07:12 18:48	07:47 16:56
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:19 (WEA 2) 06:39 (WEA 2)	05:47 21:39	06:28 20:54	06:28 (WEA 2) 06:49 (WEA 2)	07:13 18:46	07:48 16:54
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:19 (WEA 2) 06:39 (WEA 2)	05:48 21:38	06:24 20:52	06:28 (WEA 2) 06:50 (WEA 2)	07:15 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:18 (WEA 2) 06:40 (WEA 2)	05:49 21:37	06:31 20:50	06:28 (WEA 2) 06:50 (WEA 2)	07:16 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:18 (WEA 2) 06:40 (WEA 2)	05:50 21:36	06:32 20:48	06:28 (WEA 2) 06:51 (WEA 2)	07:18 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:18 (WEA 2) 06:41 (WEA 2)	05:51 21:35	06:34 20:46	06:28 (WEA 2) 06:51 (WEA 2)	07:19 18:38	07:55 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:18 (WEA 2) 06:41 (WEA 2)	05:52 21:33	06:35 20:44	06:28 (WEA 2) 06:51 (WEA 2)	07:20 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	06:17 (WEA 2) 06:40 (WEA 2)	05:54 21:32	06:37 20:42	06:28 (WEA 2) 06:51 (WEA 2)	07:22 18:35	07:58 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:17 (WEA 2) 06:40 (WEA 2)	05:55 21:31	06:38 20:40	06:28 (WEA 2) 06:50 (WEA 2)	07:23 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:18 (WEA 2) 06:40 (WEA 2)	05:56 21:30	06:40 20:38	06:28 (WEA 2) 06:50 (WEA 2)	07:25 18:31	08:01 16:46
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:19 (WEA 2) 06:41 (WEA 2)	05:57 21:29	06:41 20:36	06:29 (WEA 2) 06:51 (WEA 2)	07:26 18:29	08:02 16:45
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:19 (WEA 2) 06:41 (WEA 2)	05:59 21:27	06:42 20:34	06:29 (WEA 2) 06:50 (WEA 2)	07:28 18:27	08:04 16:44
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:19 (WEA 2) 06:41 (WEA 2)	06:00 21:26	06:44 20:32	06:29 (WEA 2) 06:50 (WEA 2)	07:29 18:26	08:05 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:19 (WEA 2) 06:40 (WEA 2)	06:01 21:25	06:45 20:30	06:30 (WEA 2) 06:49 (WEA 2)	07:31 18:24	08:06 16:43
29	08:14 17:26	07:23 20:02	06:20 20:50	05:38 21:31	05:38 21:48	05:33 21:48	06:19 (WEA 2) 06:40 (WEA 2)	06:03 21:23	06:47 20:28	06:31 (WEA 2) 06:49 (WEA 2)	07:32 18:22	08:08 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	05:37 21:32	05:37 21:48	05:33 21:48	06:20 (WEA 2) 06:39 (WEA 2)	06:04 21:22	06:48 20:26	06:32 (WEA 2) 06:48 (WEA 2)	07:34 18:20	08:09 16:41
31	08:12 17:30	07:18 20:06	06:18 20:51	05:36 21:33	05:36 21:48	05:33 21:48	06:21 (WEA 2) 06:40 (WEA 2)	06:05 21:21	06:50 20:24	06:33 (WEA 2) 06:46 (WEA 2)	07:22 18:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					411	123	523	13				
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48	0,48				
Reduktion Betriebsdauer					0,93	0,93	0,93	0,93				
Reduktion Windrichtung					0,74	0,74	0,74	0,74				
Gesamte Reduktion					0,30	0,31	0,33	0,33				
Met. wahrsch. Beschattung					124	38	170	4				

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584



## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-11 - Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:29 (WEA 2) 21:47	06:07 21:19	06:35 (WEA 2) 20:22	06:51 19:18	07:35 17:17	08:11 16:41
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:29 (WEA 2) 21:47	06:08 21:18	06:36 (WEA 2) 20:20	06:53 19:15	07:37 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:31 (WEA 2) 21:47	06:09 21:16	06:37 (WEA 2) 20:18	06:54 19:13	07:38 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:33 (WEA 2) 21:46	06:11 21:15	06:39 (WEA 2) 20:16	06:56 19:11	07:40 17:12	08:14 16:39
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:36 (WEA 2) 21:46	06:12 21:13	06:44 (WEA 2) 20:14	06:57 19:09	07:41 17:10	08:16 16:39
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:14 21:11	06:45 (WEA 2) 20:12	06:59 19:07	07:43 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	05:39 21:44	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	06:29 (WEA 2) 21:47	06:18 21:44	07:03 20:05	07:47 19:01	07:37 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	06:26 (WEA 2) 21:42	06:19 21:43	07:04 20:03	07:49 18:59	07:39 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:26 (WEA 2) 21:43	06:21 21:43	07:06 20:01	07:50 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:24 (WEA 2) 21:43	06:22 21:42	07:07 19:59	07:52 18:54	07:42 17:00	08:23 16:37
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	06:24 (WEA 2) 21:44	06:24 20:59	07:09 19:57	07:54 18:52	07:44 16:58	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	06:23 (WEA 2) 21:45	06:25 21:40	07:10 19:54	07:55 18:50	07:45 16:57	08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:23 (WEA 2) 21:45	06:26 21:39	07:12 19:52	07:57 18:48	07:47 16:56	08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	06:22 (WEA 2) 21:46	06:28 21:39	07:13 19:50	07:58 18:46	07:48 16:54	08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:22 (WEA 2) 21:46	06:29 21:38	07:15 19:48	08:00 18:44	07:50 16:53	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:22 (WEA 2) 21:46	06:31 21:37	07:16 19:46	08:01 18:42	07:51 16:52	08:28 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	06:23 (WEA 2) 21:47	06:32 21:36	07:18 19:44	08:03 18:40	07:53 16:51	08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	06:23 (WEA 2) 21:47	06:34 21:35	07:19 19:41	08:05 18:38	07:55 16:50	08:30 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:23 (WEA 2) 21:47	06:35 21:33	07:20 19:39	08:06 18:36	07:56 16:49	08:30 16:39
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	06:22 (WEA 2) 21:48	06:37 21:32	07:22 19:37	08:08 18:35	07:58 16:48	08:31 16:40
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:23 (WEA 2) 21:48	06:38 21:31	07:23 19:35	08:09 18:33	07:59 16:47	08:31 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:23 (WEA 2) 21:48	06:40 21:30	07:25 19:33	08:11 18:31	08:01 16:46	08:32 16:41
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:24 (WEA 2) 21:48	06:41 21:29	07:26 19:31	08:13 18:29	08:02 16:45	08:32 16:41
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:25 (WEA 2) 21:48	06:42 21:27	07:28 19:28	08:14 18:27	08:04 16:44	08:32 16:42
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:25 (WEA 2) 21:48	06:44 21:26	07:29 19:26	08:16 18:25	08:05 16:43	08:33 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:26 (WEA 2) 21:48	06:45 21:25	07:31 19:24	08:17 18:23	08:06 16:43	08:33 16:43
29	08:14 17:26	07:23 20:02	06:20 20:50	05:38 21:31	05:38 21:48	05:33 21:48	06:26 (WEA 2) 21:48	06:47 21:23	07:32 19:22	08:19 18:22	08:08 16:42	08:33 16:44
30	08:13 17:28	07:20 20:04	06:18 20:51	05:37 21:32	05:37 21:48	05:33 21:48	06:27 (WEA 2) 21:48	06:48 21:22	07:34 19:20	08:21 18:20	08:09 16:41	08:33 16:45
31	08:12 17:30	07:18 20:06	06:18 20:51	05:36 21:33	05:36 21:48	05:33 21:48	06:28 (WEA 2) 21:48	06:50 21:21	07:34 19:20	08:21 18:20	08:09 16:41	08:33 16:45
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					464	37	443	60				
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48	0,48				
Reduktion Betriebsdauer					0,93	0,93	0,93	0,93				
Reduktion Windrichtung					0,73	0,73	0,73	0,73				
Gesamte Reduktion					0,30	0,31	0,32	0,33				
Met. wahrsch. Beschattung					139	11	144	20				

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: D-12 - 53, Rue Emile Mark, 4620 Differdange

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:07 21:19	06:37 (WEA 2) 21:19	06:51 20:22	07:35 19:18	07:24 17:17
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:38 (WEA 2) 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:38 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	05:36 21:46	06:11 21:15	06:38 (WEA 2) 21:15	06:56 20:16	07:40 19:11	07:29 17:12
5	08:33 16:51	08:05 17:38	07:14 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:40 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:31 17:10
6	08:33 16:53	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:14 21:11	06:41 (WEA 2) 21:11	06:59 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:10	06:42 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:32 21:41	05:39 21:44	06:16 21:08	06:46 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	06:49 (WEA 2) 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:41 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:42 21:43	06:21 21:03	07:06 20:01	07:51 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:23 16:37
13	08:30 17:02	07:52 17:52	06:57 18:38	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:24 20:59	07:09 19:57	07:54 18:52	07:44 16:58	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:56 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57	08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	05:46 21:39	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56	08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:30 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54	08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	07:50 16:53	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52	08:28 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:30 21:47	05:50 21:36	06:32 20:48	07:18 19:44	08:03 18:40	07:53 16:51	08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 16:50	08:30 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:33	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49	08:30 16:39
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:54 21:32	06:37 20:42	07:22 19:37	08:08 18:35	07:58 16:48	08:31 16:40
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47	08:31 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:40 20:38	07:25 19:33	08:11 18:31	08:01 16:46	08:32 16:41
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:31	08:13 17:29	08:02 16:45	08:32 16:41
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:59 21:27	06:42 20:34	07:28 19:28	07:14 17:27	08:04 16:44	08:32 16:42
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:32 21:48	06:00 21:26	06:44 20:32	07:29 19:26	07:16 17:25	08:05 16:43	08:33 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	07:17 17:23	08:06 16:43	08:33 16:43
29	08:14 17:26	07:23 18:02	06:20 19:01	06:16 20:50	05:38 21:31	05:33 21:48	06:03 21:23	06:47 20:28	07:32 19:22	07:19 17:22	08:08 16:42	08:33 16:44
30	08:13 17:28	07:20 18:04	06:18 19:01	06:14 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	07:21 17:20	08:09 16:41	08:33 16:45
31	08:12 17:30	07:18 18:06	07:18 19:06	07:14 20:06	07:10 21:33	07:06 21:48	07:02 21:22	07:00 20:24	07:22 17:18	07:18 16:46	07:18 16:46	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					406		287	124				
Red. Sonnenscheinwahrsch.					0,44		0,48	0,48				
Reduktion Betriebsdauer					0,93		0,93	0,93				
Reduktion Windrichtung					0,73		0,73	0,73				
Gesamte Reduktion					0,30		0,32	0,33				
Met. wahrsch. Beschattung					121		93	40				

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com  
Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-01 - Z.I. Gadderscheier

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

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

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

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





## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-02 - 3, Z.A. Gadderscheier, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	10:00 (WEA 1) 17:31	10:12 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16	08:11 16:40
2	08:33 16:48	10:00 (WEA 1) 17:33	10:13 (WEA 1) 18:20	07:20 20:14	06:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	10:01 (WEA 1) 17:34	10:14 (WEA 1) 18:21	07:18 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	10:01 (WEA 1) 17:36	10:15 (WEA 1) 18:23	07:15 20:12	06:11 20:57	05:33 21:37	05:35 21:46	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:11	08:14 16:39
5	08:33 16:51	10:01 (WEA 1) 17:38	10:17 (WEA 1) 18:25	07:13 20:09	06:06 20:51	05:36 21:38	05:37 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10	08:16 16:38
6	08:33 16:52	10:02 (WEA 1) 17:40	10:18 (WEA 1) 18:26	07:11 20:05	06:08 20:15	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:54	10:01 (WEA 1) 17:41	10:19 (WEA 1) 18:27	07:09 20:03	06:06 20:12	05:32 21:40	05:38 21:45	06:15 21:00	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:33 16:55	10:02 (WEA 1) 17:43	10:22 (WEA 1) 18:29	07:01 20:18	06:04 21:03	05:31 21:41	05:39 21:44	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38
9	08:33 16:56	10:02 (WEA 1) 17:45	10:24 (WEA 1) 18:31	07:05 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:20 16:37
10	08:31 16:57	10:03 (WEA 1) 17:46	10:27 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:03	07:04 20:03	07:49 18:58	07:39 17:02	08:21 16:37
11	08:31 16:59	10:03 (WEA 1) 17:48	10:32 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:01	07:06 20:01	07:50 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	10:03 (WEA 1) 17:50	10:36 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 20:05	07:52 18:54	07:42 16:59	08:23 16:37
13	08:30 17:01	10:04 (WEA 1) 17:51	10:37 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 20:03	07:54 18:52	07:43 16:58	08:24 16:37
14	08:29 17:03	10:04 (WEA 1) 17:53	10:38 (WEA 1) 18:39	06:55 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 20:04	07:55 18:50	07:45 16:57	08:25 16:37
15	08:28 17:04	10:04 (WEA 1) 17:55	10:40 (WEA 1) 18:40	06:53 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 20:03	07:57 18:48	07:47 16:55	08:26 16:37
16	08:28 17:06	10:04 (WEA 1) 17:57	10:41 (WEA 1) 18:42	06:50 20:30	05:53 21:15	05:29 21:46	05:46 21:39	06:28 20:54	07:13 20:05	07:58 18:46	07:48 16:54	08:27 16:37
17	08:27 17:07	10:04 (WEA 1) 17:58	10:42 (WEA 1) 18:43	06:48 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 20:08	08:00 18:44	07:50 16:53	08:28 16:38
18	08:26 17:09	10:05 (WEA 1) 18:00	10:46 (WEA 1) 18:44	06:46 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 20:06	08:01 18:42	07:51 16:52	08:29 16:38
19	08:25 17:10	10:05 (WEA 1) 18:02	10:47 (WEA 1) 18:46	06:44 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 20:09	08:03 18:40	07:53 16:51	08:29 16:38
20	08:24 17:12	10:05 (WEA 1) 18:03	10:48 (WEA 1) 18:47	06:42 20:36	05:47 21:20	05:29 21:47	05:51 21:35	06:34 20:46	07:19 20:08	08:05 18:38	07:55 16:50	08:30 16:39
21	08:23 17:13	10:06 (WEA 1) 18:05	10:49 (WEA 1) 18:48	06:40 20:38	05:46 21:21	05:30 21:47	05:52 21:33	06:35 20:44	07:20 20:06	08:06 18:36	07:56 16:49	08:30 16:39
22	08:22 17:15	10:06 (WEA 1) 18:07	10:50 (WEA 1) 18:51	06:38 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 20:03	08:08 18:34	07:58 16:48	08:31 16:39
23	08:21 17:16	10:07 (WEA 1) 18:08	10:51 (WEA 1) 18:52	06:35 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 20:05	08:09 18:33	07:59 16:47	08:31 16:40
24	08:20 17:18	10:07 (WEA 1) 18:10	10:52 (WEA 1) 18:53	06:33 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 20:03	08:11 18:31	08:01 16:46	08:32 16:40
25	08:19 17:20	10:07 (WEA 1) 18:12	10:53 (WEA 1) 18:54	06:31 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 20:06	08:13 18:29	08:02 16:45	08:32 16:41
26	08:18 17:21	10:08 (WEA 1) 18:13	10:54 (WEA 1) 18:55	06:29 20:45	05:41 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 20:08	08:14 18:27	08:04 16:44	08:32 16:42
27	08:17 17:23	10:09 (WEA 1) 18:14	10:55 (WEA 1) 18:56	06:27 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 20:06	08:16 18:25	08:05 16:43	08:33 16:43
28	08:16 17:24	10:10 (WEA 1) 18:16	10:56 (WEA 1) 18:57	06:25 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 20:04	08:17 18:23	08:06 16:42	08:33 16:43
29	08:14 17:26	10:11 (WEA 1) 18:17	10:57 (WEA 1) 18:58	06:22 20:50	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 20:02	08:19 18:22	08:08 16:42	08:33 16:44
30	08:13 17:28	10:11 (WEA 1) 18:18	10:58 (WEA 1) 18:59	06:20 20:51	05:38 21:32	05:32 21:48	06:04 21:22	06:49 20:26	07:34 20:02	08:21 18:20	08:09 16:41	08:33 16:45
31	08:12 17:29	10:12 (WEA 1) 18:19	10:59 (WEA 1) 19:00	06:18 20:55	05:37 21:33	05:33 21:48	06:04 21:22	06:48 20:24	07:34 20:02	08:21 18:20	08:09 16:41	08:33 16:45
Sonneneinstrahlung	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	1747	390								12	1517	1686
Red. Sonneneinstrahlung	0,15	0,24								0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93								0,93	0,93	0,93
Reduktion Windrichtung	0,54	0,54								0,54	0,54	0,54
Gesamte Reduktion	0,07	0,12								0,14	0,08	0,06
Met. wahrsch. Beschattung	128	47								2	115	106

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-03 - 3, Z.A. Gadderscheier, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	09:34 (WEA 1)   08:10 10:45 (WEA 2)   17:31	09:32 (WEA 1)   07:22 10:25 (WEA 1)   18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 20:22	06:51 20:22	07:35 19:18	07:24 17:16	09:07 (WEA 1)   08:11 09:50 (WEA 1)   16:40
2	08:33 16:48	09:34 (WEA 1)   08:09 10:44 (WEA 2)   17:33	09:32 (WEA 1)   07:20 10:24 (WEA 1)   18:20	07:14 20:09	06:14 20:54	05:35 21:35	05:34 21:47	06:08 20:20	06:53 20:20	07:37 19:15	07:26 17:15	09:06 (WEA 1)   08:12 09:51 (WEA 1)   16:40
3	08:33 16:49	09:34 (WEA 1)   08:08 10:44 (WEA 2)   17:34	09:33 (WEA 1)   07:18 10:25 (WEA 1)   18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 20:18	06:54 20:18	07:38 19:13	07:27 17:13	09:05 (WEA 1)   08:13 09:52 (WEA 1)   16:39
4	08:33 16:50	09:33 (WEA 1)   08:06 10:42 (WEA 2)   17:36	09:33 (WEA 1)   07:16 10:24 (WEA 1)   18:23	07:10 20:12	06:11 20:57	05:33 21:37	05:36 21:46	06:11 20:15	06:56 20:16	07:40 19:11	07:29 17:11	09:04 (WEA 1)   08:14 09:52 (WEA 1)   16:39
5	08:33 16:51	09:33 (WEA 1)   08:05 10:40 (WEA 2)   17:38	09:34 (WEA 1)   07:13 10:24 (WEA 1)   18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 20:13	06:57 20:14	07:41 19:09	07:30 17:10	09:04 (WEA 1)   08:16 09:53 (WEA 1)   16:38
6	08:33 16:52	09:33 (WEA 1)   08:03 10:40 (WEA 2)   17:40	09:34 (WEA 1)   07:11 10:24 (WEA 1)   18:26	07:05 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 20:12	06:58 20:12	07:43 19:07	07:32 17:08	09:04 (WEA 1)   08:17 09:54 (WEA 1)   16:38
7	08:33 16:54	09:32 (WEA 1)   08:02 10:40 (WEA 2)   17:41	09:35 (WEA 1)   07:09 10:23 (WEA 1)   18:26	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 20:09	07:00 19:05	07:44 19:05	07:34 17:07	09:04 (WEA 1)   08:18 09:55 (WEA 1)   16:38
8	08:32 16:55	09:33 (WEA 1)   08:00 10:40 (WEA 2)   17:43	09:36 (WEA 1)   07:07 10:23 (WEA 1)   18:29	07:01 20:18	06:04 21:03	05:31 21:41	05:39 21:45	06:16 20:08	07:01 19:03	07:46 19:03	07:35 17:05	09:03 (WEA 1)   08:19 09:55 (WEA 1)   16:38
9	08:32 16:56	09:32 (WEA 1)   07:58 10:40 (WEA 2)   17:45	09:36 (WEA 1)   07:05 10:22 (WEA 1)   18:31	07:00 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 20:06	07:03 19:01	07:47 19:01	07:37 17:04	09:03 (WEA 1)   08:20 09:55 (WEA 1)   16:37
10	08:31 16:57	09:33 (WEA 1)   07:57 10:40 (WEA 2)   17:46	09:37 (WEA 1)   07:03 10:20 (WEA 1)   18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 20:03	07:04 18:58	07:49 18:58	07:39 17:02	09:03 (WEA 1)   08:21 09:56 (WEA 1)   16:37
11	08:31 16:59	09:32 (WEA 1)   07:55 10:40 (WEA 2)   17:48	09:38 (WEA 1)   07:01 10:19 (WEA 1)   18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 20:01	07:06 18:56	07:50 18:56	07:40 17:01	09:04 (WEA 1)   08:22 09:56 (WEA 1)   16:37
12	08:30 17:00	09:32 (WEA 1)   07:53 10:40 (WEA 2)   17:50	09:40 (WEA 1)   06:59 10:19 (WEA 1)   18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 20:01	07:07 18:54	07:52 18:54	07:42 16:59	09:03 (WEA 1)   08:23 09:56 (WEA 1)   16:37
13	08:30 17:01	09:32 (WEA 1)   07:52 10:40 (WEA 2)   17:51	09:41 (WEA 1)   06:57 10:17 (WEA 1)   18:37	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 18:52	07:54 18:52	07:43 16:58	09:03 (WEA 1)   08:24 09:56 (WEA 1)   16:37
14	08:29 17:03	09:32 (WEA 1)   07:50 10:40 (WEA 2)   17:53	09:42 (WEA 1)   06:55 10:15 (WEA 1)   18:39	06:55 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 18:50	07:55 18:50	07:45 16:57	09:04 (WEA 1)   08:25 09:57 (WEA 1)   16:37
15	08:28 17:04	09:31 (WEA 1)   07:48 10:40 (WEA 2)   17:55	09:44 (WEA 1)   06:53 10:13 (WEA 1)   18:41	06:47 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 18:48	07:57 18:48	07:47 16:56	09:04 (WEA 1)   08:26 09:57 (WEA 1)   16:37
16	08:28 17:06	09:31 (WEA 1)   07:46 10:40 (WEA 2)   17:56	09:46 (WEA 1)   06:50 10:10 (WEA 1)   18:42	06:50 20:30	05:53 21:15	05:29 21:46	05:46 21:39	06:28 20:54	07:13 18:46	07:58 18:46	07:48 16:54	09:04 (WEA 1)   08:27 09:56 (WEA 1)   16:37
17	08:27 17:07	09:31 (WEA 1)   07:45 10:40 (WEA 2)   18:00	09:46 (WEA 1)   06:48 10:10 (WEA 1)   18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 18:44	08:00 18:44	07:50 16:53	09:05 (WEA 1)   08:28 09:57 (WEA 1)   16:38
18	08:27 17:09	09:31 (WEA 1)   07:43 10:40 (WEA 2)   18:01	09:46 (WEA 1)   06:46 10:10 (WEA 1)   18:45	06:43 20:33	05:50 21:17	05:29 21:46	05:48 21:37	06:30 20:50	07:16 18:42	08:01 18:42	07:51 16:52	09:05 (WEA 1)   08:28 09:57 (WEA 1)   16:38
19	08:25 17:10	09:31 (WEA 1)   07:41 10:40 (WEA 2)   18:02	09:46 (WEA 1)   06:44 10:10 (WEA 1)   18:46	06:44 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 18:40	08:03 18:40	07:53 16:51	09:05 (WEA 1)   08:29 09:56 (WEA 1)   16:38
20	08:24 17:12	09:31 (WEA 1)   07:39 10:40 (WEA 2)   18:03	09:46 (WEA 1)   06:42 10:10 (WEA 1)   18:48	06:42 20:36	05:47 21:20	05:29 21:47	05:51 21:35	06:34 20:46	07:19 18:38	08:05 18:38	07:55 16:50	09:06 (WEA 1)   08:30 09:57 (WEA 1)   16:39
21	08:23 17:13	09:31 (WEA 1)   07:37 10:40 (WEA 2)   18:05	09:46 (WEA 1)   06:40 10:10 (WEA 1)   18:50	06:40 20:38	05:46 21:21	05:29 21:47	05:52 21:33	06:35 20:44	07:20 18:36	08:06 18:36	07:56 16:49	09:07 (WEA 1)   08:30 09:57 (WEA 1)   16:39
22	08:22 17:15	09:31 (WEA 1)   07:35 10:40 (WEA 2)   18:07	09:46 (WEA 1)   06:38 10:10 (WEA 1)   18:52	06:38 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 18:34	08:08 18:34	07:58 16:48	09:07 (WEA 1)   08:31 09:56 (WEA 1)   16:39
23	08:21 17:16	09:31 (WEA 1)   07:33 10:40 (WEA 2)   18:08	09:46 (WEA 1)   06:35 10:10 (WEA 1)   18:53	06:35 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 18:33	08:09 18:33	07:59 16:47	09:08 (WEA 1)   08:31 09:56 (WEA 1)   16:40
24	08:20 17:18	09:31 (WEA 1)   07:31 10:40 (WEA 2)   18:10	09:46 (WEA 1)   06:33 10:10 (WEA 1)   18:55	06:33 20:42	05:43 21:25	05:30 21:48	05:56 21:33	06:39 20:38	07:25 18:31	08:11 18:31	10:24 (WEA 1)   08:01 10:32 (WEA 1)   16:46	
25	08:19 17:20	09:31 (WEA 1)   07:29 10:40 (WEA 2)   18:12	09:46 (WEA 1)   06:31 10:10 (WEA 1)   18:56	06:31 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:19 18:29	08:05 18:29	07:55 16:45	09:09 (WEA 1)   08:32 09:56 (WEA 1)   16:41
26	08:18 17:21	09:31 (WEA 1)   07:28 10:40 (WEA 2)   18:13	09:46 (WEA 1)   06:29 10:10 (WEA 1)   18:58	06:29 20:45	05:41 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 17:27	08:04 18:27	07:54 16:44	09:10 (WEA 1)   08:32 09:56 (WEA 1)   16:42
27	08:17 17:23	09:31 (WEA 1)   07:26 10:40 (WEA 2)   18:14	09:46 (WEA 1)   06:27 10:10 (WEA 1)   18:59	06:27 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 17:25	08:05 18:25	07:53 16:43	09:11 (WEA 1)   08:33 09:56 (WEA 1)   16:43
28	08:16 17:24	09:32 (WEA 1)   07:24 10:40 (WEA 2)   18:17	09:46 (WEA 1)   06:25 10:10 (WEA 1)   19:01	06:25 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:20	07:31 17:23	08:06 18:23	07:52 16:42	09:12 (WEA 1)   08:33 09:56 (WEA 1)   16:43
29	08:14 17:26	09:31 (WEA 1)   07:22 10:40 (WEA 2)   18:19	09:46 (WEA 1)   06:23 10:10 (WEA 1)   19:03	06:23 20:50	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 17:22	08:08 18:22	07:51 16:42	09:10 (WEA 1)   08:33 09:56 (WEA 1)   16:44
30	08:13 17:28	09:32 (WEA 1)   07:20 10:40 (WEA 2)   18:21	09:46 (WEA 1)   06:21 10:10 (WEA 1)   19:05	06:21 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 17:20	08:09 18:20	07:50 16:41	09:14 (WEA 1)   08:33 09:56 (WEA 1)   16:45
31	08:12 17:29	09:32 (WEA 1)   07:18 10:40 (WEA 2)   18:23	09:46 (WEA 1)   06:19 10:10 (WEA 1)   19:07	06:19 20:53	05:36 21:33	05:34 21:48	06:06 21:22	06:50 20:24	07:22 17:18	08:11 18:21	07:49 16:40	09:15 (WEA 1)   08:33 09:56 (WEA 1)   16:46
Sonneneinstrahlung	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	1428	711								235		1356
Red. Sonneneinstrahlung	0,15	0,24								0,28		0,13
Reduktion Betriebsdauer	0,93	0,93								0,93		0,93
Reduktion Windrichtung	0,51	0,51								0,51		0,53
Gesamte Reduktion	0,07	0,11								0,13		0,06
Met. wahrsch. Beschattung	99	80								31		83

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-04 - 3, Z.A. Gadderscheier, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	10:08 (WEA 2) 17:31	08:10 17:31	09:15 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	08:11 16:40
2	08:33 16:48	10:08 (WEA 2) 17:33	08:09 17:33	09:15 (WEA 1) 18:20	07:20 20:09	06:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:12 16:40
3	08:33 16:49	10:09 (WEA 2) 17:34	08:08 17:34	09:15 (WEA 1) 18:21	07:18 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:13 16:39
4	08:33 16:50	10:10 (WEA 2) 17:36	08:06 17:36	09:15 (WEA 1) 18:23	07:16 20:12	06:11 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:14 16:39
5	08:33 16:51	10:11 (WEA 2) 17:37	08:05 17:37	09:16 (WEA 1) 18:25	07:13 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:16 16:38
6	08:33 16:52	10:12 (WEA 2) 17:40	08:03 17:40	09:15 (WEA 1) 18:26	07:11 20:15	06:08 20:57	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	08:17 16:38
7	08:33 16:54	10:13 (WEA 2) 17:41	08:02 17:41	09:15 (WEA 1) 18:26	07:09 20:15	06:06 20:57	05:32 21:39	05:38 21:46	06:15 21:11	07:00 20:12	07:44 19:07	08:18 16:38
8	08:33 16:55	10:14 (WEA 2) 17:43	08:00 17:43	09:16 (WEA 1) 18:29	07:07 20:18	06:04 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:19 16:38
9	08:33 16:56	10:15 (WEA 2) 17:45	07:58 17:45	09:16 (WEA 1) 18:31	07:05 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:20 16:37
10	08:31 16:57	10:16 (WEA 2) 17:46	07:57 17:46	09:16 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:58	08:21 16:37
11	08:31 16:59	10:17 (WEA 2) 17:48	07:55 17:48	09:16 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:22 16:37
12	08:30 17:00	10:18 (WEA 2) 17:50	07:53 17:50	09:18 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:23 16:37
13	08:30 17:01	10:19 (WEA 2) 17:51	07:52 17:51	09:18 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:24 16:37
14	08:29 17:03	10:20 (WEA 2) 17:53	07:51 17:53	09:18 (WEA 1) 18:39	06:55 20:27	05:55 21:12	05:44 21:45	05:44 21:45	06:25 20:58	07:10 19:54	07:55 18:50	08:25 16:37
15	08:28 17:04	10:21 (WEA 2) 17:54	07:48 17:54	09:19 (WEA 1) 18:41	06:53 20:29	05:54 21:13	05:45 21:45	05:45 21:45	06:26 20:56	07:12 19:52	07:57 18:48	08:26 16:37
16	08:28 17:06	10:22 (WEA 2) 17:55	07:46 17:55	09:20 (WEA 1) 18:42	06:50 20:30	05:53 21:15	05:46 21:46	05:46 21:46	06:28 20:54	07:13 19:50	07:58 18:46	08:27 16:37
17	08:27 17:07	10:23 (WEA 2) 17:56	07:45 17:56	09:22 (WEA 1) 18:44	06:48 20:32	05:51 21:16	05:48 21:46	05:48 21:46	06:29 20:52	07:15 19:48	08:00 18:44	08:28 16:37
18	08:26 17:09	10:24 (WEA 2) 17:57	07:43 17:57	09:23 (WEA 1) 18:46	06:46 20:33	05:50 21:17	05:49 21:46	05:49 21:46	06:31 20:50	07:16 19:46	08:01 18:42	08:29 16:37
19	08:25 17:10	10:25 (WEA 2) 17:58	07:41 17:58	09:24 (WEA 1) 18:47	06:44 20:35	05:49 21:19	05:50 21:47	05:50 21:47	06:32 20:48	07:17 19:44	08:03 18:40	08:30 16:37
20	08:24 17:12	10:26 (WEA 2) 18:00	07:39 18:00	09:26 (WEA 1) 18:48	06:42 20:36	05:47 21:20	05:51 21:47	05:51 21:47	06:34 20:46	07:19 19:41	08:05 18:40	08:31 16:37
21	08:23 17:13	10:27 (WEA 2) 18:01	07:37 18:01	09:28 (WEA 1) 18:50	06:40 20:38	05:46 21:21	05:52 21:47	05:52 21:47	06:35 20:44	07:20 19:39	08:06 18:36	08:32 16:37
22	08:22 17:15	10:28 (WEA 2) 18:03	07:35 18:03	09:31 (WEA 1) 18:52	06:38 20:39	05:45 21:23	05:53 21:48	05:53 21:48	06:37 20:42	07:22 19:37	08:08 18:34	08:33 16:37
23	08:21 17:16	10:29 (WEA 2) 18:04	07:33 18:04	09:33 (WEA 1) 18:54	06:36 20:41	05:44 21:24	05:55 21:48	05:55 21:48	06:38 20:40	07:23 19:35	08:09 18:33	08:34 16:37
24	08:20 17:18	10:30 (WEA 2) 18:05	07:31 18:05	09:35 (WEA 1) 18:56	06:33 20:42	05:43 21:25	05:56 21:48	05:56 21:48	06:39 20:38	07:25 19:33	08:11 18:31	08:35 16:37
25	08:19 17:20	10:31 (WEA 2) 18:06	07:29 18:06	09:36 (WEA 1) 18:57	06:31 20:43	05:42 21:26	05:57 21:49	05:57 21:49	06:41 20:36	07:26 19:30	08:13 18:30	08:36 16:37
26	08:18 17:21	10:32 (WEA 2) 18:07	07:28 18:07	09:37 (WEA 1) 18:58	06:29 20:44	05:41 21:27	05:58 21:49	05:58 21:49	06:42 20:37	07:28 19:29	08:14 18:31	08:37 16:37
27	08:17 17:23	10:33 (WEA 2) 18:08	07:26 18:08	09:38 (WEA 1) 18:59	06:27 20:45	05:40 21:28	06:00 21:49	06:00 21:49	06:44 20:34	07:29 19:27	08:15 18:30	08:38 16:37
28	08:16 17:24	10:34 (WEA 2) 18:09	07:24 18:09	09:39 (WEA 1) 19:00	06:25 20:46	05:39 21:29	06:01 21:48	06:01 21:48	06:45 20:32	07:31 19:26	08:16 18:29	08:39 16:37
29	08:14 17:26	10:35 (WEA 2) 18:10	07:22 18:10	09:40 (WEA 1) 19:01	06:22 20:47	05:38 21:30	06:02 21:48	06:02 21:48	06:47 20:29	07:32 19:24	08:17 18:28	08:40 16:37
30	08:13 17:28	10:36 (WEA 2) 18:11	07:20 18:11	09:41 (WEA 1) 19:02	06:20 20:48	05:37 21:31	06:04 21:48	06:04 21:48	06:48 20:28	07:34 19:22	08:18 18:27	08:41 16:37
31	08:12 17:29	10:37 (WEA 2) 18:12	07:18 18:12	09:42 (WEA 1) 19:03	06:18 20:49	05:36 21:32	06:06 21:49	06:06 21:49	06:49 20:27	07:35 19:21	08:19 18:26	08:42 16:37
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)	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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-05 - 1, Z.A. Gadderscheier, 4570 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	09:54 (WEA 2) 10:27 (WEA 2)	08:10 17:31	09:05 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16
2	08:33 16:48	09:55 (WEA 2) 10:28 (WEA 2)	08:09 17:33	09:04 (WEA 1) 18:20	07:14 20:09	06:15 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	09:55 (WEA 2) 10:27 (WEA 2)	08:08 17:35	09:04 (WEA 1) 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	09:55 (WEA 2) 10:27 (WEA 2)	08:06 17:36	09:04 (WEA 1) 18:23	07:16 20:12	06:11 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	09:55 (WEA 2) 10:27 (WEA 2)	08:05 17:33	09:04 (WEA 1) 18:25	07:13 20:13	06:10 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	09:57 (WEA 2) 10:28 (WEA 2)	08:03 17:40	09:04 (WEA 1) 18:26	07:11 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	09:58 (WEA 2) 10:27 (WEA 2)	08:02 17:41	09:03 (WEA 1) 18:28	07:09 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:00	07:00 20:09	07:44 19:05	07:34 17:07
8	08:33 16:55	09:59 (WEA 2) 10:28 (WEA 2)	08:00 17:43	09:04 (WEA 1) 18:29	07:07 20:18	06:04 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:33 16:56	09:59 (WEA 2) 10:27 (WEA 2)	08:00 17:45	09:03 (WEA 1) 18:31	07:05 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	10:01 (WEA 2) 10:28 (WEA 2)	07:57 17:46	09:03 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	10:01 (WEA 2) 10:27 (WEA 2)	07:55 17:48	09:03 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:41 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	10:02 (WEA 2) 10:26 (WEA 2)	07:53 17:50	09:04 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 20:59	07:52 18:54	07:42 16:59
13	08:30 17:01	10:04 (WEA 2) 10:27 (WEA 2)	07:52 17:51	09:04 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 20:57	07:54 18:52	07:43 16:58
14	08:29 17:03	10:05 (WEA 2) 10:28 (WEA 2)	07:50 17:53	09:04 (WEA 1) 18:39	06:55 20:27	05:55 21:12	05:44 21:45	05:44 21:40	06:25 20:58	07:10 20:54	07:55 18:50	07:45 16:57
15	08:28 17:04	10:06 (WEA 2) 10:25 (WEA 2)	07:48 17:55	09:05 (WEA 1) 18:41	06:53 20:29	06:47 21:13	05:54 21:45	05:45 21:39	06:26 20:56	07:12 20:52	07:57 18:48	07:47 16:56
16	08:28 17:06	10:08 (WEA 2) 10:24 (WEA 2)	07:46 17:57	09:05 (WEA 1) 18:42	06:50 20:30	06:45 21:15	05:53 21:46	05:46 21:39	06:28 20:54	07:13 20:50	07:58 18:46	07:48 16:54
17	08:27 17:07	10:11 (WEA 2) 10:22 (WEA 2)	07:45 17:58	09:06 (WEA 1) 18:44	06:48 20:32	06:43 21:16	05:51 21:46	05:48 21:38	06:29 20:52	07:15 20:48	08:00 18:44	07:50 16:53
18	08:26 17:09	10:15 (WEA 2) 10:17 (WEA 2)	07:43 18:00	09:07 (WEA 1) 18:45	06:46 20:33	06:41 21:17	05:50 21:46	05:49 21:37	06:31 20:50	07:16 20:46	08:01 18:42	07:51 16:52
19	08:25 17:10	10:17 (WEA 2) 10:29 (WEA 2)	07:41 18:03	09:08 (WEA 1) 18:46	06:44 20:36	06:39 21:20	05:49 21:47	05:50 21:35	06:32 20:46	07:17 20:41	08:03 18:40	07:53 16:51
20	08:24 17:12	10:19 (WEA 2) 10:31 (WEA 2)	07:39 18:03	09:09 (WEA 1) 18:48	06:42 20:36	06:37 21:20	05:47 21:47	05:51 21:35	06:34 20:46	07:19 20:41	08:05 18:44	07:55 16:50
21	08:23 17:13	10:21 (WEA 2) 10:33 (WEA 2)	07:37 18:05	09:10 (WEA 1) 18:50	06:40 20:38	06:35 21:21	05:46 21:47	05:52 21:33	06:35 20:44	07:20 20:39	08:06 18:36	07:56 16:49
22	08:22 17:15	10:23 (WEA 2) 10:35 (WEA 2)	07:35 18:07	09:11 (WEA 1) 18:52	06:38 20:39	06:33 21:23	05:45 21:48	05:53 21:32	06:37 20:42	07:22 20:37	08:08 18:35	07:58 16:48
23	08:21 17:16	10:25 (WEA 2) 10:37 (WEA 2)	07:33 18:08	09:12 (WEA 1) 18:53	06:35 20:41	06:31 21:24	05:44 21:48	05:55 21:31	06:38 20:40	07:23 20:35	08:09 18:33	07:59 16:47
24	08:20 17:18	10:27 (WEA 2) 10:39 (WEA 2)	07:31 18:10	09:13 (WEA 1) 18:55	06:33 20:42	06:29 21:25	05:43 21:48	05:56 21:30	06:39 20:38	07:25 20:33	08:11 18:31	08:01 16:46
25	08:19 17:20	10:29 (WEA 2) 10:41 (WEA 2)	07:30 18:12	09:14 (WEA 1) 18:56	06:31 20:44	06:27 21:26	05:42 21:48	05:57 21:29	06:41 20:36	07:26 20:30	08:13 18:29	08:02 16:45
26	08:18 17:21	10:31 (WEA 2) 10:43 (WEA 2)	07:28 18:13	09:15 (WEA 1) 18:58	06:29 20:45	06:25 21:28	05:41 21:48	05:58 21:27	06:42 20:34	07:28 20:28	08:14 18:27	08:04 16:44
27	08:17 17:23	10:33 (WEA 2) 10:45 (WEA 2)	07:26 18:15	09:16 (WEA 1) 19:00	06:27 20:47	06:23 21:29	05:40 21:48	06:00 21:26	06:44 20:32	07:29 20:26	08:15 18:25	08:05 17:25
28	08:16 17:24	10:35 (WEA 2) 10:47 (WEA 2)	07:24 18:17	09:17 (WEA 1) 19:02	06:25 20:48	06:22 21:30	05:39 21:48	06:01 21:25	06:45 20:30	07:31 20:24	08:16 18:23	08:06 17:23
29	08:14 17:26	10:37 (WEA 2) 10:49 (WEA 2)	07:22 18:19	09:18 (WEA 1) 19:04	06:22 20:50	06:20 21:31	05:38 21:48	06:02 21:23	06:47 20:28	07:32 20:22	08:17 18:22	08:07 17:22
30	08:13 17:28	10:39 (WEA 2) 10:51 (WEA 2)	07:20 18:21	09:19 (WEA 1) 19:06	06:20 20:51	06:18 21:32	05:37 21:48	06:04 21:22	06:48 20:26	07:34 20:20	08:18 18:20	08:09 17:20
31	08:12 17:29	10:41 (WEA 2) 10:53 (WEA 2)	07:18 18:23	09:20 (WEA 1) 19:08	06:18 20:53	06:16 21:33	05:36 21:48	06:04 21:22	06:48 20:26	07:34 20:20	08:18 18:20	08:09 17:20
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)	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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-07 - 1, Z.A. Gadderscheier, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-08 - Z.I. Gadderscheier

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:11 16:40
2	08:33 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	05:36 21:48	06:11 21:15	06:56 20:15	07:40 19:11	07:29 17:12	08:14 16:39
5	08:33 16:51	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:49	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10	08:16 16:39
6	08:33 16:52	08:03 17:41	07:11 18:26	07:05 20:14	06:08 20:58	05:32 21:39	05:37 21:50	06:13 21:14	06:58 20:15	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:53	08:02 17:40	07:09 18:26	07:03 20:15	06:06 21:00	05:32 21:40	05:38 21:51	06:15 21:11	07:00 20:16	07:45 19:07	07:34 17:08	08:18 16:38
8	08:32 16:54	08:00 17:41	07:07 18:28	07:01 20:16	06:05 21:02	05:31 21:41	05:39 21:52	06:16 21:12	07:01 20:17	07:46 19:05	07:35 17:07	08:19 16:38
9	08:32 16:55	07:58 17:43	07:05 18:30	06:59 20:18	06:03 21:03	05:31 21:42	05:40 21:53	06:18 21:13	07:03 20:18	07:47 19:03	07:37 17:05	08:20 16:38
10	08:31 16:56	07:57 17:45	07:03 18:31	06:57 20:19	06:01 21:05	05:31 21:43	05:41 21:54	06:19 21:14	07:04 20:19	07:48 19:01	07:39 17:04	08:21 16:37
11	08:31 16:57	07:55 17:46	07:01 18:33	06:55 20:21	06:00 21:06	05:30 21:43	05:41 21:55	06:21 21:15	07:05 20:20	07:50 19:01	07:40 17:02	08:22 16:37
12	08:30 16:57	07:52 17:48	06:59 18:33	06:53 20:22	05:58 21:08	05:30 21:44	05:42 21:56	06:22 21:16	07:07 20:21	07:52 19:01	07:42 17:01	08:23 16:37
13	08:30 17:00	07:50 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:45	05:42 21:57	06:22 21:17	07:07 20:22	07:52 19:02	07:42 17:00	08:23 16:37
14	08:29 17:01	07:52 17:52	06:57 18:37	06:53 20:25	05:57 21:11	05:30 21:46	05:43 21:58	06:23 21:18	07:09 20:23	07:54 19:02	07:43 17:01	08:24 16:37
15	08:29 17:02	07:50 17:52	06:55 18:37	06:49 20:26	05:55 21:12	05:30 21:47	05:44 21:59	06:25 21:19	07:10 20:24	07:55 19:03	07:45 17:01	08:25 16:37
16	08:28 17:03	07:48 17:55	06:53 18:41	06:47 20:27	05:54 21:13	05:30 21:48	05:45 22:00	06:26 21:20	07:12 20:25	07:57 19:04	07:47 17:02	08:26 16:37
17	08:28 17:04	07:46 17:55	06:50 18:41	06:45 20:28	05:53 21:14	05:30 21:49	05:47 22:01	06:28 21:21	07:13 20:26	07:58 19:05	07:48 17:01	08:27 16:37
18	08:26 17:06	07:43 17:57	06:46 18:42	06:41 20:30	05:50 21:15	05:29 21:50	05:49 22:02	06:31 21:22	07:16 20:27	08:01 19:06	07:51 17:00	08:28 16:37
19	08:25 17:07	07:41 18:00	06:44 18:45	06:39 20:31	05:49 21:16	05:29 21:51	05:50 22:03	06:32 21:23	07:17 20:28	08:03 19:07	07:53 17:00	08:29 16:37
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:32	05:48 21:17	05:29 21:52	05:51 22:04	06:34 21:24	07:19 20:29	08:05 19:08	07:55 17:00	08:30 16:37
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:33	05:46 21:18	05:30 21:53	05:52 22:05	06:35 21:25	07:20 20:30	08:06 19:10	07:56 17:00	08:30 16:37
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:34	05:45 21:19	05:30 21:54	05:53 22:06	06:37 21:26	07:22 20:31	08:08 19:11	07:58 17:00	08:31 16:37
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:35	05:44 21:20	05:30 21:55	05:55 22:07	06:38 21:27	07:23 20:32	08:09 19:12	07:59 17:00	08:31 16:37
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:36	05:43 21:21	05:30 21:56	05:56 22:08	06:39 21:28	07:25 20:33	08:11 19:13	08:01 17:00	08:32 16:37
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:37	05:42 21:22	05:30 21:57	05:57 22:09	06:40 21:29	07:26 20:34	08:12 19:14	08:02 17:00	08:32 16:37
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:38	05:41 21:23	05:30 21:58	05:59 22:10	06:41 21:30	07:27 20:35	08:13 19:15	08:03 17:00	08:32 16:37
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:39	05:40 21:24	05:30 21:59	06:00 22:11	06:42 21:31	07:28 20:36	08:14 19:16	08:04 17:00	08:32 16:37
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:40	05:39 21:25	05:30 22:00	06:01 22:12	06:45 21:32	07:31 20:37	08:15 19:17	08:06 17:00	08:33 16:37
29	08:14 17:26	07:23 18:20	06:23 19:02	06:20 20:41	05:38 21:26	05:30 22:01	06:02 22:13	06:47 21:33	07:32 20:38	08:16 19:18	08:08 17:00	08:33 16:37
30	08:13 17:28	07:20 18:24	06:21 19:04	06:18 20:42	05:37 21:27	05:30 22:02	06:04 22:14	06:48 21:34	07:34 20:39	08:17 19:19	08:09 17:00	08:33 16:37
31	08:12 17:30	07:18 18:25	06:21 19:05	06:18 20:43	05:36 21:28	05:30 22:03	06:05 22:15	06:50 21:35	07:35 20:40	08:18 19:20	08:10 17:00	08:33 16:37
astr. max. mögl. Beschattung	269	283	368	412	529	769	935	1051	252	517	335	275
Red. Sonnenscheinwahrsch.	0,35	0,35	0,35	0,46	0,46	0,44	0,45	0,48	0,48	0,42	0,46	0,46
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,66	0,66	0,66	0,66	0,66	0,75	0,75	0,75	0,69	0,66	0,66	0,66
Gesamte Reduktion	0,21	0,21	0,21	0,28	0,28	0,30	0,31	0,32	0,31	0,26	0,26	0,26
Met. wahrsch. Beschattung	28	28	149	229	229	229	289	339	77	134	146	155

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

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



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-09 - Z.I. Gadderscheier

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33	08:10	07:22	07:16	06:16	07:17 (WEA 2)	05:36	05:34	06:13 (WEA 1)	06:07	06:51	07:35
2	16:47	17:31	18:18	20:07	20:53	07:53 (WEA 2)	21:34	21:47	06:27 (WEA 1)	21:19	20:22	19:18
3	08:33	08:09	07:20	07:14	06:15	07:18 (WEA 2)	05:35	05:34	06:13 (WEA 1)	06:08	07:39 (WEA 2)	06:53
4	08:33	08:08	07:18	07:12	06:13	07:18 (WEA 2)	05:34	21:47	06:25 (WEA 1)	21:18	07:50 (WEA 2)	06:53
5	16:49	17:35	18:21	20:10	20:56	07:52 (WEA 2)	21:36	21:47	06:25 (WEA 1)	21:16	07:52 (WEA 2)	06:58
6	08:33	08:06	07:16	07:10	06:11	07:18 (WEA 2)	05:34	05:36	06:17 (WEA 1)	06:11	07:33 (WEA 2)	06:56
7	16:50	17:36	18:23	20:12	20:57	07:50 (WEA 2)	21:37	21:46	06:24 (WEA 1)	21:15	07:54 (WEA 2)	06:58
8	08:33	08:05	07:13	07:08	06:09	07:19 (WEA 2)	05:33	21:10	07:58 (WEA 2)	20:09	19:05	17:07
9	16:51	17:38	18:25	20:13	20:59	07:50 (WEA 2)	21:38	21:13	07:56 (WEA 2)	20:14	19:09	17:10
10	08:33	08:03	07:11	07:05	06:08	07:20 (WEA 2)	05:32	05:37	07:31 (WEA 2)	06:58	07:43	07:32
11	16:53	17:40	18:26	20:15	21:00	07:48 (WEA 2)	21:39	21:46	07:57 (WEA 2)	20:12	19:07	17:08
12	08:33	08:02	07:09	07:03	06:06	07:22 (WEA 2)	05:32	05:38	07:29 (WEA 2)	07:00	07:44	07:34
13	16:54	17:41	18:28	20:16	21:02	07:47 (WEA 2)	21:40	21:45	07:58 (WEA 2)	20:09	19:05	17:07
14	08:33	08:00	07:07	07:01	06:05	07:22 (WEA 2)	05:31	06:13 (WEA 1)	07:29 (WEA 2)	07:01	07:46	07:35
15	16:55	17:43	18:30	20:18	21:03	07:45 (WEA 2)	21:41	21:46	08:00 (WEA 2)	20:07	19:03	17:05
16	08:33	07:58	07:05	06:59	06:03	07:25 (WEA 2)	05:31	06:10 (WEA 1)	07:27 (WEA 2)	07:03	07:47	07:37
17	16:56	17:45	18:31	20:19	21:05	07:44 (WEA 2)	21:41	21:46	08:00 (WEA 2)	20:05	19:01	17:04
18	08:31	07:57	07:03	06:57	06:01	07:26 (WEA 2)	05:31	06:10 (WEA 1)	07:26 (WEA 2)	07:02	07:49	07:39
19	16:57	17:46	18:33	20:21	21:06	07:41 (WEA 2)	21:42	21:47	08:00 (WEA 2)	20:03	18:59	17:02
20	08:31	07:55	07:01	06:55	06:00	07:30 (WEA 2)	05:30	06:09 (WEA 1)	07:26 (WEA 2)	07:06	07:50	07:40
21	16:59	17:48	18:34	20:22	21:08	07:37 (WEA 2)	21:43	21:48	08:02 (WEA 2)	20:01	18:56	17:01
22	08:30	07:53	06:59	06:53	05:58	07:33 (WEA 2)	05:30	06:08 (WEA 1)	07:25 (WEA 2)	07:07	07:52	07:42
23	17:00	17:50	18:36	20:24	21:09	07:47 (WEA 2)	21:43	21:48	08:02 (WEA 2)	20:01	18:54	17:00
24	08:30	07:52	06:57	06:51	05:57	07:29 (WEA 2)	05:30	06:07 (WEA 1)	07:24 (WEA 2)	07:09	07:54	07:43
25	17:01	17:52	18:37	20:25	21:11	07:50 (WEA 2)	21:41	21:46	08:02 (WEA 2)	20:02	18:52	16:58
26	08:29	07:50	06:55	06:49	05:55	07:27 (WEA 2)	05:30	06:07 (WEA 1)	07:24 (WEA 2)	07:10	07:55	07:45
27	17:03	17:53	18:39	20:27	21:12	07:52 (WEA 2)	21:42	21:47	08:02 (WEA 2)	20:01	18:54	17:00
28	08:28	07:48	06:53	06:47	05:54	07:25 (WEA 2)	05:30	06:07 (WEA 1)	07:23 (WEA 2)	07:12	07:57	07:47
29	17:04	17:55	18:41	20:29	21:13	07:53 (WEA 2)	21:43	21:48	08:02 (WEA 2)	20:01	18:56	17:01
30	08:28	07:46	06:50	06:45	05:53	07:23 (WEA 2)	05:30	06:07 (WEA 1)	07:24 (WEA 2)	07:13	07:58	07:48
31	17:06	17:57	18:42	20:30	21:15	07:54 (WEA 2)	21:43	21:48	08:03 (WEA 2)	20:02	18:56	17:01
32	08:27	07:45	06:48	06:43	05:51	07:22 (WEA 2)	05:29	06:07 (WEA 1)	07:23 (WEA 2)	07:15	07:50	07:40
33	17:07	17:58	18:44	20:32	21:16	07:55 (WEA 2)	21:46	21:51	08:02 (WEA 2)	20:01	18:54	17:00
34	08:26	07:43	06:46	06:41	05:50	07:21 (WEA 2)	05:29	06:07 (WEA 1)	07:22 (WEA 2)	07:16	08:01	07:51
35	17:09	18:00	18:45	20:33	21:17	07:55 (WEA 2)	21:46	21:51	08:02 (WEA 2)	20:01	18:54	17:00
36	08:25	07:41	06:44	06:39	05:49	07:20 (WEA 2)	05:29	06:07 (WEA 1)	07:23 (WEA 2)	07:17	08:03	07:53
37	17:10	18:02	18:47	20:35	21:19	07:56 (WEA 2)	21:47	21:52	08:02 (WEA 2)	20:01	18:54	17:00
38	08:24	07:39	06:42	06:37	05:48	07:19 (WEA 2)	05:28	06:08 (WEA 1)	07:22 (WEA 2)	07:19	08:05	07:55
39	17:12	18:03	18:48	20:36	21:20	07:56 (WEA 2)	21:47	21:52	08:02 (WEA 2)	20:01	18:54	17:00
40	08:23	07:37	06:40	06:35	05:46	07:18 (WEA 2)	05:28	06:08 (WEA 1)	07:22 (WEA 2)	07:20	08:06	07:56
41	17:13	18:05	18:50	20:38	21:21	07:56 (WEA 2)	21:47	21:52	08:02 (WEA 2)	20:01	18:54	17:00
42	08:22	07:35	06:38	06:33	05:45	07:17 (WEA 2)	05:28	06:08 (WEA 1)	07:23 (WEA 2)	07:22	08:08	07:58
43	17:15	18:07	18:52	20:39	21:23	07:56 (WEA 2)	21:47	21:52	08:01 (WEA 2)	20:01	18:54	17:00
44	08:21	07:33	06:35	06:31	05:44	07:17 (WEA 2)	05:28	06:08 (WEA 1)	07:23 (WEA 2)	07:23	08:09	07:59
45	17:16	18:08	18:53	20:41	21:24	07:56 (WEA 2)	21:48	21:53	08:00 (WEA 2)	20:01	18:54	17:00
46	08:20	07:31	06:33	06:29	05:43	07:16 (WEA 2)	05:28	06:09 (WEA 1)	07:24 (WEA 2)	07:25	08:11	08:01
47	17:18	18:10	18:55	20:42	21:25	07:56 (WEA 2)	21:48	21:53	07:59 (WEA 2)	20:01	18:54	17:00
48	08:19	07:30	06:31	06:27	05:42	07:17 (WEA 2)	05:28	06:09 (WEA 1)	07:24 (WEA 2)	07:26	08:13	08:02
49	17:20	18:12	18:56	20:44	21:26	07:56 (WEA 2)	21:48	21:53	07:58 (WEA 2)	20:01	18:54	17:00
50	08:18	07:28	06:29	06:25	05:41	07:16 (WEA 2)	05:28	06:09 (WEA 1)	07:24 (WEA 2)	07:28	08:14	08:04
51	17:21	18:13	18:58	20:45	21:28	07:56 (WEA 2)	21:48	21:53	07:56 (WEA 2)	20:01	18:54	17:00
52	08:17	07:26	06:27	06:24	05:40	07:16 (WEA 2)	05:28	06:10 (WEA 1)	07:25 (WEA 2)	07:29	08:16	08:05
53	17:23	18:15	18:59	20:47	21:29	07:55 (WEA 2)	21:48	21:53	07:56 (WEA 2)	20:01	18:54	17:00
54	08:16	07:24	06:25	06:22	05:39	07:16 (WEA 2)	05:28	06:10 (WEA 1)	07:26 (WEA 2)	07:31	08:17	08:06
55	17:25	18:17	19:01	20:48	21:30	07:55 (WEA 2)	21:48	21:53	07:54 (WEA 2)	20:01	18:54	17:00
56	08:14	07:23	06:20	06:17	05:38	07:17 (WEA 2)	05:28	06:11 (WEA 1)	07:28 (WEA 2)	07:32	08:19	08:08
57	17:26	18:18	19:02	20:50	21:31	07:55 (WEA 2)	21:48	21:53	07:52 (WEA 2)	20:01	18:54	17:00
58	08:13	07:20	06:18	06:15	05:37	07:17 (WEA 2)	05:28	06:11 (WEA 1)	07:29 (WEA 2)	07:34	08:21	08:10
59	17:28	18:20	19:04	20:51	21:32	07:54 (WEA 2)	21:47	21:52	07:49 (WEA 2)	20:01	18:54	17:00
60	08:12	07:18	06:15	06:12	05:36	07:16 (WEA 2)	05:28	06:10 (WEA 1)	07:29 (WEA 2)	07:34	08:21	08:10
61	17:30	18:22	19:06	20:53	21:34	07:54 (WEA 2)	21:47	21:52	07:46 (WEA 2)	20:01	18:54	17:00
62	Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275
63	astr. max.mögl. Beschattung				647	285	378	43	942			
64	Red. Sonnenscheinwahrsch.				0,46	0,44	0,45	0,48	0,48			
65	Reduktion Betriebsdauer				0,93	0,93	0,93	0,93	0,93			
66	Reduktion Windrichtung				0,69	0,69	0,74	0,69	0,69			
67	Gesamte Reduktion				0,29	0,28	0,31	0,33	0,31			
68	Met. wahrsch. Beschattung				190	80	119	14	289			

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: I-10 - Z.I. Gadderscheier

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April		Mai		Jun	Jul		August		September	Oktober	November	Dezember			
1	08:33	08:10	07:22	07:16		06:16		07:00 (WEA 2)	05:36	05:34	06:07		07:10 (WEA 2)	06:51	07:35	07:24	08:11		
	16:47	17:31	18:18	20:07		20:53	39	07:39 (WEA 2)	21:34	21:47	21:19	38	07:48 (WEA 2)	20:22	19:18	17:16	16:40		
2	08:33	08:09	07:20	07:14		06:15		07:01 (WEA 2)	05:35	05:34	06:08		07:10 (WEA 2)	06:53	07:37	07:26	08:12		
	16:48	17:33	18:20	20:09		20:54	39	07:40 (WEA 2)	21:35	21:47	21:18	39	07:49 (WEA 2)	20:20	19:15	17:15	16:40		
3	08:33	08:08	07:18	07:12		06:13		07:00 (WEA 2)	05:34	05:35	06:09		07:10 (WEA 2)	06:54	07:38	07:27	08:13		
	16:49	17:35	18:21	20:10		20:56	40	07:40 (WEA 2)	21:36	21:47	21:16	39	07:49 (WEA 2)	20:18	19:13	17:13	16:39		
4	08:33	08:06	07:16	07:10		06:11		06:59 (WEA 2)	05:34	05:36	06:11		07:09 (WEA 2)	06:56	07:40	07:29	08:14		
	16:50	17:36	18:23	20:12		20:57	40	07:39 (WEA 2)	21:37	21:46	21:15	40	07:49 (WEA 2)	20:16	19:11	17:12	16:39		
5	08:33	08:05	07:13	07:08		06:09		07:00 (WEA 2)	05:33	05:36	06:12		07:09 (WEA 2)	06:57	07:41	07:30	08:16		
	16:51	17:38	18:25	20:13		20:59	40	07:40 (WEA 2)	21:38	21:46	21:13	41	07:50 (WEA 2)	20:14	19:09	17:10	16:39		
6	08:33	08:03	07:11	07:05		06:08		06:59 (WEA 2)	05:32	05:37	06:13		07:09 (WEA 2)	06:58	07:43	07:32	08:17		
	16:53	17:40	18:26	20:15		21:00	40	07:39 (WEA 2)	21:39	21:46	21:11	40	07:49 (WEA 2)	20:12	19:07	17:08	16:38		
7	08:33	08:02	07:09	07:03		06:06		06:59 (WEA 2)	05:32	05:38	06:15		07:09 (WEA 2)	07:00	07:44	07:34	08:18		
	16:54	17:41	18:28	20:16		21:02	41	07:40 (WEA 2)	21:40	21:45	21:10	40	07:49 (WEA 2)	20:09	19:05	17:07	16:38		
8	08:32	08:00	07:07	07:01		06:05		06:59 (WEA 2)	05:31	05:39	06:16		07:09 (WEA 2)	07:01	07:46	07:35	08:19		
	16:55	17:43	18:30	20:18		21:03	40	07:39 (WEA 2)	21:41	21:44	21:08	40	07:49 (WEA 2)	20:07	19:03	17:05	16:38		
9	08:32	07:58	07:05	06:59		06:03		07:00 (WEA 2)	05:31	05:40	06:18		07:09 (WEA 2)	07:03	07:47	07:37	08:20		
	16:56	17:45	18:31	20:19		21:05	39	07:39 (WEA 2)	21:41	21:44	21:06	40	07:49 (WEA 2)	20:05	19:01	17:04	16:37		
10	08:31	07:57	07:03	06:57		06:01		06:59 (WEA 2)	05:31	05:41	06:19		07:09 (WEA 2)	07:04	07:49	07:39	08:21		
	16:57	17:46	18:33	20:21		21:06	39	07:38 (WEA 2)	21:42	21:43	21:05	39	07:48 (WEA 2)	20:03	18:59	17:02	16:37		
11	08:31	07:55	07:01	06:55		06:00		07:00 (WEA 2)	05:30	05:41	06:21		07:09 (WEA 2)	07:06	07:50	07:40	08:22		
	16:59	17:48	18:34	20:22		21:08	38	07:38 (WEA 2)	21:43	21:43	21:03	39	07:48 (WEA 2)	20:01	18:56	17:01	16:37		
12	08:30	07:53	06:59	06:53		05:58		06:59 (WEA 2)	05:30	05:42	06:22		07:09 (WEA 2)	07:07	07:52	07:42	08:23		
	17:00	17:50	18:36	20:24		21:09	38	07:37 (WEA 2)	21:43	21:42	21:01	39	07:48 (WEA 2)	20:01	18:54	17:00	16:37		
13	08:30	07:52	06:57	06:51		05:57		07:00 (WEA 2)	05:30	05:43	06:23		07:09 (WEA 2)	07:09	07:54	07:43	08:24		
	17:01	17:52	18:37	20:25		21:11	37	07:37 (WEA 2)	21:44	21:41	20:59	38	07:47 (WEA 2)	20:01	18:52	16:58	16:37		
14	08:29	07:50	06:55	06:49		05:55		07:01 (WEA 2)	05:30	05:44	06:25		07:10 (WEA 2)	07:10	07:55	07:45	08:25		
	17:03	17:53	18:39	20:27		21:12	36	07:37 (WEA 2)	21:45	21:40	20:58	37	07:47 (WEA 2)	20:01	18:50	16:57	16:37		
15	08:28	07:48	06:53	06:47		05:54		07:01 (WEA 2)	05:30	05:45	06:26		07:10 (WEA 2)	07:12	07:57	07:47	08:26		
	17:04	17:55	18:41	20:29		21:13	35	07:36 (WEA 2)	21:45	21:39	20:56	35	07:45 (WEA 2)	20:01	18:48	16:56	16:37		
16	08:28	07:46	06:50	06:45		05:53		07:02 (WEA 2)	05:29	05:47	06:28		07:12 (WEA 2)	07:13	07:58	07:48	08:27		
	17:06	17:57	18:42	20:30		21:15	33	07:35 (WEA 2)	21:46	21:39	20:54	33	07:45 (WEA 2)	20:01	18:46	16:54	16:37		
17	08:27	07:45	06:48	06:43		05:51		07:02 (WEA 2)	05:29	05:48	06:29		07:12 (WEA 2)	07:15	08:00	07:50	08:28		
	17:07	17:58	18:44	20:32		21:16	33	07:35 (WEA 2)	21:46	21:38	8	07:32 (WEA 2)	20:52	31	07:43 (WEA 2)	19:48	18:44	16:53	16:38
18	08:26	07:43	06:46	06:41		05:50		07:03 (WEA 2)	05:29	05:49	06:31		07:22 (WEA 2)	07:16	08:01	07:51	08:28		
	17:09	18:00	18:45	20:33		21:17	31	07:34 (WEA 2)	21:46	21:37	13	07:35 (WEA 2)	20:50	29	07:42 (WEA 2)	19:46	18:42	16:52	16:38
19	08:25	07:41	06:44	06:39		05:49		07:04 (WEA 2)	05:29	05:50	06:32		07:21 (WEA 2)	07:14	08:03	07:53	08:29		
	17:10	18:02	18:47	20:35		21:19	30	07:34 (WEA 2)	21:47	21:36	16	07:37 (WEA 2)	20:48	27	07:41 (WEA 2)	19:44	18:40	16:51	16:38
20	08:24	07:39	06:42	06:37		05:48		07:05 (WEA 2)	05:30	05:51	06:34		07:16 (WEA 2)	07:19	08:05	07:55	08:30		
	17:12	18:03	18:48	20:36		21:20	28	07:33 (WEA 2)	21:47	21:35	20	07:39 (WEA 2)	20:46	22	07:38 (WEA 2)	19:41	18:38	16:50	16:39
21	08:23	07:37	06:40	06:35		05:46		07:05 (WEA 2)	05:30	05:52	06:35		07:18 (WEA 2)	07:17	08:06	07:56	08:30		
	17:13	18:05	18:50	20:38	12	07:16 (WEA 2)	21:21	07:28 (WEA 2)	21:21	21:33	22	07:40 (WEA 2)	20:44	18	07:35 (WEA 2)	19:39	18:36	16:49	16:39
22	08:22	07:35	06:38	06:33		05:45		07:06 (WEA 2)	05:30	05:53	06:37		07:16 (WEA 2)	07:16	08:02	07:58	08:31		
	17:15	18:07	18:52	20:39	19	07:31 (WEA 2)	21:23	07:30 (WEA 2)	21:47	21:32	25	07:41 (WEA 2)	20:42	11	07:32 (WEA 2)	19:37	18:35	16:48	16:39
23	08:21	07:33	06:35	06:31		05:44		07:08 (WEA 2)	05:30	05:55	06:38		07:15 (WEA 2)	07:15	08:09	07:59	08:31		
	17:16	18:08	18:53	20:41	23	07:33 (WEA 2)	21:24	07:29 (WEA 2)	21:48	21:31	27	07:42 (WEA 2)	20:40		19:35	18:33	16:47	16:40	
24	08:20	07:31	06:33	06:29		05:43		07:09 (WEA 2)	05:30	05:56	06:39		07:14 (WEA 2)	07:14	08:01	07:51	08:32		
	17:18	18:10	18:55	20:42	27	07:34 (WEA 2)	21:25	07:28 (WEA 2)	21:48	21:30	29	07:43 (WEA 2)	20:38		19:33	18:31	16:46	16:41	
25	08:19	07:30	06:31	06:27		05:42		07:11 (WEA 2)	05:31	05:57	06:41		07:14 (WEA 2)	07:14	08:02	07:52	08:32		
	17:20	18:12	18:56	20:44	29	07:36 (WEA 2)	21:26	07:26 (WEA 2)	21:48	21:29	31	07:45 (WEA 2)	20:36		19:30	17:29	16:45	16:41	
26	08:18	07:28	06:29	06:25		05:41		07:14 (WEA 2)	05:31	05:59	06:42		07:13 (WEA 2)	07:13	08:04	07:54	08:32		
	17:21	18:13	18:58	20:45	32	07:37 (WEA 2)	21:28	07:25 (WEA 2)	21:48	21:27	32	07:45 (WEA 2)	20:34		19:28	17:27	16:44	16:42	
27	08:17	07:26	06:27	06:24		05:40		07:19 (WEA 2)	05:32	06:00	06:44		07:13 (WEA 2)	07:13	08:05	07:55	08:33		
	17:23	18:15	18:59	20:47	33	07:37 (WEA 2)	21:29	07:20 (WEA 2)	21:48	21:26	33	07:46 (WEA 2)	20:32		19:26	17:25	16:43	16:43	
28	08:16	07:24	06:25	06:22		05:39		07:02 (WEA 2)	05:32	06:01	06:45		07:12 (WEA 2)	07:12	08:06	07:56	08:33		
	17:25	18:17	19:01	20:48	36	07:38 (WEA 2)	21:30	07:28 (WEA 2)	21:48	21:25	34	07:46 (WEA 2)	20:30		19:24	17:23	16:42	16:43	
29	08:14		07:23	06:20		05:38		07:02 (WEA 2)	05:32	06:02	06:47		07:12 (WEA 2)	07:12	08:08	07:58	08:33		
	17:26		20:02	20:50	37	07:39 (WEA 2)	21:31	07:39 (WEA 2)	21:48	21:23	36	07:48 (WEA 2)	20:28		19:22	17:22	16:42	16:44	
30	08:13		07:20	06:18		05:37		07:01 (WEA 2)	05:33	06:04	06:48		07:11 (WEA 2)	07:11	08:09	07:59	08:33		
	17:28		20:04	20:51	38	07:39 (WEA 2)	21:32	07:39 (WEA 2)	21:47	21:22	37	07:48 (WEA 2)	20:26		19:20	17:20	16:41	16:45	
31	08:12		07:18			05:36				06:05	06:50		07:10 (WEA 2)	07:10	08:09	07:59	08:33		
	17:30		20:05			21:33				21:21	20:24		07:48 (WEA 2)	07:48	08:39	08:29	09:04	16:46	
Sonnenscheinstunden	269	283	368	411		475		486	490	401	447		379	335	275	255			
astr. max. mögl. Beschattung				286		853				401		755							
Red. Sonnenscheinwahrsch.				0.46		0.44				0.48		0.48							
Reduktion Betriebsdauer				0.93		0.93				0.93		0.93							
Reduktion Windrichtung				0.70		0.70				0.70		0.70							
Gesamte Reduktion				0.30		0.29				0.31		0.31							
Met. wahrsch. Beschattung				85		243				124		235							



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-01 - 189, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:33 16:47 21	11:27 (WEA 1) 17:31 18:18	08:10 17:31 18:18	07:22 20:07 20:53	06:16 20:53 21:34	05:35 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16	07:24 17:16 16:40	08:11 16:40 16:10	
2	08:33 16:48 18	11:29 (WEA 1) 17:33 18:20	08:09 17:33 18:20	07:20 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15	07:26 17:15 16:40	08:12 16:40 16:10	
3	08:33 16:49 17	11:30 (WEA 1) 17:34 18:21	08:08 17:34 18:21	07:18 20:10 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13	07:27 17:13 16:39	08:13 16:39 16:10	
4	08:33 16:50 14	11:31 (WEA 1) 17:36 18:23	08:06 17:36 18:23	07:15 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 21:15 20:16	06:56 20:16 19:11	07:40 19:11 17:11	07:29 17:11 16:39	08:14 16:39 16:10	
5	08:33 16:51 10	11:34 (WEA 1) 17:38 18:25	08:05 17:38 18:25	07:13 20:13 20:59	07:08 20:59 21:38	06:09 21:38 21:46	05:36 21:46 21:13	06:12 21:13 20:14	06:57 20:14 19:09	07:41 19:09 17:10	07:30 17:10 16:38	08:16 16:38 16:10	
6	08:33 16:52	11:44 (WEA 1) 17:38 18:25	08:03 17:38 18:25	07:11 20:15 21:00	07:05 21:00 21:39	06:08 21:39 21:46	05:37 21:46 21:11	06:13 21:11 20:12	06:58 20:12 19:07	07:43 19:07 17:08	07:32 17:08 16:38	08:17 16:38 16:10	
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Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255	591
astr. max. mögl. Beschattung													0,13
Red. Sonnenscheinwahrsch.													0,93
Reduktion Betriebsdauer													0,56
Reduktion Windrichtung													0,08
Gesamte Reduktion													0,07
Met. wahrsch. Beschattung													38

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-02 - 193, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
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Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung												851
Red. Sonnenscheinwahrsch.												0,13
Reduktion Betriebsdauer												0,93
Reduktion Windrichtung												0,56
Gesamte Reduktion												0,07
Met. wahrsch. Beschattung												55

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-03 - 197, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 35	11:02 (WEA 1) 11:37 (WEA 1) 17:31	08:10 17:31 18:18	07:22 20:07 18:18	06:16 20:53 21:34	05:35 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16	07:24 17:16 16:40	08:11 16:40 17
2	08:33 16:48 34	11:03 (WEA 1) 11:37 (WEA 1) 17:33	08:09 17:33 18:20	07:20 20:09 18:20	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 19:15	06:53 19:15 17:15	07:37 17:15 16:40	07:26 16:40 21	08:12 16:40 21
3	08:33 16:49 33	11:04 (WEA 1) 11:37 (WEA 1) 17:34	08:08 17:34 18:21	07:18 20:10 18:23	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 19:13	06:54 19:13 17:13	07:38 17:13 16:39	07:27 16:39 23	08:13 16:39 23
4	08:33 16:50 31	11:05 (WEA 1) 11:36 (WEA 1) 17:38	08:06 17:38 18:25	07:15 20:12 18:25	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 20:16 19:11	06:56 19:11 17:11	07:40 17:11 16:39	07:29 16:39 25	08:14 16:39 25
5	08:33 16:51 30	11:06 (WEA 1) 11:36 (WEA 1) 17:38	08:05 17:38 18:25	07:13 20:13 18:25	06:09 20:59 21:38	05:33 21:38 21:46	05:35 21:46 21:13	06:12 20:14 19:09	06:57 19:09 17:10	07:41 17:10 16:38	07:30 16:38 27	08:16 16:38 27
6	08:33 16:52 29	11:07 (WEA 1) 11:36 (WEA 1) 17:40	08:03 17:40 18:26	07:11 20:15 18:26	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 20:12 19:07	06:58 19:07 17:08	07:43 17:08 16:38	07:32 16:38 28	08:17 16:38 28
7	08:33 16:54 27	11:08 (WEA 1) 11:35 (WEA 1) 17:41	08:02 17:41 18:28	07:09 20:16 18:28	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:10 20:09	06:15 20:09 19:05	07:00 19:05 17:07	07:44 17:07 16:38	07:34 16:38 30	08:18 16:38 30
8	08:32 16:55 25	11:10 (WEA 1) 11:35 (WEA 1) 17:43	08:00 17:43 18:29	07:07 20:18 18:29	06:04 21:03 21:41	05:31 21:41 21:45	05:39 21:08 20:07	06:16 20:07 19:03	07:01 19:03 17:05	07:46 17:05 16:38	07:35 16:38 31	08:19 16:38 31
9	08:32 16:56 23	11:11 (WEA 1) 11:34 (WEA 1) 17:45	07:58 17:45 18:31	07:05 20:19 18:31	06:03 21:05 21:41	05:31 21:41 21:44	05:40 21:06 20:05	06:18 20:05 19:01	07:03 19:01 17:04	07:47 17:04 16:37	07:37 16:37 33	08:20 16:37 33
10	08:31 16:57 21	11:13 (WEA 1) 11:34 (WEA 1) 17:46	07:57 17:46 18:33	07:03 20:21 18:33	06:01 21:06 21:42	05:31 21:42 21:43	05:40 21:05 20:03	06:19 20:03 19:04	07:04 19:04 17:02	07:49 17:02 16:37	07:39 16:37 34	08:21 16:37 34
11	08:31 16:59 17	11:15 (WEA 1) 11:32 (WEA 1) 17:48	07:55 17:48 18:34	07:01 20:22 18:34	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:03 20:01	06:21 20:01 19:59	07:06 19:59 18:56	07:50 18:56 17:01	07:40 17:01 16:37	08:22 16:37 35
12	08:30 17:00 13	11:17 (WEA 1) 11:30 (WEA 1) 17:50	07:53 17:50 18:36	06:59 20:24 18:36	06:53 21:09 21:43	05:58 21:09 21:43	05:30 21:42 21:01	06:22 21:01 19:59	07:07 19:59 18:54	07:52 18:54 16:59	07:42 16:59 16:37	08:23 16:59 36
13	08:30 17:01 3	11:23 (WEA 1) 11:26 (WEA 1) 17:51	07:52 17:51 18:37	06:57 20:25 18:37	06:51 21:11 21:44	05:57 21:11 21:44	05:30 21:41 20:59	06:23 20:59 19:57	07:09 19:57 18:52	07:54 18:52 16:58	07:43 16:58 16:37	08:24 16:58 35
14	08:29 17:03	11:24 (WEA 1) 11:35 (WEA 1) 17:53	07:51 17:53 18:39	06:56 20:27 18:39	06:50 21:12 21:45	05:55 21:12 21:45	05:30 21:45 21:40	06:25 20:58 19:54	07:10 19:54 18:50	07:55 18:50 16:57	07:45 16:57 16:37	08:25 16:57 36
15	08:28 17:04	11:25 (WEA 1) 11:36 (WEA 1) 17:54	07:50 17:54 18:41	06:55 20:29 18:41	06:54 21:13 21:46	05:54 21:13 21:46	05:29 21:46 21:41	06:26 20:56 19:52	07:12 19:52 18:48	07:57 18:48 16:55	07:47 16:55 16:37	08:26 16:55 37
16	08:28 17:06	11:26 (WEA 1) 11:37 (WEA 1) 17:55	07:49 17:55 18:42	06:54 20:30 18:42	06:53 21:14 21:47	05:53 21:14 21:47	05:29 21:47 21:42	06:28 20:54 19:50	07:13 19:50 18:46	07:58 18:46 16:54	07:48 16:54 16:37	08:27 16:54 37
17	08:27 17:07	11:27 (WEA 1) 11:38 (WEA 1) 17:56	07:48 17:56 18:43	06:53 20:31 18:43	06:52 21:15 21:48	05:52 21:15 21:48	05:29 21:48 21:43	06:29 20:54 19:50	07:14 19:50 18:46	08:00 18:46 16:54	07:50 16:54 16:37	08:28 16:54 38
18	08:26 17:09	11:28 (WEA 1) 11:39 (WEA 1) 17:57	07:47 17:57 18:44	06:52 20:32 18:44	06:51 21:16 21:49	05:51 21:16 21:49	05:29 21:49 21:44	06:31 20:52 19:48	07:16 19:48 18:44	08:01 18:44 16:53	07:51 16:53 16:38	08:29 16:53 38
19	08:25 17:10	11:29 (WEA 1) 11:40 (WEA 1) 17:58	07:46 17:58 18:45	06:51 20:33 18:45	06:50 21:17 21:50	05:50 21:17 21:50	05:29 21:50 21:45	06:32 20:50 19:46	07:17 19:46 18:42	08:03 18:42 16:52	07:53 16:52 16:38	08:30 16:52 39
20	08:24 17:12	11:30 (WEA 1) 11:41 (WEA 1) 17:59	07:45 17:59 18:46	06:50 20:34 18:46	06:49 21:18 21:51	05:49 21:18 21:51	05:29 21:51 21:46	06:34 20:48 19:43	07:19 19:43 18:40	08:05 18:40 16:51	07:55 16:51 16:38	08:31 16:51 39
21	08:23 17:13	11:31 (WEA 1) 11:42 (WEA 1) 18:00	07:44 18:00 18:47	06:49 20:35 18:47	06:48 21:19 21:52	05:48 21:19 21:52	05:29 21:52 21:47	06:36 20:46 19:41	07:20 19:41 18:38	08:06 18:38 16:50	07:56 16:50 16:38	08:32 16:50 39
22	08:22 17:15	11:32 (WEA 1) 11:43 (WEA 1) 18:01	07:43 18:01 18:48	06:48 20:36 18:48	06:47 21:20 21:53	05:47 21:20 21:53	05:29 21:53 21:48	06:37 20:46 19:41	07:22 19:41 18:39	08:08 18:39 16:49	07:58 16:49 16:39	08:33 16:49 39
23	08:21 17:16	11:33 (WEA 1) 11:44 (WEA 1) 18:02	07:42 18:02 18:49	06:47 20:37 18:49	06:46 21:21 21:54	05:46 21:21 21:54	05:29 21:54 21:49	06:38 20:46 19:41	07:23 19:41 18:39	08:09 18:39 16:48	07:59 16:48 16:39	08:34 16:48 39
24	08:20 17:18	11:34 (WEA 1) 11:45 (WEA 1) 18:03	07:41 18:03 18:50	06:46 20:38 18:50	06:45 21:22 21:55	05:45 21:22 21:55	05:29 21:55 21:50	06:39 20:46 19:41	07:25 19:41 18:39	08:11 18:39 16:47	08:01 16:47 16:40	08:35 16:47 39
25	08:19 17:20	11:35 (WEA 1) 11:46 (WEA 1) 18:04	07:40 18:04 18:51	06:45 20:39 18:51	06:44 21:23 21:56	05:44 21:23 21:56	05:29 21:56 21:51	06:40 20:46 19:41	07:26 19:41 18:39	08:12 18:39 16:46	08:02 16:46 16:40	08:36 16:46 38
26	08:18 17:21	11:36 (WEA 1) 11:47 (WEA 1) 18:05	07:39 18:05 18:52	06:44 20:40 18:52	06:43 21:24 21:57	05:43 21:24 21:57	05:29 21:57 21:52	06:41 20:46 19:41	07:27 19:41 18:39	08:13 18:39 16:45	08:03 16:45 16:40	08:37 16:45 38
27	08:17 17:23	11:37 (WEA 1) 11:48 (WEA 1) 18:06	07:38 18:06 18:53	06:43 20:41 18:53	06:42 21:25 21:58	05:42 21:25 21:58	05:29 21:58 21:53	06:42 20:46 19:41	07:28 19:41 18:39	08:14 18:39 16:44	08:04 16:44 16:40	08:38 16:44 38
28	08:16 17:24	11:38 (WEA 1) 11:49 (WEA 1) 18:07	07:37 18:07 18:54	06:42 20:42 18:54	06:41 21:26 21:59	05:41 21:26 21:59	05:29 21:59 21:54	06:43 20:46 19:41	07:29 19:41 18:39	08:15 18:39 16:43	08:05 16:43 16:40	08:39 16:43 37
29	08:14 17:26	11:39 (WEA 1) 11:50 (WEA 1) 18:08	07:36 18:08 18:55	06:41 20:43 18:55	06:40 21:27 22:00	05:40 21:27 22:00	05:29 22:00 21:55	06:44 20:46 19:41	07:30 19:41 18:39	08:16 18:39 16:42	08:06 16:42 16:40	08:40 16:42 37
30	08:13 17:28	11:40 (WEA 1) 11:51 (WEA 1) 18:09	07:35 18:09 18:56	06:40 20:44 18:56	06:39 21:28 22:01	05:39 21:28 22:01	05:29 22:01 21:56	06:45 20:46 19:41	07:31 19:41 18:39	08:17 18:39 16:41	08:07 16:41 16:40	08:41 16:41 36
31	08:12 17:29	11:41 (WEA 1) 11:52 (WEA 1) 18:10	07:34 18:10 18:57	06:39 20:45 18:57	06:38 21:29 22:02	05:38 21:29 22:02	05:29 22:02 21:57	06:46 20:46 19:41	07:32 19:41 18:39	08:18 18:39 16:40	08:08 16:40 16:40	08:42 16:40 35
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	321										14	1050
Red. Sonnenscheinwahrsch.	0,15										0,15	0,13
Reduktion Betriebsdauer	0,93										0,93	0,93
Reduktion Windrichtung	0,56										0,56	0,56
Gesamte Reduktion	0,08										0,08	0,07
Met. wahrsch. Beschattung	24										1	68

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-04 - 203, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

			Januar		Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November		Dezember											
1	08:33		10:46 (WEA 1)	08:10	07:22	07:16	06:16	05:35	05:34	06:06	06:51	07:35	07:24		08:11	10:37 (WEA 1)											
	16:47	41	11:27 (WEA 1)	17:31	18:18	20:07	20:53	21:34	21:47	21:19	20:22	19:17	17:16		16:40	31 11:08 (WEA 1)											
2	08:33		10:47 (WEA 1)	08:09	07:20	07:14	06:14	05:35	05:34	06:08	06:53	07:37	07:26		08:12	10:36 (WEA 1)											
	16:48	40	11:27 (WEA 1)	17:33	18:20	20:09	20:54	21:35	21:47	21:18	20:20	19:15	17:15		16:40	33 11:09 (WEA 1)											
3	08:33		10:48 (WEA 1)	08:08	07:18	07:12	06:13	05:34	05:35	06:09	06:54	07:38	07:27		08:13	10:37 (WEA 1)											
	16:49	39	11:27 (WEA 1)	17:34	18:21	20:10	20:56	21:36	21:47	21:16	20:18	19:13	17:13		16:39	33 11:10 (WEA 1)											
4	08:33		10:48 (WEA 1)	08:06	07:15	07:10	06:11	05:33	05:35	06:11	06:56	07:40	07:29		08:14	10:36 (WEA 1)											
	16:50	39	11:27 (WEA 1)	17:36	18:23	20:12	20:57	21:37	21:46	21:15	20:16	19:11	17:11		16:39	35 11:11 (WEA 1)											
5	08:33		10:49 (WEA 1)	08:05	07:13	07:08	06:09	05:33	05:36	06:12	06:57	07:41	07:30		08:16	10:36 (WEA 1)											
	16:51	38	11:27 (WEA 1)	17:38	18:25	20:13	20:59	21:38	21:46	21:13	20:14	19:09	17:10		16:38	36 11:12 (WEA 1)											
6	08:33		10:50 (WEA 1)	08:03	07:11	07:05	06:08	05:32	05:37	06:13	06:58	07:43	07:32		08:17	10:36 (WEA 1)											
	16:52	37	11:27 (WEA 1)	17:40	18:26	20:15	21:00	21:39	21:46	21:11	20:12	19:07	17:08		16:38	37 11:13 (WEA 1)											
7	08:33		10:51 (WEA 1)	08:02	07:09	07:03	06:06	05:32	05:38	06:15	07:00	07:44	07:34		08:18	10:36 (WEA 1)											
	16:54	36	11:27 (WEA 1)	17:41	18:28	20:16	21:02	21:40	21:45	21:10	20:09	19:05	17:07		16:38	38 11:14 (WEA 1)											
8	08:32		10:52 (WEA 1)	08:00	07:07	07:01	06:04	05:31	05:39	06:16	07:01	07:46	07:35		08:19	10:36 (WEA 1)											
	16:55	35	11:27 (WEA 1)	17:43	18:29	20:18	21:03	21:41	21:45	21:08	07:07	19:03	17:05		16:38	39 11:15 (WEA 1)											
9	08:32		10:53 (WEA 1)	07:58	07:05	06:59	06:03	05:31	05:40	06:18	07:03	07:47	07:37		08:20	10:36 (WEA 1)											
	16:56	33	11:26 (WEA 1)	17:45	18:31	20:19	21:05	21:41	21:44	21:06	20:05	19:01	17:04		16:37	39 11:15 (WEA 1)											
10	08:31		10:54 (WEA 1)	07:57	07:03	06:57	06:01	05:31	05:40	06:19	07:04	07:49	07:39		08:21	10:36 (WEA 1)											
	16:57	33	11:27 (WEA 1)	17:46	18:33	20:21	21:06	21:42	21:43	21:05	20:03	18:58	17:02		16:37	40 11:16 (WEA 1)											
11	08:31		10:55 (WEA 1)	07:55	07:01	06:55	06:00	05:30	05:41	06:21	07:06	07:50	07:40		08:22	10:36 (WEA 1)											
	16:59	31	11:26 (WEA 1)	17:48	18:34	20:22	21:08	21:43	21:43	21:03	20:01	18:56	17:01		16:37	41 11:17 (WEA 1)											
12	08:30		10:56 (WEA 1)	07:53	06:59	06:53	05:58	05:30	05:42	06:22	07:07	07:52	07:42		08:23	10:36 (WEA 1)											
	17:00	29	11:25 (WEA 1)	17:50	18:36	20:24	21:09	21:43	21:42	21:01	19:59	18:54	16:59		16:37	41 11:17 (WEA 1)											
13	08:30		10:58 (WEA 1)	07:52	06:57	06:51	05:57	05:30	05:43	06:23	07:09	07:54	07:43		08:24	10:37 (WEA 1)											
	17:01	27	11:25 (WEA 1)	17:51	18:37	20:25	21:11	21:44	21:41	20:59	19:57	18:52	16:58		16:37	41 11:18 (WEA 1)											
14	08:29		11:00 (WEA 1)	07:50	06:55	06:49	05:55	05:30	05:44	06:25	07:10	07:55	07:45		08:25	10:37 (WEA 1)											
	17:03	24	11:24 (WEA 1)	17:53	18:39	20:27	21:12	21:45	21:40	20:58	19:54	18:50	16:57		16:37	42 11:19 (WEA 1)											
15	08:28		11:01 (WEA 1)	07:48	06:52	06:47	05:54	05:29	05:45	06:26	07:12	07:57	07:47		08:26	10:38 (WEA 1)											
	17:04	21	11:22 (WEA 1)	17:55	18:41	20:29	21:13	21:45	21:39	20:56	19:52	18:48	16:55		16:37	42 11:20 (WEA 1)											
16	08:28		11:04 (WEA 1)	07:46	06:50	06:45	05:53	05:29	05:46	06:28	07:13	07:58	07:48		08:27	10:38 (WEA 1)											
	17:06	16	11:20 (WEA 1)	17:57	18:42	20:30	21:15	21:46	21:39	20:54	19:50	18:46	16:54		16:37	42 11:20 (WEA 1)											
17	08:27		11:07 (WEA 1)	07:45	06:48	06:43	05:51	05:29	05:48	06:29	07:14	08:00	07:50		08:28	10:39 (WEA 1)											
	17:07	10	11:17 (WEA 1)	17:58	18:44	20:32	21:16	21:46	21:38	20:52	19:48	18:44	16:53		16:38	42 11:21 (WEA 1)											
18	08:26		11:08 (WEA 1)	07:43	06:46	06:41	05:50	05:29	05:49	06:31	07:16	08:01	07:51		08:28	10:38 (WEA 1)											
	17:09		18:00	18:45	20:33	21:17	21:46	21:37	20:50	19:46	18:42	16:52			16:38	43 11:21 (WEA 1)											
19	08:25		11:09 (WEA 1)	07:41	06:44	06:39	05:47	05:30	05:41	06:29	07:17	08:02	07:53		08:29	10:39 (WEA 1)											
	17:10		18:02	18:47	20:35	21:19	21:47	21:36	20:48	19:43	18:40	16:51			16:38	43 11:22 (WEA 1)											
20	08:24		11:10 (WEA 1)	07:39	06:42	06:37	05:47	05:29	05:51	06:34	07:19	08:05	07:55		08:30	10:39 (WEA 1)											
	17:12		18:03	18:48	20:36	21:20	21:47	21:35	20:46	19:41	18:38	16:50			16:39	43 11:22 (WEA 1)											
21	08:23		11:11 (WEA 1)	07:37	06:40	06:35	05:46	05:30	05:52	06:35	07:20	08:06	07:56		08:30	10:40 (WEA 1)											
	17:13		18:05	18:50	20:38	21:21	21:47	21:33	20:44	19:39	18:36	16:49			16:39	43 11:23 (WEA 1)											
22	08:22		11:12 (WEA 1)	07:35	06:38	06:33	05:45	05:30	05:53	06:37	07:22	08:08	07:58		08:31	10:40 (WEA 1)											
	17:15		18:07	18:52	20:39	21:23	21:48	21:32	20:42	19:37	18:34	16:48			16:39	43 11:23 (WEA 1)											
23	08:21		11:13 (WEA 1)	07:33	06:35	06:31	05:44	05:30	05:55	06:38	07:23	08:09	07:59		08:31	10:41 (WEA 1)											
	17:16		18:08	18:53	20:41	21:24	21:48	21:31	20:40	19:35	18:33	16:47			16:40	43 11:24 (WEA 1)											
24	08:20		11:14 (WEA 1)	07:31	06:33	06:29	05:43	05:30	05:56	06:39	07:25	08:11	08:01		08:32	10:41 (WEA 1)											
	17:18		18:10	18:55	20:42	21:25	21:48	21:30	20:38	19:33	18:31	16:46			16:40	43 11:24 (WEA 1)											
25	08:19		11:15 (WEA 1)	07:29	06:31	06:27	05:42	05:31	05:57	06:41	07:26	07:13	08:02	10:45 (WEA 1)	08:32	10:42 (WEA 1)											
	17:20		18:12	18:56	20:44	21:26	21:48	21:29	20:36	19:30	17:29	16:45	10	10:55 (WEA 1)	16:41	43 11:25 (WEA 1)											
26	08:18		11:16 (WEA 1)	07:28	06:29	06:25	05:41	05:31	05:58	06:42	07:28	07:14	08:04	10:43 (WEA 1)	08:32	10:43 (WEA 1)											
	17:21		18:13	18:58	20:45	21:28	21:51	21:27	20:34	19:28	17:27	16:44	16	10:59 (WEA 1)	16:42	42 11:25 (WEA 1)											
27	08:17		11:17 (WEA 1)	07:26	06:27	06:23	05:40	05:31	06:00	06:44	07:29	07:16	08:05	10:41 (WEA 1)	08:33	10:43 (WEA 1)											
	17:23		18:15	18:59	20:47	21:29	21:48	21:26	20:32	19:26	17:25	16:43	20	11:01 (WEA 1)	16:42	42 11:25 (WEA 1)											
28	08:16		11:18 (WEA 1)	07:24	06:25	06:22	05:39	05:32	06:01	06:45	07:31	07:17	08:06	10:40 (WEA 1)	08:33	10:43 (WEA 1)											
	17:24		18:16	19:01	20:48	21:30	21:48	21:25	20:30	19:24	17:23	16:42	24	11:04 (WEA 1)	16:43	43 11:26 (WEA 1)											
29	08:14		11:19 (WEA 1)	07:22	06:20	06:16	05:38	05:32	06:02	06:47	07:32	07:19	08:08	10:38 (WEA 1)	08:33	10:44 (WEA 1)											
	17:26		18:17	19:02	20:50	21:31	21:48	21:23	20:28	19:22	17:22	16:42	27	11:05 (WEA 1)	16:44	42 11:26 (WEA 1)											
30	08:13		11:20 (WEA 1)	07:20	06:18	06:14	05:37	05:33	06:04	06:48	07:33	07:21	08:09	10:39 (WEA 1)	08:34	10:44 (WEA 1)											
	17:28		18:18	19:03	20:51	21:32	21:48	21:22	20:26	19:20	17:20	16:41	29	11:07 (WEA 1)	16:45	42 11:26 (WEA 1)											
31	08:12		11:21 (WEA 1)	07:18	06:16	06:12	05:36	05:32	06:05	06:50	07:35	07:23	08:11	10:40 (WEA 1)	08:35	10:45 (WEA 1)											
	17:29		18:19	19:04	20:55	21:36	21:51	21:25	20:30	19:24	17:24	16:43	30	11:08 (WEA 1)	16:46	41 11:26 (WEA 1)											
Sonnenscheinstunden	269			283		368		412		475		486		491		447		379		335		275				255	
astr.max.mögl.Beschattung		529																									1248
Red.Sonnenscheinwahrsch.		0,15																									0,13
Reduktion Betriebsdauer		0,93																									0,93
Reduktion Windrichtung		0,56																									0,56
Gesamte Reduktion		0,08																									0,08
Met.wahrsch.Beschattung		40																									81



Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-05 - 194, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33 16:47 21	11:14 (WEA 1) 17:31 18:18	08:10 17:22 18:18	07:16 20:07 18:18	06:16 20:53 18:18	05:35 21:34 18:18	05:34 21:47 18:18	06:06 21:19 18:18	06:51 20:22 18:18	07:35 19:17 18:18	07:24 17:16 18:18	08:11 16:40 18:18
2	08:33 16:48 20	11:15 (WEA 1) 17:33 18:20	08:09 17:20 18:18	07:14 20:09 18:18	06:14 20:54 18:18	05:35 21:35 18:18	05:34 21:47 18:18	06:08 21:18 18:18	06:53 20:20 18:18	07:37 19:15 18:18	07:26 17:15 18:18	08:12 16:40 18:18
3	08:33 16:49 18	11:17 (WEA 1) 17:34 18:21	08:08 17:19 18:18	07:12 20:10 18:18	06:13 20:56 18:18	05:34 21:36 18:18	05:35 21:47 18:18	06:09 21:16 18:18	06:54 20:18 18:18	07:38 19:13 18:18	07:27 17:13 18:18	08:13 16:39 18:18
4	08:33 16:50 15	11:18 (WEA 1) 17:36 18:23	08:06 17:17 18:18	07:10 20:12 18:18	06:11 20:57 18:18	05:33 21:37 18:18	05:35 21:46 18:18	06:11 21:15 18:18	06:56 20:16 18:18	07:40 19:11 18:18	07:29 17:11 18:18	08:14 16:39 18:18
5	08:33 16:51 12	11:20 (WEA 1) 17:38 18:25	08:05 17:18 18:18	07:13 20:13 18:18	07:08 20:59 18:18	06:09 21:38 18:18	05:36 21:46 18:18	06:12 21:13 18:18	06:57 20:14 18:18	07:41 19:09 18:18	07:30 17:10 18:18	08:16 16:38 18:18
6	08:33 16:52 6	11:24 (WEA 1) 17:40 18:26	08:03 17:21 18:18	07:11 20:15 18:18	07:05 21:00 18:18	06:08 21:39 18:18	05:37 21:46 18:18	06:13 21:11 18:18	06:58 20:12 18:18	07:43 19:07 18:18	07:32 17:08 18:18	08:17 16:38 18:18
7	08:33 16:54 17:41	11:30 (WEA 1) 17:40 18:26	08:02 17:20 18:18	07:09 20:16 18:18	07:03 21:02 18:18	06:06 21:40 18:18	05:32 21:45 18:18	06:15 21:10 18:18	07:00 20:09 18:18	07:44 19:05 18:18	07:34 17:07 18:18	08:18 16:38 18:18
8	08:32 16:55 17:45	11:32 (WEA 1) 17:42 18:28	08:00 17:19 18:18	07:07 20:18 18:18	07:01 21:03 18:18	06:04 21:41 18:18	05:31 21:45 18:18	06:16 21:08 18:18	07:01 20:07 18:18	07:46 19:03 18:18	07:35 17:05 18:18	08:19 16:38 18:18
9	08:32 16:56 17:45	11:33 (WEA 1) 17:43 18:29	08:00 17:19 18:18	07:07 20:18 18:18	07:01 21:03 18:18	06:04 21:41 18:18	05:31 21:45 18:18	06:16 21:08 18:18	07:01 20:07 18:18	07:46 19:03 18:18	07:35 17:05 18:18	08:19 16:38 18:18
10	08:31 16:57 17:46	11:34 (WEA 1) 17:44 18:30	08:00 17:20 18:18	07:07 20:19 18:18	07:01 21:04 18:18	06:04 21:42 18:18	05:31 21:46 18:18	06:16 21:09 18:18	07:01 20:08 18:18	07:46 19:04 18:18	07:35 17:04 18:18	08:19 16:37 18:18
11	08:31 16:59 17:48	11:35 (WEA 1) 17:45 18:31	08:00 17:21 18:18	07:07 20:20 18:18	07:01 21:05 18:18	06:04 21:43 18:18	05:31 21:47 18:18	06:16 21:10 18:18	07:01 20:09 18:18	07:46 19:05 18:18	07:35 17:05 18:18	08:19 16:37 18:18
12	08:30 17:00 17:51	11:36 (WEA 1) 17:46 18:32	08:00 17:22 18:18	07:07 20:21 18:18	07:01 21:06 18:18	06:04 21:44 18:18	05:31 21:48 18:18	06:16 21:11 18:18	07:01 20:10 18:18	07:46 19:06 18:18	07:35 17:06 18:18	08:19 16:37 18:18
13	08:30 17:01 17:52	11:37 (WEA 1) 17:47 18:33	08:00 17:23 18:18	07:07 20:22 18:18	07:01 21:07 18:18	06:04 21:45 18:18	05:31 21:49 18:18	06:16 21:12 18:18	07:01 20:11 18:18	07:46 19:07 18:18	07:35 17:07 18:18	08:19 16:37 18:18
14	08:29 17:03 17:53	11:38 (WEA 1) 17:48 18:34	08:00 17:24 18:18	07:07 20:23 18:18	07:01 21:08 18:18	06:04 21:46 18:18	05:31 21:50 18:18	06:16 21:13 18:18	07:01 20:12 18:18	07:46 19:08 18:18	07:35 17:08 18:18	08:19 16:37 18:18
15	08:28 17:04 17:54	11:39 (WEA 1) 17:49 18:35	08:00 17:25 18:18	07:07 20:24 18:18	07:01 21:09 18:18	06:04 21:47 18:18	05:31 21:51 18:18	06:16 21:14 18:18	07:01 20:13 18:18	07:46 19:09 18:18	07:35 17:09 18:18	08:19 16:37 18:18
16	08:28 17:06 17:56	11:40 (WEA 1) 17:50 18:36	08:00 17:26 18:18	07:07 20:25 18:18	07:01 21:10 18:18	06:04 21:48 18:18	05:31 21:52 18:18	06:16 21:15 18:18	07:01 20:14 18:18	07:46 19:10 18:18	07:35 17:10 18:18	08:19 16:37 18:18
17	08:27 17:07 17:57	11:41 (WEA 1) 17:51 18:37	08:00 17:27 18:18	07:07 20:26 18:18	07:01 21:11 18:18	06:04 21:49 18:18	05:31 21:53 18:18	06:16 21:16 18:18	07:01 20:15 18:18	07:46 19:11 18:18	07:35 17:11 18:18	08:19 16:37 18:18
18	08:26 17:09 17:59	11:42 (WEA 1) 17:52 18:38	08:00 17:28 18:18	07:07 20:27 18:18	07:01 21:12 18:18	06:04 21:50 18:18	05:31 21:54 18:18	06:16 21:17 18:18	07:01 20:16 18:18	07:46 19:12 18:18	07:35 17:12 18:18	08:19 16:37 18:18
19	08:25 17:10 18:00	11:43 (WEA 1) 17:53 18:39	08:00 17:29 18:18	07:07 20:28 18:18	07:01 21:13 18:18	06:04 21:51 18:18	05:31 21:55 18:18	06:16 21:18 18:18	07:01 20:17 18:18	07:46 19:13 18:18	07:35 17:13 18:18	08:19 16:37 18:18
20	08:24 17:12 18:01	11:44 (WEA 1) 17:54 18:40	08:00 17:30 18:18	07:07 20:29 18:18	07:01 21:14 18:18	06:04 21:52 18:18	05:31 21:56 18:18	06:16 21:19 18:18	07:01 20:18 18:18	07:46 19:14 18:18	07:35 17:14 18:18	08:19 16:37 18:18
21	08:23 17:13 18:02	11:45 (WEA 1) 17:55 18:41	08:00 17:31 18:18	07:07 20:30 18:18	07:01 21:15 18:18	06:04 21:53 18:18	05:31 21:57 18:18	06:16 21:20 18:18	07:01 20:19 18:18	07:46 19:15 18:18	07:35 17:15 18:18	08:19 16:37 18:18
22	08:22 17:15 18:03	11:46 (WEA 1) 17:56 18:42	08:00 17:32 18:18	07:07 20:31 18:18	07:01 21:16 18:18	06:04 21:54 18:18	05:31 21:58 18:18	06:16 21:21 18:18	07:01 20:20 18:18	07:46 19:16 18:18	07:35 17:16 18:18	08:19 16:37 18:18
23	08:21 17:16 18:04	11:47 (WEA 1) 17:57 18:43	08:00 17:33 18:18	07:07 20:32 18:18	07:01 21:17 18:18	06:04 21:55 18:18	05:31 21:59 18:18	06:16 21:22 18:18	07:01 20:21 18:18	07:46 19:17 18:18	07:35 17:17 18:18	08:19 16:37 18:18
24	08:20 17:18 18:05	11:48 (WEA 1) 17:58 18:44	08:00 17:34 18:18	07:07 20:33 18:18	07:01 21:18 18:18	06:04 21:56 18:18	05:31 22:00 18:18	06:16 21:23 18:18	07:01 20:22 18:18	07:46 19:18 18:18	07:35 17:18 18:18	08:19 16:37 18:18
25	08:19 17:20 18:06	11:49 (WEA 1) 17:59 18:45	08:00 17:35 18:18	07:07 20:34 18:18	07:01 21:19 18:18	06:04 21:57 18:18	05:31 22:01 18:18	06:16 21:24 18:18	07:01 20:23 18:18	07:46 19:19 18:18	07:35 17:19 18:18	08:19 16:37 18:18
26	08:18 17:21 18:07	11:50 (WEA 1) 18:00 18:46	08:00 17:36 18:18	07:07 20:35 18:18	07:01 21:20 18:18	06:04 21:58 18:18	05:31 22:02 18:18	06:16 21:25 18:18	07:01 20:24 18:18	07:46 19:20 18:18	07:35 17:20 18:18	08:19 16:37 18:18
27	08:17 17:23 18:08	11:51 (WEA 1) 18:01 18:47	08:00 17:37 18:18	07:07 20:36 18:18	07:01 21:21 18:18	06:04 21:59 18:18	05:31 22:03 18:18	06:16 21:26 18:18	07:01 20:25 18:18	07:46 19:21 18:18	07:35 17:21 18:18	08:19 16:37 18:18
28	08:16 17:24 18:09	11:52 (WEA 1) 18:02 18:48	08:00 17:38 18:18	07:07 20:37 18:18	07:01 21:22 18:18	06:04 22:00 18:18	05:31 22:04 18:18	06:16 21:27 18:18	07:01 20:26 18:18	07:46 19:22 18:18	07:35 17:22 18:18	08:19 16:37 18:18
29	08:14 17:26 18:10	11:53 (WEA 1) 18:03 18:49	08:00 17:39 18:18	07:07 20:38 18:18	07:01 21:23 18:18	06:04 22:01 18:18	05:31 22:05 18:18	06:16 21:28 18:18	07:01 20:27 18:18	07:46 19:23 18:18	07:35 17:23 18:18	08:19 16:37 18:18
30	08:13 17:28 18:11	11:54 (WEA 1) 18:04 18:50	08:00 17:40 18:18	07:07 20:39 18:18	07:01 21:24 18:18	06:04 22:02 18:18	05:31 22:06 18:18	06:16 21:29 18:18	07:01 20:28 18:18	07:46 19:24 18:18	07:35 17:24 18:18	08:19 16:37 18:18
31	08:12 17:29 18:12	11:55 (WEA 1) 18:05 18:51	08:00 17:41 18:18	07:07 20:40 18:18	07:01 21:25 18:18	06:04 22:03 18:18	05:31 22:07 18:18	06:16 21:30 18:18	07:01 20:29 18:18	07:46 19:25 18:18	07:35 17:25 18:18	08:19 16:37 18:18
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	92											623
Red. Sonnenscheinwahrsch.	0,15											0,13
Reduktion Betriebsdauer	0,93											0,93
Reduktion Windrichtung	0,56											0,56
Gesamte Reduktion	0,08											0,07
Met. wahrsch. Beschattung	7											41

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-06 - 200, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:33 16:47 31	10:58 (WEA 1) 11:29 (WEA 1) 08:09	08:10 17:31 18:18	07:22 20:07 17:14	07:16 20:53 06:14	05:35 21:34 05:35	05:34 21:47 05:34	06:06 21:19 06:08	06:51 20:22 06:53	07:35 19:17 07:37	07:24 17:16 07:26	08:11 16:40 08:12	10:56 (WEA 1) 11:03 (WEA 1) 10:53 (WEA 1)
2	08:33 16:48 30	11:29 (WEA 1) 11:00 (WEA 1) 08:08	17:33 18:20 07:18	20:09 20:54 07:12	20:54 21:35 06:13	21:35 21:47 05:34	21:47 21:35 05:35	06:09 21:18 06:09	06:54 20:20 06:54	07:38 19:15 07:38	07:27 17:15 07:27	08:13 16:40 08:13	11:06 (WEA 1) 10:52 (WEA 1) 10:52 (WEA 1)
3	08:33 16:49 29	11:29 (WEA 1) 11:01 (WEA 1) 08:06	17:34 18:21 07:15	20:10 20:56 07:10	20:56 21:36 06:11	21:36 21:47 05:33	21:47 21:36 05:35	06:11 21:16 06:11	06:56 20:18 06:56	07:40 19:13 07:40	07:29 17:13 07:29	08:14 16:39 08:14	11:09 (WEA 1) 10:51 (WEA 1) 10:51 (WEA 1)
4	08:33 16:50 27	11:28 (WEA 1) 11:02 (WEA 1) 08:05	17:36 18:23 07:13	20:12 20:57 07:08	20:57 21:37 06:09	21:37 21:46 05:33	21:46 21:35 05:36	06:12 21:15 06:12	06:57 20:16 06:57	07:41 19:11 07:41	07:30 17:11 07:30	08:16 16:39 08:16	11:11 (WEA 1) 10:50 (WEA 1) 10:50 (WEA 1)
5	08:33 16:51 27	11:29 (WEA 1) 11:04 (WEA 1) 08:03	17:38 18:25 07:11	20:13 20:59 07:05	20:59 21:38 06:08	21:38 21:46 05:32	21:46 21:35 05:37	06:13 21:13 06:13	06:58 20:14 06:58	07:43 19:09 07:43	07:32 17:10 07:32	08:17 16:38 08:17	11:12 (WEA 1) 10:50 (WEA 1) 10:50 (WEA 1)
6	08:33 16:52 24	11:28 (WEA 1) 11:05 (WEA 1) 08:02	17:40 18:26 07:09	20:15 21:00 07:03	21:00 21:39 06:06	21:39 21:46 05:32	21:46 21:35 05:38	06:15 21:10 06:15	07:00 20:09 07:00	07:44 19:05 07:44	07:34 17:07 07:34	08:18 16:38 08:18	11:14 (WEA 1) 10:49 (WEA 1) 10:49 (WEA 1)
7	08:33 16:54 22	11:27 (WEA 1) 11:07 (WEA 1) 08:00	17:41 18:29 07:07	20:16 21:01 07:01	21:02 21:41 06:04	21:41 21:49 05:31	21:49 21:38 05:39	06:16 21:08 06:16	07:01 20:07 07:01	07:46 19:03 07:46	07:35 17:05 07:35	08:19 16:38 08:19	11:16 (WEA 1) 10:49 (WEA 1) 10:49 (WEA 1)
8	08:32 16:55 20	11:27 (WEA 1) 11:08 (WEA 1) 07:58	17:43 18:31 07:05	20:18 21:03 06:59	21:03 21:41 06:03	21:41 21:49 05:31	21:49 21:38 05:40	06:18 21:08 06:18	07:03 20:07 07:03	07:47 19:03 07:47	07:37 17:05 07:37	08:20 16:38 08:20	11:16 (WEA 1) 10:48 (WEA 1) 10:48 (WEA 1)
9	08:32 16:56 17	11:25 (WEA 1) 11:11 (WEA 1) 07:57	17:45 18:33 07:03	20:19 21:04 06:57	21:05 21:42 06:01	21:42 21:49 05:31	21:49 21:38 05:40	06:19 21:06 06:19	07:04 20:05 07:04	07:49 19:01 07:49	07:39 17:04 07:39	08:21 16:37 08:21	11:17 (WEA 1) 10:48 (WEA 1) 10:48 (WEA 1)
10	08:31 16:57 14	11:25 (WEA 1) 11:14 (WEA 1) 07:55	17:46 18:34 07:01	20:21 21:06 06:55	21:06 21:43 06:00	21:43 21:49 05:30	21:49 21:38 05:41	06:21 21:05 06:21	07:04 20:03 07:04	07:49 18:58 07:49	07:39 17:02 07:39	08:21 16:37 08:21	11:18 (WEA 1) 10:48 (WEA 1) 10:48 (WEA 1)
11	08:31 16:59 8	11:22 (WEA 1) 11:14 (WEA 1) 07:55	17:48 18:34 07:01	20:22 21:08 06:55	21:08 21:43 06:00	21:43 21:49 05:30	21:49 21:38 05:41	06:21 21:03 06:21	07:06 20:01 07:06	07:50 18:56 07:50	07:40 17:01 07:40	08:22 16:37 08:22	11:19 (WEA 1) 10:48 (WEA 1) 10:48 (WEA 1)
12	08:30 17:00	07:53 18:36	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59	08:23 16:37	11:20 (WEA 1)
13	08:30 17:01	07:52 18:37	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	07:43 16:58	08:24 16:37	11:21 (WEA 1)
14	08:29 17:03	07:50 18:39	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57	08:25 16:37	11:22 (WEA 1)
15	08:28 17:04	07:48 18:41	06:52 18:41	06:47 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:55	08:26 16:37	11:23 (WEA 1)
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17	08:27 17:07	07:45 18:44	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:14 19:48	08:00 18:44	07:50 16:53	08:28 16:38	11:24 (WEA 1)
18	08:26 17:09	07:43 18:45	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52	08:28 16:38	11:24 (WEA 1)
19	08:25 17:10	07:41 18:42	06:44 18:42	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:43	08:03 18:40	07:53 16:51	08:29 16:38	11:25 (WEA 1)
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 16:50	08:30 16:38	11:25 (WEA 1)
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:33	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49	08:30 16:39	11:26 (WEA 1)
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:34	07:58 16:48	08:31 16:39	11:26 (WEA 1)
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47	08:31 16:40	11:27 (WEA 1)
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 19:33	08:11 18:31	08:01 16:46	08:32 16:40	11:27 (WEA 1)
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:30	08:13 17:29	08:02 16:45	08:32 16:41	11:28 (WEA 1)
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 19:28	08:14 17:27	08:04 16:44	08:32 16:42	11:28 (WEA 1)
27	08:17 17:23	07:26 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 19:26	08:16 17:25	08:05 16:43	08:33 16:42	11:29 (WEA 1)
28	08:16 17:24	07:24 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	08:17 17:23	08:06 16:42	08:33 16:43	11:29 (WEA 1)
29	08:14 17:26	07:22 18:20	06:20 20:50	06:18 21:31	05:38 21:48	05:32 21:23	06:02 21:23	06:47 20:28	07:32 19:22	08:19 17:22	08:08 16:42	08:33 16:44	11:29 (WEA 1)
30	08:13 17:28	07:20 18:24	06:18 20:51	06:18 21:32	05:37 21:48	05:33 21:22	06:04 21:22	06:48 20:26	07:34 19:20	08:21 17:20	08:09 16:41	08:33 16:45	11:29 (WEA 1)
31	08:12 17:29	07:18 20:05	06:18 21:33	06:18 21:33	05:36 21:33	05:36 21:21	06:05 20:24	06:50 20:24	07:22 17:18	08:09 16:46	08:33 16:46	08:33 16:46	11:29 (WEA 1)
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255	927
astr. max. mögl. Beschattung													0,13
Red. Sonnenscheinwahrsch.													0,93
Reduktion Betriebsdauer													0,56
Reduktion Windrichtung													0,07
Gesamte Reduktion													60
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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-07 - 200, Rue de Niederkorn, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-08 - 36, Rue de l'Industrie, 4991 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember	
1	08:33 16:47 29	10:46 (WEA 1) 17:31 08:09	08:10 18:18 07:20	07:22 20:07 07:14	07:16 20:53 06:14	05:35 21:34 05:35	05:34 21:47 05:34	06:06 21:19 06:08	06:51 20:22 06:53	07:35 19:17 07:37	07:24 17:16 07:26	08:11 16:40 08:12	
2	08:33 16:48 28	10:47 (WEA 1) 17:33 08:08	08:09 18:20 07:18	07:14 20:09 07:12	06:14 20:54 06:13	05:35 21:35 05:35	05:34 21:47 05:35	06:09 21:18 06:09	06:54 20:20 06:54	07:38 19:15 07:38	07:27 17:15 07:27	08:13 16:40 08:13	11 10:53 (WEA 1) 10:40 (WEA 1)
3	08:33 16:49 27	10:48 (WEA 1) 17:34 08:06	08:08 18:21 07:15	07:12 20:10 07:10	06:13 20:56 06:11	05:34 21:36 05:33	05:35 21:47 05:35	06:09 21:16 06:11	06:54 20:18 06:56	07:38 19:13 07:40	07:27 17:13 07:29	08:13 16:39 08:14	15 10:55 (WEA 1) 10:38 (WEA 1)
4	08:33 16:50 26	10:48 (WEA 1) 17:36 08:05	08:06 18:23 07:13	07:10 20:12 07:08	06:11 20:57 06:09	05:33 21:37 05:33	05:35 21:46 05:36	06:12 21:15 06:12	06:56 20:16 06:57	07:41 19:11 07:41	07:30 17:11 07:30	08:16 16:39 08:16	19 10:57 (WEA 1) 10:37 (WEA 1)
5	08:33 16:51 24	10:51 (WEA 1) 17:38 08:03	08:05 18:25 07:11	07:13 20:13 07:05	07:08 20:59 06:08	05:33 21:38 05:32	05:36 21:46 05:37	06:12 21:13 06:13	06:57 20:14 06:58	07:41 19:09 07:43	07:30 17:10 07:32	08:16 16:38 08:17	21 10:58 (WEA 1) 10:37 (WEA 1)
6	08:33 16:52 23	10:51 (WEA 1) 17:40 08:02	08:03 18:26 07:09	07:11 20:15 07:03	07:05 21:00 06:06	05:32 21:39 05:32	05:37 21:46 05:38	06:13 21:11 06:15	06:58 20:12 07:00	07:43 19:07 07:44	07:32 17:08 07:34	08:17 16:38 08:18	23 11:00 (WEA 1) 10:37 (WEA 1)
7	08:33 16:54 21	10:52 (WEA 1) 17:41 08:00	08:02 18:28 07:07	07:03 20:16 07:01	06:06 21:02 06:04	05:32 21:40 05:31	05:38 21:45 05:39	06:15 21:10 06:16	07:00 20:09 07:01	07:44 19:05 07:46	07:34 17:07 07:35	08:18 16:38 08:19	24 11:01 (WEA 1) 10:36 (WEA 1)
8	08:32 16:55 19	10:54 (WEA 1) 17:43 08:00	08:00 18:29 07:05	07:01 20:18 06:59	06:04 21:03 06:03	05:31 21:41 05:31	05:39 21:45 05:40	06:16 21:08 06:18	07:01 20:07 07:03	07:46 19:03 07:47	07:35 17:05 07:37	08:19 16:38 08:20	26 11:02 (WEA 1) 10:36 (WEA 1)
9	08:32 16:56 15	10:56 (WEA 1) 17:45 08:00	08:00 18:31 07:03	07:05 20:19 06:57	06:03 21:05 06:01	05:31 21:41 05:31	05:40 21:44 05:40	06:18 21:06 06:19	07:03 20:05 07:04	07:47 19:01 07:49	07:37 17:04 07:39	08:20 16:37 08:21	27 11:03 (WEA 1) 10:36 (WEA 1)
10	08:31 16:57 11	10:59 (WEA 1) 17:46 08:00	07:57 18:33 07:03	07:03 20:21 06:57	06:01 21:06 06:01	05:31 21:42 05:31	05:40 21:43 05:41	06:19 21:05 06:21	07:04 20:03 07:06	07:49 18:58 07:50	07:39 17:02 07:40	08:21 16:37 08:22	28 11:04 (WEA 1) 10:36 (WEA 1)
11	08:31 16:59 2	11:03 (WEA 1) 17:48 08:00	07:55 18:34 07:01	07:01 20:22 06:55	06:00 21:08 06:00	05:30 21:43 05:30	05:41 21:43 05:41	06:21 21:03 06:22	07:06 20:01 07:07	07:50 18:56 07:52	07:40 17:01 07:42	08:22 16:37 08:23	29 11:05 (WEA 1) 10:36 (WEA 1)
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13	08:30 17:01	11:05 (WEA 1) 17:53 08:00	07:53 18:37 07:03	06:59 20:25 06:57	05:58 21:11 05:57	05:30 21:44 05:30	05:43 21:41 05:44	06:23 21:09 06:25	07:09 19:57 07:10	07:54 18:52 07:55	07:43 16:58 07:45	08:24 16:37 08:25	31 11:07 (WEA 1) 10:36 (WEA 1)
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16	08:28 17:06	11:05 (WEA 1) 17:57 08:00	07:53 18:42 07:03	06:57 20:30 06:55	05:53 21:15 05:53	05:29 21:46 05:29	05:46 21:39 05:48	06:28 21:04 06:29	07:13 19:50 07:15	07:58 18:46 08:00	07:48 16:54 07:50	08:27 16:37 08:28	32 11:09 (WEA 1) 10:38 (WEA 1)
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19	08:25 17:10	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:32 21:02 06:33	07:17 19:43 07:19	08:03 18:40 08:05	07:53 16:51 07:55	08:29 16:38 08:30	33 11:11 (WEA 1) 10:38 (WEA 1)
20	08:24 17:12	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:34 21:02 06:35	07:19 19:41 07:20	08:05 18:38 08:06	07:55 16:50 07:56	08:30 16:39 08:30	33 11:11 (WEA 1) 10:39 (WEA 1)
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22	08:22 17:15	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:36 21:02 06:37	07:22 19:37 07:24	08:08 18:34 08:10	07:58 16:48 07:59	08:31 16:39 08:32	33 11:12 (WEA 1) 10:40 (WEA 1)
23	08:21 17:16	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:38 21:02 06:39	07:23 19:35 07:25	08:09 18:33 08:11	07:59 16:47 08:01	08:31 16:40 08:32	33 11:13 (WEA 1) 10:40 (WEA 1)
24	08:20 17:18	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:39 21:02 06:40	07:25 19:33 07:26	08:11 18:31 08:13	08:01 16:46 08:02	08:32 16:40 08:32	33 11:13 (WEA 1) 10:41 (WEA 1)
25	08:19 17:20	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:41 21:02 06:42	07:26 19:30 07:28	08:13 18:29 08:15	08:02 16:45 08:04	08:32 16:41 08:32	33 11:14 (WEA 1) 10:42 (WEA 1)
26	08:18 17:21	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:42 21:02 06:43	07:28 19:28 07:29	08:15 18:27 08:17	08:04 16:44 08:05	08:32 16:42 08:33	32 11:14 (WEA 1) 10:42 (WEA 1)
27	08:17 17:23	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:44 21:02 06:45	07:29 19:26 07:31	08:17 18:25 08:19	08:05 16:43 08:06	08:33 16:42 08:33	32 11:14 (WEA 1) 10:42 (WEA 1)
28	08:16 17:24	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:45 21:02 06:46	07:31 19:24 07:32	08:19 18:23 08:21	08:06 16:42 08:07	08:33 16:43 08:33	32 11:14 (WEA 1) 10:43 (WEA 1)
29	08:14 17:26	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:47 21:02 06:48	07:32 19:22 07:34	08:19 18:22 08:21	08:08 16:42 08:09	08:33 16:44 08:33	31 11:14 (WEA 1) 10:44 (WEA 1)
30	08:13 17:28	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:48 21:02 06:49	07:34 19:20 07:36	08:21 18:20 08:23	08:09 16:41 08:11	08:33 16:45 08:34	30 11:14 (WEA 1) 10:45 (WEA 1)
31	08:12 17:29	11:05 (WEA 1) 17:58 08:00	07:53 18:44 07:03	06:57 20:32 06:55	05:53 21:16 05:53	05:29 21:46 05:29	05:49 21:37 05:50	06:50 21:02 06:51	07:36 19:26 07:38	08:23 18:18 08:21	08:11 16:46 08:13	08:34 16:46 08:35	30 11:15 (WEA 1) 10:46 (WEA 1)
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255	861
astr. max. mögl. Beschattung													0,15
Red. Sonnenscheinwahrsch.													0,93
Reduktion Betriebsdauer													0,56
Reduktion Windrichtung													0,08
Gesamte Reduktion													17
Met. wahrsch. Beschattung													56

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-09 - 246, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33 16:47 44	10:34 (WEA 1) 11:18 (WEA 1) 17:31	08:10 07:22 18:18	07:16 20:07 20:53	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16		08:11 16:40 36
2	08:33 16:48 43	10:35 (WEA 1) 11:18 (WEA 1) 17:33	08:09 07:20 18:20	07:14 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15		08:12 16:40 38
3	08:33 16:49 42	10:36 (WEA 1) 11:18 (WEA 1) 17:34	08:08 07:18 18:21	07:12 20:09 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13		08:13 16:39 38
4	08:33 16:50 42	10:36 (WEA 1) 11:18 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 21:15 20:16	06:56 20:16 19:11	07:40 19:11 17:11		08:14 16:39 39
5	08:33 16:51 41	10:37 (WEA 1) 11:18 (WEA 1) 17:38	08:05 07:13 18:25	07:08 20:13 20:59	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 21:13 20:14	06:57 20:14 19:09	07:41 19:09 17:10		08:16 16:38 40
6	08:33 16:52 41	10:38 (WEA 1) 11:19 (WEA 1) 17:40	08:03 07:11 18:26	07:05 20:15 21:00	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 21:11 20:12	06:58 20:12 19:07	07:43 19:07 17:08		08:17 16:38 41
7	08:33 16:54 40	10:38 (WEA 1) 11:18 (WEA 1) 17:41	08:02 07:09 18:28	07:03 20:16 21:02	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 21:10 20:09	07:00 20:09 19:05	07:44 19:05 17:07		08:18 16:38 41
8	08:32 16:55 40	10:39 (WEA 1) 11:19 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 21:03	06:04 21:03 21:41	05:31 21:41 21:45	05:39 21:45 21:08	06:16 21:08 20:07	07:01 20:07 19:03	07:46 19:03 17:05		08:19 16:38 42
9	08:32 16:56 38	10:40 (WEA 1) 11:18 (WEA 1) 17:45	07:58 07:05 18:31	06:59 20:19 21:05	06:03 21:05 21:41	05:31 21:41 21:44	05:40 21:44 21:06	06:18 21:06 20:05	07:03 20:05 19:01	07:47 19:01 17:04		08:20 16:37 43
10	08:31 16:57 38	10:41 (WEA 1) 11:19 (WEA 1) 17:46	07:57 07:03 18:33	06:57 20:21 21:06	06:01 21:06 21:42	05:31 21:42 21:43	05:40 21:43 21:05	06:19 21:05 20:03	07:04 20:03 18:58	07:49 18:58 17:02		08:21 16:37 43
11	08:31 16:59 36	10:42 (WEA 1) 11:18 (WEA 1) 17:48	07:55 07:01 18:34	06:55 20:22 21:08	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:21 21:03 20:01	07:06 20:01 18:56	07:50 18:56 17:01		08:22 16:37 44
12	08:30 17:00 34	10:43 (WEA 1) 11:17 (WEA 1) 17:50	07:53 06:59 18:36	06:53 20:24 21:09	05:58 21:09 21:43	05:30 21:43 21:42	05:42 21:42 21:01	06:22 21:01 19:59	07:07 19:59 18:54	07:52 18:54 16:59		08:23 16:37 43
13	08:30 17:01 34	10:44 (WEA 1) 11:18 (WEA 1) 17:51	07:52 06:57 18:37	06:51 20:25 21:11	05:57 21:11 21:44	05:30 21:44 21:41	05:43 21:41 20:59	06:23 20:59 19:57	07:09 19:57 18:52	07:54 18:52 16:58		08:24 16:37 44
14	08:29 17:02 32	10:45 (WEA 1) 11:17 (WEA 1) 17:53	07:50 06:55 18:39	06:49 20:27 21:12	05:55 21:12 21:45	05:30 21:45 21:40	05:44 21:40 20:58	06:25 20:58 19:54	07:10 19:54 18:50	07:55 18:50 16:57		08:25 16:37 45
15	08:28 17:04 30	10:46 (WEA 1) 11:16 (WEA 1) 17:55	07:48 06:53 18:41	06:47 20:29 21:13	05:54 21:13 21:45	05:29 21:45 21:39	05:45 21:39 20:56	06:26 20:56 19:52	07:12 19:52 18:48	07:57 18:48 16:55		08:26 16:37 44
16	08:28 17:06 27	10:48 (WEA 1) 11:15 (WEA 1) 17:57	07:46 06:50 18:42	06:45 20:30 21:15	05:29 21:15 21:46	05:29 21:46 21:39	05:46 21:39 20:54	06:28 20:54 19:50	07:13 19:50 18:46	07:58 18:46 16:54		08:27 16:37 45
17	08:27 17:07 25	10:49 (WEA 1) 11:14 (WEA 1) 17:58	07:45 06:48 18:44	06:43 20:32 21:16	05:29 21:16 21:46	05:29 21:46 21:38	05:48 21:38 20:52	06:29 20:52 19:48	07:15 19:48 18:44	08:00 18:44 16:53		08:28 16:37 45
18	08:26 17:09 22	10:51 (WEA 1) 11:13 (WEA 1) 18:00	07:43 06:46 18:45	06:41 20:33 21:17	05:29 21:17 21:46	05:29 21:46 21:37	05:49 21:37 20:50	06:31 20:50 19:46	07:16 19:46 18:42	08:01 18:42 16:52		08:29 16:38 45
19	08:25 17:10 17	10:54 (WEA 1) 11:11 (WEA 1) 18:02	07:41 06:44 18:47	06:39 20:35 21:19	05:29 21:19 21:47	05:29 21:47 21:36	05:50 21:36 20:48	06:32 20:48 19:43	07:17 19:43 18:40	08:03 18:40 16:51		08:30 16:38 45
20	08:24 17:12 11	10:57 (WEA 1) 11:08 (WEA 1) 18:03	07:39 06:42 18:48	06:37 20:36 21:20	05:29 21:20 21:47	05:29 21:47 21:35	05:51 21:35 20:46	06:34 20:46 19:41	07:19 19:41 18:38	08:05 18:38 16:50		08:30 16:39 46
21	08:23 17:13 11	11:08 (WEA 1) 18:03 07:37	06:40 06:35 18:50	06:35 20:38 21:21	05:29 21:21 21:47	05:30 21:47 21:33	05:52 21:33 20:44	06:35 20:44 19:39	07:20 19:39 18:36	08:06 18:36 16:49		08:30 16:39 45
22	08:22 17:15 11	18:05 07:35 18:07	06:38 06:33 18:52	05:30 20:39 21:23	05:30 21:23 21:48	05:33 21:48 21:32	05:53 21:32 20:42	06:37 20:42 19:37	07:22 19:37 18:34	08:08 18:34 16:48		08:31 16:39 45
23	08:21 17:16 11	18:07 07:33 18:08	06:36 06:31 18:53	05:44 20:41 21:24	05:30 21:24 21:48	05:30 21:48 21:31	05:55 21:31 20:40	06:38 20:40 19:35	07:23 19:35 18:33	08:09 18:33 16:47		08:31 16:40 46
24	08:20 17:18 11	18:08 07:31 18:10	06:33 06:29 18:55	05:43 20:42 21:25	05:30 21:25 21:48	05:30 21:48 21:30	05:56 21:30 20:38	06:39 20:38 19:33	07:25 19:33 18:31	08:11 18:31 16:46		08:32 16:40 45
25	08:19 17:20 11	18:09 07:29 18:12	06:31 06:27 18:56	05:42 20:44 21:26	05:31 21:26 21:48	05:31 21:48 21:29	05:57 21:29 20:36	06:41 20:36 19:30	07:26 19:30 18:29	08:13 18:29 16:45		08:32 16:41 45
26	08:18 17:21 11	18:12 07:28 18:13	06:29 06:25 18:58	05:41 20:45 21:28	05:31 21:28 21:48	05:31 21:48 21:27	05:58 21:27 20:34	06:42 20:34 19:28	07:28 19:28 18:27	08:14 18:27 16:44		08:32 16:42 45
27	08:17 17:23 11	18:13 07:26 18:15	06:27 06:23 18:59	05:40 20:47 21:29	05:31 21:29 21:48	05:31 21:48 21:26	06:00 21:26 20:32	06:44 20:32 19:26	07:29 19:26 18:25	08:15 18:25 16:43		08:33 16:42 45
28	08:16 17:24 11	18:15 07:24 18:16	06:25 06:22 19:01	05:39 20:48 21:30	05:32 21:30 21:48	05:32 21:48 21:25	06:01 21:25 20:30	06:45 20:30 19:24	07:31 19:24 18:23	08:16 18:23 16:42		08:33 16:43 44
29	08:14 17:26 11	18:16 07:22 18:17	06:25 06:20 19:02	05:39 20:50 21:31	05:32 21:31 21:48	05:32 21:48 21:23	06:02 21:23 20:28	06:47 20:28 19:22	07:32 19:22 18:22	08:17 18:22 16:42		08:33 16:44 45
30	08:13 17:28 11	18:17 07:20 18:18	06:20 06:18 19:03	05:37 20:51 21:32	05:33 21:32 21:48	05:33 21:48 21:22	06:04 21:22 20:26	06:48 20:26 19:20	07:34 19:20 18:21	08:19 18:21 16:41		08:33 16:45 44
31	08:12 17:29 11	18:18 07:18 18:19	06:18 20:05 19:04	05:36 21:33 21:49	05:36 21:33 21:49	05:36 21:49 21:21	06:05 21:21 20:24	06:50 20:24 19:21	07:22 19:21 18:18	08:20 18:18 17:18		08:33 16:46 44
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	677											1340
Red.Sonnenscheinwahrsch.	0,15											0,13
Reduktion Betriebsdauer	0,93											0,93
Reduktion Windrichtung	0,56											0,56
Gesamte Reduktion	0,08											0,06
Met.wahrsch.Beschattung	51									18		87

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-10 - 241, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 42	10:27 (WEA 1) 11:09 (WEA 1) 17:31	08:10 07:22 18:18	07:16 20:07 20:53	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 20:22 19:18	06:51 19:18 17:16	07:35 17:16 17:16	07:24 17:16 17:16	08:11 16:40 34
2	08:33 16:48 41	10:28 (WEA 1) 11:09 (WEA 1) 17:33	08:09 07:20 18:20	07:14 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 19:15	06:53 19:15 17:15	07:37 17:15 17:15	07:26 17:15 17:15	08:12 16:40 36
3	08:33 16:49 41	10:29 (WEA 1) 11:10 (WEA 1) 17:34	08:08 07:18 18:21	07:12 20:09 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 19:13	06:54 19:13 17:13	07:38 17:13 17:13	07:27 17:13 17:13	08:13 16:39 37
4	08:33 16:50 40	10:29 (WEA 1) 11:09 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 20:16 19:11	06:56 19:11 17:11	07:40 17:11 17:11	07:29 17:11 17:11	08:14 16:39 38
5	08:33 16:51 40	10:30 (WEA 1) 11:10 (WEA 1) 17:38	08:05 07:13 18:25	07:08 20:13 20:59	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 19:09	06:57 19:09 17:10	07:41 17:10 17:10	07:30 17:10 17:10	08:16 16:38 39
6	08:33 16:52 39	10:31 (WEA 1) 11:10 (WEA 1) 17:40	08:03 07:11 18:26	07:05 20:15 21:00	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 20:12 19:07	06:58 19:07 17:08	07:43 17:08 17:08	07:32 17:08 17:08	08:17 16:38 39
7	08:33 16:54 39	10:31 (WEA 1) 11:10 (WEA 1) 17:41	08:02 07:09 18:28	07:03 20:16 21:02	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 20:09 19:05	07:00 19:05 17:07	07:44 17:07 17:07	07:34 17:07 17:07	08:18 16:38 40
8	08:32 16:55 38	10:32 (WEA 1) 11:10 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 21:03	06:04 21:03 21:41	05:31 21:41 21:45	05:39 21:45 21:08	06:16 20:07 19:03	07:01 19:03 17:05	07:46 17:05 17:05	07:35 17:05 17:05	08:19 16:38 40
9	08:32 16:56 38	10:32 (WEA 1) 11:10 (WEA 1) 17:45	07:58 07:05 18:31	06:59 20:19 21:05	06:03 21:05 21:41	05:31 21:41 21:44	05:40 21:44 21:06	06:18 20:05 19:01	07:03 19:01 17:04	07:47 17:04 17:04	07:37 17:04 17:04	08:20 16:37 41
10	08:31 16:57 36	10:34 (WEA 1) 11:10 (WEA 1) 17:46	07:57 07:03 18:33	06:57 20:21 21:06	06:01 21:06 21:42	05:31 21:42 21:43	05:40 21:43 21:05	06:19 20:03 19:03	07:04 19:03 17:02	07:49 17:02 17:02	07:39 17:02 17:02	08:21 16:37 41
11	08:31 16:59 35	10:34 (WEA 1) 11:09 (WEA 1) 17:48	07:55 07:01 18:34	06:55 20:22 21:08	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:21 20:01 19:01	07:06 18:56 17:01	07:50 17:01 17:01	07:40 17:01 17:01	08:22 16:37 42
12	08:30 17:00 34	10:35 (WEA 1) 11:09 (WEA 1) 17:50	07:53 06:59 18:36	06:53 20:24 21:09	05:58 21:09 21:43	05:30 21:43 21:42	05:42 21:42 21:01	06:22 19:59 18:54	07:07 18:54 16:59	07:52 16:59 16:59	07:42 16:59 16:59	08:23 16:37 43
13	08:30 17:01 32	10:37 (WEA 1) 11:09 (WEA 1) 17:51	07:52 06:57 18:37	06:51 20:25 21:11	05:57 21:11 21:44	05:30 21:44 21:41	05:43 21:41 20:59	06:23 19:57 18:52	07:09 18:52 16:58	07:54 16:58 16:58	07:43 16:58 16:58	08:24 16:37 42
14	08:29 17:02 30	10:38 (WEA 1) 11:08 (WEA 1) 17:53	07:50 06:55 18:39	06:49 20:27 21:12	05:55 21:12 21:45	05:30 21:45 21:40	05:44 21:40 20:58	06:25 19:54 18:50	07:10 18:50 16:57	07:55 16:57 16:57	07:45 16:57 16:57	08:25 16:37 43
15	08:28 17:04 29	10:39 (WEA 1) 11:08 (WEA 1) 17:55	07:48 06:53 18:41	06:47 20:29 21:13	05:54 21:13 21:45	05:29 21:45 21:39	05:45 21:39 20:56	06:26 19:52 18:48	07:12 18:48 16:55	07:57 16:55 16:55	07:47 16:55 16:55	08:26 16:37 43
16	08:28 17:06 27	10:40 (WEA 1) 11:07 (WEA 1) 17:57	07:46 06:50 18:42	06:45 20:30 21:15	05:29 21:15 21:46	05:29 21:46 21:39	05:46 20:54 19:50	06:28 19:50 18:46	07:13 18:46 16:54	07:58 16:54 16:54	07:48 16:54 16:54	08:27 16:37 43
17	08:27 17:07 23	10:42 (WEA 1) 11:05 (WEA 1) 17:58	07:45 06:48 18:44	06:43 20:32 21:16	05:29 21:16 21:46	05:29 21:46 21:38	05:48 20:52 19:48	06:29 19:48 18:44	07:15 18:44 16:53	08:00 16:53 16:53	07:50 16:53 16:53	08:28 16:38 43
18	08:26 17:09 20	10:44 (WEA 1) 11:04 (WEA 1) 18:00	07:43 06:46 18:45	06:41 20:33 21:17	05:29 21:17 21:46	05:29 21:46 21:37	05:49 20:50 19:46	06:31 19:46 18:42	07:16 18:42 16:52	08:01 16:52 16:52	07:51 16:52 16:52	08:29 16:38 43
19	08:25 17:10 16	10:46 (WEA 1) 11:02 (WEA 1) 18:02	07:41 06:44 18:47	06:39 20:35 21:19	05:29 21:19 21:47	05:29 21:47 21:36	05:50 20:48 19:44	06:32 19:44 18:40	07:17 18:40 16:51	08:03 16:51 16:51	07:53 16:51 16:51	08:30 16:38 44
20	08:24 17:12 9	10:50 (WEA 1) 10:59 (WEA 1) 18:03	07:39 06:42 18:48	06:37 20:36 21:20	05:29 21:20 21:47	05:29 21:47 21:35	05:51 20:46 19:41	06:34 19:41 18:38	07:19 18:38 16:50	08:05 16:50 16:50	07:55 16:50 16:50	08:30 16:39 44
21	08:23 17:13	10:59 (WEA 1) 18:05	07:37 06:40 18:50	06:35 20:38 21:21	05:29 21:21 21:47	05:30 21:47 21:33	05:52 20:44 19:39	06:35 19:39 18:36	07:20 18:36 16:49	08:06 16:49 16:49	07:56 16:49 16:49	08:30 16:39 44
22	08:22 17:15	18:05 18:07	07:35 06:38 18:52	06:33 20:39 21:23	05:29 21:23 21:48	05:30 21:48 21:32	05:53 20:42 19:37	06:37 19:37 18:34	07:22 18:34 16:48	08:08 16:48 16:48	07:58 16:48 16:48	10:26 (WEA 1) 10:35 (WEA 1) 16:39
23	08:21 17:16	18:07 18:08	07:33 06:35 18:53	06:31 20:41 21:24	05:29 21:24 21:48	05:30 21:48 21:31	05:55 20:40 19:35	06:38 19:35 18:33	07:23 18:33 16:47	08:09 16:47 16:47	07:59 16:47 16:47	9 10:35 (WEA 1) 16:40
24	08:20 17:18	18:08 18:10	07:33 06:33 18:55	06:31 20:42 21:25	05:29 21:25 21:48	05:30 21:48 21:30	05:56 20:38 19:33	06:39 19:33 18:31	07:25 18:31 16:46	08:11 16:46 16:46	08:01 16:46 16:46	16 10:42 (WEA 1) 16:40
25	08:19 17:20	18:10 18:12	07:29 06:31 18:56	06:27 20:44 21:26	05:27 21:26 21:48	05:31 21:48 21:29	05:57 20:36 19:30	06:41 19:30 17:29	07:26 17:29 16:45	08:13 16:45 16:45	08:02 16:45 16:45	20 10:44 (WEA 1) 16:41
26	08:18 17:21	18:12 18:13	07:28 06:29 18:58	06:25 20:45 21:28	05:27 21:28 21:48	05:31 21:48 21:27	05:58 20:34 19:28	06:42 19:28 17:27	07:28 17:27 16:44	08:14 16:44 16:44	08:04 16:44 16:44	23 10:46 (WEA 1) 16:42
27	08:17 17:23	18:13 18:15	07:26 06:27 18:59	06:23 20:47 21:29	05:26 21:29 21:48	05:31 21:48 21:26	06:00 20:32 19:26	06:44 19:26 17:25	07:29 17:25 16:43	08:05 16:43 16:43	08:05 16:43 16:43	26 10:48 (WEA 1) 16:42
28	08:16 17:24	18:15 18:16	07:24 06:25 19:01	06:22 20:48 21:30	05:25 21:30 21:48	05:32 21:48 21:25	06:01 20:30 19:24	06:45 19:24 17:23	07:31 17:23 16:42	08:06 16:42 16:42	08:06 16:42 16:42	29 10:48 (WEA 1) 16:43
29	08:14 17:26	18:16 18:17	07:22 06:20 19:02	06:20 20:50 21:31	05:24 21:31 21:48	05:32 21:48 21:23	06:02 20:28 19:22	06:47 19:22 17:22	07:32 17:22 16:42	08:08 16:42 16:42	08:08 16:42 16:42	30 10:49 (WEA 1) 16:44
30	08:13 17:28	18:17 18:18	07:20 06:18 19:04	06:18 20:51 21:32	05:23 21:32 21:48	05:33 21:48 21:22	06:04 20:26 19:20	06:48 19:20 17:20	07:34 17:20 16:41	08:09 16:41 16:41	08:09 16:41 16:41	32 10:51 (WEA 1) 16:45
31	08:12 17:29	18:18 18:19	07:18 06:15 19:05	06:15 20:53 21:33	05:22 21:33 21:48	05:34 21:48 21:21	06:05 20:24 19:18	06:50 19:18 17:18	07:22 17:18 16:40	08:10 16:40 16:40	08:10 16:40 16:40	34 10:51 (WEA 1) 16:45
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	649											1292
Red.Sonnenscheinwahrsch.	0,15											0,13
Reduktion Betriebsdauer	0,93											0,93
Reduktion Windrichtung	0,55											0,55
Gesamte Reduktion	0,07											0,06
Met.wahrsch.Beschattung	49									17		83

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-11 - 236, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember	
1	08:33 16:47 46	10:18 (WEA 1) 11:04 (WEA 1) 17:31	08:10 17:31 18:18	07:22 20:07 20:53	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:18	07:35 19:18 17:16		08:11 16:40 41	10:07 (WEA 1) 10:48 (WEA 1)
2	08:33 16:48 46	10:19 (WEA 1) 11:05 (WEA 1) 17:33	08:09 17:33 18:20	07:20 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15		08:12 16:40 43	10:07 (WEA 1) 10:50 (WEA 1)
3	08:33 16:49 45	10:20 (WEA 1) 11:05 (WEA 1) 17:34	08:08 17:34 18:21	07:18 20:09 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13		08:13 16:39 43	10:07 (WEA 1) 10:50 (WEA 1)
4	08:33 16:50 45	10:20 (WEA 1) 11:05 (WEA 1) 17:36	08:06 17:36 18:23	07:15 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 21:15 20:16	06:56 20:16 19:11	07:40 19:11 17:11		08:14 16:39 43	10:07 (WEA 1) 10:50 (WEA 1)
5	08:33 16:51 45	10:20 (WEA 1) 11:05 (WEA 1) 17:38	08:05 17:38 18:25	07:13 20:13 20:59	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 21:13 20:14	06:57 20:14 19:09	07:41 19:09 17:10		08:16 16:38 44	10:07 (WEA 1) 10:50 (WEA 1)
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18	08:26 17:09 33	10:31 (WEA 1) 11:04 (WEA 1) 18:00	07:43 18:00 18:45	06:46 20:33 21:17	06:41 21:17 21:46	05:50 21:46 21:37	05:29 21:37 20:50	06:31 20:50 19:46	07:16 19:46 18:42	08:01 18:42 16:52	13	08:28 16:38 47	10:11 (WEA 1) 10:58 (WEA 1)
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Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255	1418
astr.max.mögl.Beschattung		888									400		0,13
Red.Sonnenscheinwahrsch.		0,15									0,15		0,13
Reduktion Betriebsdauer		0,93									0,93		0,93
Reduktion Windrichtung		0,55									0,55		0,55
Gesamte Reduktion		0,07									0,08		0,06
Met.wahrsch.Beschattung		66									31		91

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-12 - 239, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 44	10:14 (WEA 1) 10:58 (WEA 1) 17:31	08:10 07:22 18:18	07:16 20:07 20:53	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:18	07:35 19:18 17:16		08:11 16:40 40
2	08:33 16:48 44	10:14 (WEA 1) 10:58 (WEA 1) 17:33	08:09 07:20 18:20	07:14 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15		08:12 16:40 40
3	08:33 16:49 44	10:15 (WEA 1) 10:59 (WEA 1) 17:34	08:08 07:18 18:21	07:12 20:09 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13		08:13 16:39 41
4	08:33 16:50 43	10:15 (WEA 1) 10:58 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 21:15 20:16	06:56 20:16 19:11	07:40 19:11 17:11		08:14 16:39 42
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6	08:33 16:52 42	10:17 (WEA 1) 10:59 (WEA 1) 17:40	08:03 07:11 18:26	07:05 20:15 21:00	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 21:11 20:12	06:58 20:12 19:07	07:43 19:07 17:08		08:17 16:38 43
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11	08:31 16:59 40	10:20 (WEA 1) 11:00 (WEA 1) 17:48	07:55 07:01 18:34	06:55 20:22 21:08	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:21 21:03 20:01	07:06 20:01 18:56	07:50 18:56 17:01		08:22 16:37 44
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29	08:14 17:26		06:22 20:02 20:50	06:19 21:31 21:48	05:37 21:48 21:23	05:32 21:48 21:23	06:02 21:23 20:28	06:47 20:28 19:22	07:32 19:22 17:22	08:18 17:22 16:42	37	08:33 16:44 44
30	08:13 17:28		06:20 20:04 20:51	06:18 21:32 21:48	05:37 21:48 21:22	05:33 21:48 21:22	06:04 21:22 20:26	06:48 20:26 19:20	07:34 19:20 17:20	08:19 17:20 16:41	38	08:33 16:45 45
31	08:12 17:29		06:18 20:05	06:16 21:33	05:36 21:33	06:05 21:21	06:50 20:24	07:22 17:18	08:09 17:18	10:41 (WEA 1)	39	08:33 16:46 44
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	836										370	1362
Red.Sonnenscheinwahrsch.	0,15										0,15	0,13
Reduktion Betriebsdauer	0,93										0,93	0,93
Reduktion Windrichtung	0,55										0,55	0,55
Gesamte Reduktion	0,07										0,08	0,06
Met.wahrsch.Beschattung	62										28	87

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-13 - 228, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember	
1	08:33 16:47 47	10:08 (WEA 1) 10:55 (WEA 1) 17:31	08:10 18:18 17:31	07:22 20:07 18:18	06:16 20:53 16:14	05:36 21:34 05:35	05:34 21:47 05:34	06:06 21:19 06:08	06:51 20:22 06:53	07:35 19:18 07:37	07:24 17:16 07:26		
2	08:33 16:48 46	10:09 (WEA 1) 10:56 (WEA 1) 17:33	08:09 18:20 17:33	07:20 20:09 18:23	06:14 20:54 16:13	05:35 21:35 05:34	05:34 21:47 05:35	06:09 21:18 06:09	06:54 20:20 06:54	07:38 19:15 07:38	07:27 17:15 07:27		
3	08:33 16:49 47	10:09 (WEA 1) 10:56 (WEA 1) 17:34	08:08 18:21 17:34	07:18 20:10 18:21	06:13 20:56 16:11	05:34 21:36 05:33	05:34 21:47 05:35	06:09 21:16 06:11	06:54 20:18 06:56	07:38 19:13 07:40	07:27 17:13 07:29		
4	08:33 16:50 46	10:09 (WEA 1) 10:56 (WEA 1) 17:34	08:06 18:23 17:36	07:15 20:12 18:23	06:11 20:57 16:11	05:33 21:37 05:33	05:35 21:46 05:35	06:11 21:15 06:11	06:56 20:16 06:56	07:40 19:11 07:40	07:29 17:11 07:30		
5	08:33 16:51 46	10:10 (WEA 1) 10:57 (WEA 1) 17:38	08:05 18:25 17:38	07:13 20:13 18:25	06:09 20:59 16:11	05:33 21:38 05:33	05:36 21:46 05:36	06:12 21:13 06:12	06:57 20:14 06:57	07:41 19:09 07:41	07:30 17:10 07:30		
6	08:33 16:52 46	10:11 (WEA 1) 10:58 (WEA 1) 17:40	08:03 18:26 17:40	07:11 20:15 18:26	06:08 21:00 16:11	05:32 21:39 05:32	05:37 21:46 05:38	06:13 21:11 06:15	06:58 20:12 07:00	07:43 19:07 07:44	07:32 17:08 07:34		
7	08:33 16:54 45	10:11 (WEA 1) 10:58 (WEA 1) 17:41	08:02 18:28 17:41	07:09 20:16 18:28	06:06 21:02 16:11	05:32 21:40 05:31	05:38 21:45 05:39	06:15 21:10 06:16	07:00 20:09 07:01	07:44 19:05 07:46	07:34 17:07 07:35		
8	08:32 16:55 45	10:12 (WEA 1) 10:57 (WEA 1) 17:43	08:00 18:29 17:43	07:07 20:18 18:29	06:04 21:03 16:11	05:31 21:41 05:31	05:39 21:45 05:40	06:16 21:08 06:18	07:01 20:07 07:03	07:46 19:03 07:47	07:35 17:05 07:37		
9	08:32 16:56 45	10:12 (WEA 1) 10:57 (WEA 1) 17:45	07:58 18:31 17:45	07:05 20:19 18:31	06:03 21:05 16:11	05:31 21:41 05:31	05:40 21:44 05:41	06:18 21:06 06:20	07:03 20:05 07:05	07:47 19:01 07:48	07:37 17:04 07:39		
10	08:31 16:57 45	10:13 (WEA 1) 10:58 (WEA 1) 17:46	07:57 18:33 17:46	07:03 20:21 18:33	06:01 21:06 16:11	05:31 21:42 05:31	05:40 21:43 05:41	06:19 21:05 06:21	07:04 20:03 07:06	07:49 18:58 07:50	07:39 17:02 07:40		
11	08:31 16:59 44	10:13 (WEA 1) 10:58 (WEA 1) 17:48	07:55 18:34 17:48	07:01 20:22 18:34	06:00 21:08 16:11	05:30 21:43 05:30	05:41 21:43 05:42	06:21 21:03 06:22	07:06 20:01 07:07	07:50 18:56 07:52	07:40 17:01 07:42		
12	08:30 17:00 43	10:14 (WEA 1) 10:59 (WEA 1) 17:50	07:53 18:36 17:50	06:59 20:24 18:36	05:58 21:09 16:11	05:30 21:43 05:30	05:42 21:42 05:43	06:22 21:01 06:23	07:07 19:59 07:09	07:52 18:54 07:54	07:42 16:59 07:43		
13	08:30 17:01 43	10:15 (WEA 1) 10:58 (WEA 1) 17:51	07:52 18:37 17:51	06:57 20:25 18:37	05:57 21:11 16:11	05:30 21:44 05:30	05:43 21:41 05:44	06:23 20:59 06:25	07:09 19:57 07:10	07:54 18:52 07:55	07:43 16:58 07:45		
14	08:29 17:03 42	10:16 (WEA 1) 10:59 (WEA 1) 17:53	07:50 18:39 17:53	06:55 20:27 18:39	05:55 21:12 16:11	05:30 21:45 05:30	05:44 21:40 05:45	06:25 20:58 06:26	07:10 19:54 07:12	07:55 18:50 07:57	07:45 16:57 07:47		
15	08:28 17:04 41	10:16 (WEA 1) 10:57 (WEA 1) 17:55	07:48 18:41 17:55	06:47 20:29 18:41	05:54 21:13 16:11	05:29 21:45 05:29	05:45 21:39 05:46	06:26 20:56 06:28	07:12 19:52 07:13	07:57 18:48 07:58	07:47 16:55 07:48		
16	08:28 17:06 40	10:17 (WEA 1) 10:57 (WEA 1) 17:57	07:46 18:42 17:57	06:50 20:30 18:42	05:53 21:15 16:11	05:29 21:46 05:29	05:46 21:39 05:48	06:28 20:54 06:29	07:13 19:50 07:15	07:58 18:46 08:00	07:48 16:54 07:50		
17	08:27 17:07 40	10:17 (WEA 1) 10:57 (WEA 1) 17:58	07:45 18:44 17:58	06:48 20:32 18:44	05:51 21:16 16:11	05:29 21:46 05:29	05:48 21:38 05:49	06:29 20:52 06:31	07:15 19:48 07:16	08:00 18:44 08:01	07:50 16:53 07:51		
18	08:26 17:09 39	10:18 (WEA 1) 10:57 (WEA 1) 18:00	07:43 18:45 18:00	06:46 20:33 18:45	05:50 21:17 16:11	05:29 21:46 05:29	05:49 21:37 05:50	06:31 20:50 06:32	07:16 19:46 07:17	08:01 18:42 08:03	07:51 16:52 07:53		
19	08:25 17:10 37	10:19 (WEA 1) 10:56 (WEA 1) 18:02	07:41 18:47 18:02	06:44 20:35 18:47	05:49 21:19 16:11	05:29 21:47 05:29	05:50 21:36 05:51	06:32 20:48 06:34	07:17 19:44 07:19	08:03 18:40 08:05	07:53 16:51 07:55		
20	08:24 17:12 36	10:20 (WEA 1) 10:56 (WEA 1) 18:03	07:39 18:48 18:03	06:42 20:36 18:48	05:47 21:20 16:11	05:29 21:47 05:30	05:51 21:35 05:52	06:34 20:46 06:35	07:19 19:41 07:20	08:05 18:38 08:06	07:55 16:50 07:56		
21	08:23 17:13 33	10:22 (WEA 1) 10:55 (WEA 1) 18:05	07:37 18:50 18:05	06:40 20:38 18:50	05:46 21:21 16:11	05:30 21:47 05:30	05:52 21:33 05:53	06:35 20:44 06:37	07:20 19:39 07:22	08:06 18:36 08:08	07:56 16:49 07:58		
22	08:22 17:15 32	10:23 (WEA 1) 10:55 (WEA 1) 18:07	07:35 18:52 18:07	06:38 20:39 18:52	05:45 21:23 16:11	05:30 21:48 05:30	05:53 21:32 05:55	06:37 20:42 06:38	07:22 19:37 07:23	08:08 18:34 08:09	07:58 16:48 07:59		
23	08:21 17:16 29	10:25 (WEA 1) 10:54 (WEA 1) 18:08	07:33 18:53 18:08	06:35 20:41 18:53	05:44 21:24 16:11	05:30 21:48 05:30	05:55 21:31 05:56	06:38 20:40 06:39	07:23 19:35 07:25	08:09 18:33 08:11	07:59 16:47 08:01		
24	08:20 17:18 26	10:27 (WEA 1) 10:53 (WEA 1) 18:10	07:31 18:55 18:10	06:33 20:42 18:55	05:43 21:25 16:11	05:30 21:48 05:30	05:56 21:30 05:57	06:39 20:38 06:41	07:25 19:33 07:26	08:11 18:31 08:13	08:01 16:46 08:02		
25	08:19 17:20 22	10:28 (WEA 1) 10:50 (WEA 1) 18:12	07:29 18:56 18:12	06:31 20:44 18:56	05:42 21:26 16:11	05:31 21:48 05:31	05:57 21:29 05:58	06:41 20:36 06:42	07:26 19:30 07:28	08:13 18:29 08:14	08:02 16:45 08:04		
26	08:18 17:21 19	10:30 (WEA 1) 10:49 (WEA 1) 18:13	07:28 18:58 18:13	06:29 20:45 18:58	05:41 21:28 16:11	05:31 21:48 05:31	05:58 21:27 06:00	06:42 20:34 06:44	07:28 19:28 07:29	08:14 18:27 08:16	08:04 16:44 08:05		
27	08:17 17:23 12	10:34 (WEA 1) 10:46 (WEA 1) 18:15	07:26 18:15 18:15	06:27 18:59 18:15	05:40 21:29 16:11	05:31 21:48 05:31	06:00 21:26 06:01	06:44 20:32 06:45	07:29 19:26 07:31	08:16 18:25 08:17	08:05 16:43 08:06		
28	08:16 17:24 12		07:24 18:16 18:16	06:25 20:28 18:16	05:39 21:30 16:11	05:32 21:48 05:32	06:01 21:25 06:02	06:45 20:30 06:47	07:31 19:24 07:32	08:17 18:23 08:19	08:06 16:42 08:08		
29	08:14 17:26 12		07:22 20:02 18:14	06:20 20:50 18:14	05:38 21:31 16:11	05:32 21:48 05:33	06:02 21:23 06:04	06:47 20:28 06:48	07:32 19:22 07:34	08:19 18:22 08:21	08:08 16:42 08:09		
30	08:13 17:28 12		07:20 20:04 18:13	06:18 20:51 18:13	05:37 21:32 16:11	05:33 21:48 05:33	06:04 21:22 06:06	06:48 20:26 06:50	07:34 19:20 07:36	08:21 18:20 08:22	08:09 16:41 08:10		
31	08:12 17:29 12		07:18 20:05 18:12	06:16 20:25 18:12	05:36 21:33 16:11	05:36 21:48 05:36	06:05 21:21 06:06	06:50 20:24 06:51	07:22 18:18 07:24				
Sonnenscheinstunden	269		283	368	412	475	486	491	447	379	335	275	
astr.max.mögl.Beschattung		1036											1441
Red.Sonnenscheinwahrsch.		0,15											0,13
Reduktion Betriebsdauer		0,93											0,93
Reduktion Windrichtung		0,55											0,55
Gesamte Reduktion		0,07											0,06
Met.wahrsch.Beschattung		77										41	92

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-14 - 216, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:33 16:47 46	09:56 (WEA 1) 10:42 (WEA 1) 17:31	08:10 18:18 20:07	07:22 18:18 20:07	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 20:22 21:19	06:51 20:22 21:19	07:35 19:18 17:16		08:11 16:40 46	09:42 (WEA 1) 10:28 (WEA 1) 10:43 (WEA 1)
2	08:33 16:48 47	09:56 (WEA 1) 10:43 (WEA 1) 17:33	08:09 18:20 20:09	07:20 18:20 20:09	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 21:15	06:53 20:20 21:15	07:37 19:15 17:15		08:12 16:40 46	09:43 (WEA 1) 10:29 (WEA 1) 10:43 (WEA 1)
3	08:33 16:49 46	09:57 (WEA 1) 10:43 (WEA 1) 17:34	08:08 18:21 20:10	07:18 18:21 20:10	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 21:13	06:54 20:18 21:13	07:38 19:13 17:13		08:13 16:39 46	09:43 (WEA 1) 10:29 (WEA 1) 10:43 (WEA 1)
4	08:33 16:50 46	09:57 (WEA 1) 10:43 (WEA 1) 17:36	08:06 18:23 20:12	07:16 18:23 20:12	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 20:16 21:11	06:56 20:16 21:11	07:40 19:11 17:11		08:14 16:39 46	09:43 (WEA 1) 10:29 (WEA 1) 10:43 (WEA 1)
5	08:33 16:51 46	09:58 (WEA 1) 10:44 (WEA 1) 17:38	08:05 18:25 20:13	07:13 18:25 20:13	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 21:09	06:57 20:14 21:09	07:41 19:09 17:10		08:16 16:38 46	09:43 (WEA 1) 10:29 (WEA 1) 10:43 (WEA 1)
6	08:33 16:52 46	09:58 (WEA 1) 10:44 (WEA 1) 17:40	08:03 18:26 20:15	07:11 18:26 20:15	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 20:12 21:07	06:58 20:12 21:07	07:43 19:07 17:08		08:17 16:38 47	09:44 (WEA 1) 10:31 (WEA 1) 10:43 (WEA 1)
7	08:33 16:54 46	09:58 (WEA 1) 10:44 (WEA 1) 17:41	08:02 18:28 20:16	07:09 18:28 20:16	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 20:09 21:05	07:00 21:05 21:05	07:44 19:05 17:07		08:18 16:38 46	09:45 (WEA 1) 10:31 (WEA 1) 10:43 (WEA 1)
8	08:32 16:55 46	09:59 (WEA 1) 10:45 (WEA 1) 17:43	08:00 18:29 20:18	07:07 18:29 20:18	06:04 21:03 21:41	05:31 21:41 21:45	05:39 21:45 21:10	06:16 21:08 21:07	07:01 21:07 21:07	07:46 19:03 17:05		08:19 16:38 46	09:45 (WEA 1) 10:31 (WEA 1) 10:43 (WEA 1)
9	08:32 16:56 46	09:59 (WEA 1) 10:45 (WEA 1) 17:45	07:58 18:31 20:19	07:05 18:31 20:19	06:03 21:05 21:41	05:31 21:41 21:45	05:40 21:44 21:10	06:18 21:06 21:05	07:03 21:05 21:05	07:47 19:01 17:04		08:20 16:37 46	09:45 (WEA 1) 10:31 (WEA 1) 10:43 (WEA 1)
10	08:31 16:57 46	10:00 (WEA 1) 10:46 (WEA 1) 17:46	07:57 18:33 20:21	07:03 18:33 20:21	06:01 21:06 21:42	05:31 21:42 21:43	05:40 21:43 21:15	06:19 21:05 21:05	07:04 21:05 21:05	07:49 18:58 17:02		08:21 16:37 46	09:46 (WEA 1) 10:32 (WEA 1) 10:43 (WEA 1)
11	08:31 16:59 46	10:00 (WEA 1) 10:46 (WEA 1) 17:48	07:55 18:34 20:22	07:01 18:34 20:22	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:15	06:21 21:03 21:03	07:06 21:03 21:03	07:50 18:56 17:01	4	09:58 (WEA 1) 10:02 (WEA 1) 16:37	09:46 (WEA 1) 10:32 (WEA 1) 10:43 (WEA 1)
12	08:30 17:00 46	10:00 (WEA 1) 10:46 (WEA 1) 17:50	07:53 18:36 20:24	06:59 18:36 20:24	05:58 21:09 21:43	05:30 21:43 21:43	05:42 21:42 21:15	06:22 21:01 21:01	07:07 19:59 18:54	07:52 16:59 15	15	09:52 (WEA 1) 10:07 (WEA 1) 16:37	09:46 (WEA 1) 10:32 (WEA 1) 10:43 (WEA 1)
13	08:30 17:01 45	10:02 (WEA 1) 10:47 (WEA 1) 17:51	07:52 18:37 20:25	06:57 18:37 20:25	05:57 21:11 21:44	05:30 21:44 21:41	05:43 21:41 21:15	06:23 20:59 19:57	07:09 18:52 16:58	07:54 16:58 21	21	09:49 (WEA 1) 10:10 (WEA 1) 16:37	09:47 (WEA 1) 10:33 (WEA 1) 10:43 (WEA 1)
14	08:29 17:03 45	10:02 (WEA 1) 10:47 (WEA 1) 17:53	07:50 18:39 20:27	06:55 18:39 20:27	05:55 21:12 21:45	05:30 21:45 21:40	05:44 21:40 21:15	06:25 20:58 19:54	07:10 18:50 16:57	07:45 16:57 25	25	09:48 (WEA 1) 10:13 (WEA 1) 16:37	09:48 (WEA 1) 10:33 (WEA 1) 10:43 (WEA 1)
15	08:28 17:04 45	10:02 (WEA 1) 10:47 (WEA 1) 17:55	07:48 18:41 20:29	06:53 18:41 20:29	05:54 21:13 21:45	05:29 21:45 21:39	05:45 21:39 21:15	06:26 20:56 19:52	07:12 18:48 16:55	07:47 16:55 28	28	09:47 (WEA 1) 10:15 (WEA 1) 16:37	09:48 (WEA 1) 10:34 (WEA 1) 10:43 (WEA 1)
16	08:28 17:06 43	10:03 (WEA 1) 10:46 (WEA 1) 17:57	07:46 18:42 20:30	06:50 18:42 20:30	05:53 21:15 21:46	05:29 21:46 21:39	05:46 21:39 21:15	06:28 20:54 19:50	07:13 18:46 16:54	07:48 16:54 31	31	09:45 (WEA 1) 10:16 (WEA 1) 16:37	09:49 (WEA 1) 10:35 (WEA 1) 10:43 (WEA 1)
17	08:27 17:07 43	10:03 (WEA 1) 10:46 (WEA 1) 17:58	07:45 18:44 20:32	06:48 18:44 20:32	05:51 21:16 21:46	05:29 21:46 21:37	05:48 21:37 21:15	06:29 20:52 19:48	07:15 18:44 16:53	07:50 16:53 33	33	09:44 (WEA 1) 10:17 (WEA 1) 16:38	09:50 (WEA 1) 10:35 (WEA 1) 10:43 (WEA 1)
18	08:26 17:09 42	10:04 (WEA 1) 10:46 (WEA 1) 18:00	07:43 18:45 20:33	06:46 18:45 20:33	05:50 21:17 21:46	05:29 21:46 21:37	05:49 21:37 21:15	06:31 20:50 19:46	07:16 18:42 16:52	08:01 16:52 35	35	09:44 (WEA 1) 10:19 (WEA 1) 16:38	09:49 (WEA 1) 10:35 (WEA 1) 10:43 (WEA 1)
19	08:25 17:10 41	10:05 (WEA 1) 10:46 (WEA 1) 18:02	07:41 18:47 20:35	06:44 18:47 20:35	05:49 21:19 21:47	05:29 21:47 21:36	05:50 21:36 21:15	06:32 20:48 19:44	07:17 18:40 16:51	08:03 16:51 36	36	09:43 (WEA 1) 10:19 (WEA 1) 16:38	09:50 (WEA 1) 10:36 (WEA 1) 10:43 (WEA 1)
20	08:24 17:12 40	10:06 (WEA 1) 10:46 (WEA 1) 18:03	07:39 18:48 20:36	06:42 18:48 20:36	05:47 21:20 21:47	05:29 21:47 21:35	05:51 21:35 21:15	06:34 20:46 19:41	07:19 18:38 16:50	08:05 16:50 38	38	09:43 (WEA 1) 10:21 (WEA 1) 16:39	09:50 (WEA 1) 10:36 (WEA 1) 10:43 (WEA 1)
21	08:23 17:13 39	10:07 (WEA 1) 10:46 (WEA 1) 18:05	07:37 18:50 20:38	06:40 18:50 20:38	05:46 21:21 21:47	05:30 21:47 21:33	05:52 21:33 21:15	06:35 20:44 19:39	07:20 18:36 16:49	08:06 16:49 39	39	09:43 (WEA 1) 10:22 (WEA 1) 16:39	09:51 (WEA 1) 10:37 (WEA 1) 10:43 (WEA 1)
22	08:22 17:15 38	10:08 (WEA 1) 10:46 (WEA 1) 18:07	07:35 18:52 20:39	06:38 18:52 20:39	05:45 21:23 21:48	05:30 21:48 21:32	05:53 21:32 21:15	06:37 20:42 19:37	07:22 18:34 16:48	08:08 16:48 40	40	09:42 (WEA 1) 10:22 (WEA 1) 16:39	09:51 (WEA 1) 10:37 (WEA 1) 10:43 (WEA 1)
23	08:21 17:16 36	10:09 (WEA 1) 10:46 (WEA 1) 18:08	07:33 18:53 20:41	06:35 18:53 20:41	05:44 21:24 21:48	05:30 21:48 21:31	05:55 21:31 21:15	06:38 20:40 19:35	07:23 18:33 16:47	08:09 16:47 41	41	09:42 (WEA 1) 10:23 (WEA 1) 16:40	09:52 (WEA 1) 10:38 (WEA 1) 10:43 (WEA 1)
24	08:20 17:18 35	10:10 (WEA 1) 10:46 (WEA 1) 18:10	07:31 18:55 20:42	06:33 18:55 20:42	05:43 21:25 21:48	05:30 21:48 21:30	05:56 21:30 21:15	06:39 20:38 19:33	07:25 18:31 16:46	08:11 16:46 42	42	09:42 (WEA 1) 10:24 (WEA 1) 16:41	09:52 (WEA 1) 10:38 (WEA 1) 10:43 (WEA 1)
25	08:19 17:20 33	10:10 (WEA 1) 10:43 (WEA 1) 18:12	07:29 18:56 20:44	06:31 18:56 20:44	05:42 21:26 21:48	05:31 21:48 21:30	05:57 21:30 21:15	06:41 20:36 19:30	07:26 17:29 16:45	08:13 16:45 42	42	09:42 (WEA 1) 10:24 (WEA 1) 16:41	09:53 (WEA 1) 10:39 (WEA 1) 10:43 (WEA 1)
26	08:18 17:21 31	10:12 (WEA 1) 10:43 (WEA 1) 18:13	07:28 18:58 20:45	06:29 18:58 20:45	05:41 21:28 21:48	05:31 21:48 21:30	05:58 21:27 21:15	06:42 20:34 19:28	07:28 17:27 16:44	08:14 16:44 43	43	09:42 (WEA 1) 10:25 (WEA 1) 16:42	09:54 (WEA 1) 10:39 (WEA 1) 10:43 (WEA 1)
27	08:17 17:23 28	10:14 (WEA 1) 10:42 (WEA 1) 18:15	07:26 18:59 20:47	06:27 18:59 20:47	05:40 21:29 21:48	05:31 21:48 21:30	06:00 21:26 21:15	06:44 20:32 19:26	07:29 17:25 16:43	08:05 16:43 44	44	09:42 (WEA 1) 10:26 (WEA 1) 16:43	09:54 (WEA 1) 10:39 (WEA 1) 10:43 (WEA 1)
28	08:16 17:24 25	10:16 (WEA 1) 10:41 (WEA 1) 18:16	07:24 18:56 20:48	06:25 18:56 20:48	05:39 21:30 21:48	05:32 21:48 21:30	06:01 21:25 21:15	06:45 20:30 19:24	07:31 17:23 16:42	08:06 16:42 45	45	09:42 (WEA 1) 10:27 (WEA 1) 16:43	09:54 (WEA 1) 10:40 (WEA 1) 10:43 (WEA 1)
29	08:14 17:26 20	10:18 (WEA 1) 10:41 (WEA 1) 18:17	07:22 18:58 20:50	06:22 18:58 20:50	05:37 21:31 21:48	05:32 21:48 21:30	06:02 21:23 21:15	06:47 20:28 19:22	07:32 17:22 16:42	08:08 16:42 45	45	09:42 (WEA 1) 10:27 (WEA 1) 16:44	09:54 (WEA 1) 10:40 (WEA 1) 10:43 (WEA 1)
30	08:13 17:28 15	10:21 (WEA 1) 10:36 (WEA 1) 18:18	07:20 18:58 20:51	06:18 18:58 20:51	05:37 21:32 21:48	05:33 21:48 21:30	06:04 21:22 21:15	06:48 20:26 19:20	07:34 17:20 16:41	08:09 16:41 45	45	09:43 (WEA 1) 10:28 (WEA 1) 16:45	09:55 (WEA 1) 10:41 (WEA 1) 10:43 (WEA 1)
31	08:12 17:29		07:18 20:05	06:18 20:05	05:36 21:33	05:36 21:33	06:05 21:21	06:50 20:24	07:22 17:18			08:33 16:46	09:55 (WEA 1) 10:41 (WEA 1)
Sonnenscheinstunden	269		283	368	412	475	486	491	447	379	335	275	
astr.max.mögl.Beschattung	1197											692	1423
Red.Sonnenscheinwahrsch.	0,15											0,15	0,13
Reduktion Betriebsdauer	0,93											0,93	0,93
Reduktion Windrichtung	0,54											0,54	0,54
Gesamte Reduktion	0,07											0,08	0,06
Met.wahrsch.Beschattung	87											52	89

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-15 - 237A, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:33 16:47 44	10:01 (WEA 1) 10:45 (WEA 1) 17:31	08:10 07:22 18:18	07:16 20:07 20:53	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:18	07:35 19:18 17:16		08:11 16:40 42	09:48 (WEA 1) 10:30 (WEA 1)
2	08:33 16:48 44	10:01 (WEA 1) 10:45 (WEA 1) 17:33	08:09 07:20 18:20	07:14 20:09 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15		08:12 16:40 42	09:49 (WEA 1) 10:31 (WEA 1)
3	08:33 16:49 44	10:02 (WEA 1) 10:46 (WEA 1) 17:34	08:08 07:18 18:21	07:12 20:09 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13		08:13 16:39 42	09:49 (WEA 1) 10:31 (WEA 1)
4	08:33 16:50 44	10:02 (WEA 1) 10:46 (WEA 1) 17:36	08:06 07:16 18:23	07:10 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:15	06:11 21:15 20:16	06:56 20:16 19:11	07:40 19:11 17:11		08:14 16:39 43	09:49 (WEA 1) 10:32 (WEA 1)
5	08:33 16:51 43	10:03 (WEA 1) 10:47 (WEA 1) 17:38	08:05 07:13 18:25	07:08 20:13 20:59	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 21:13 20:14	06:57 20:14 19:09	07:41 19:09 17:10		08:16 16:38 43	09:49 (WEA 1) 10:32 (WEA 1)
6	08:33 16:52 44	10:03 (WEA 1) 10:47 (WEA 1) 17:40	08:03 07:11 18:26	07:05 20:15 21:00	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 21:11 20:12	06:58 20:12 19:07	07:43 19:07 17:08		08:17 16:38 43	09:50 (WEA 1) 10:33 (WEA 1)
7	08:33 16:54 44	10:03 (WEA 1) 10:47 (WEA 1) 17:41	08:02 07:09 18:28	07:03 20:16 21:02	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 21:10 20:09	07:00 20:09 19:05	07:44 19:05 17:07		08:18 16:38 43	09:50 (WEA 1) 10:34 (WEA 1)
8	08:32 16:55 43	10:04 (WEA 1) 10:47 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 21:03	06:04 21:03 21:41	05:31 21:41 21:45	05:39 21:45 21:08	06:16 21:08 20:07	07:01 20:07 19:03	07:46 19:03 17:05		08:19 16:38 44	09:50 (WEA 1) 10:34 (WEA 1)
9	08:32 16:56 42	10:05 (WEA 1) 10:47 (WEA 1) 17:45	07:58 07:05 18:31	06:59 20:19 21:05	06:03 21:05 21:41	05:31 21:41 21:44	05:40 21:44 21:06	06:18 21:06 20:05	07:03 20:05 19:01	07:47 19:01 17:04		08:20 16:37 44	09:50 (WEA 1) 10:34 (WEA 1)
10	08:31 16:57 42	10:06 (WEA 1) 10:48 (WEA 1) 17:46	07:57 07:03 18:33	06:57 20:21 21:06	06:01 21:06 21:42	05:31 21:42 21:43	05:40 21:43 21:05	06:19 21:05 20:03	07:04 20:03 18:58	07:49 18:58 17:02		08:21 16:37 44	09:50 (WEA 1) 10:34 (WEA 1)
11	08:31 16:59 42	10:06 (WEA 1) 10:48 (WEA 1) 17:48	07:55 07:01 18:34	06:55 20:22 21:08	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:21 21:03 20:01	07:06 20:01 18:56	07:50 18:56 17:01		08:22 16:37 44	09:51 (WEA 1) 10:35 (WEA 1)
12	08:30 17:00 42	10:06 (WEA 1) 10:48 (WEA 1) 17:50	07:53 06:59 18:36	06:53 20:24 21:09	05:58 21:09 21:43	05:30 21:43 21:42	05:42 21:42 21:01	06:22 21:01 19:59	07:07 19:59 18:54	07:52 18:54 16:59		08:23 16:37 44	09:51 (WEA 1) 10:35 (WEA 1)
13	08:30 17:01 40	10:08 (WEA 1) 10:48 (WEA 1) 17:51	07:52 06:57 18:37	06:51 20:25 21:11	05:57 21:11 21:44	05:30 21:44 21:41	05:43 21:41 20:59	06:23 20:59 19:57	07:09 19:57 18:52	07:54 18:52 16:58		08:24 16:37 44	09:52 (WEA 1) 10:36 (WEA 1)
14	08:29 17:03 40	10:08 (WEA 1) 10:48 (WEA 1) 17:53	07:50 06:55 18:39	06:49 20:27 21:12	05:55 21:12 21:45	05:30 21:45 21:40	05:44 21:40 20:58	06:25 20:58 19:54	07:10 20:58 18:50	07:55 18:50 16:57		08:25 16:36 44	09:52 (WEA 1) 10:36 (WEA 1)
15	08:28 17:04 39	10:09 (WEA 1) 10:48 (WEA 1) 17:55	07:48 06:53 18:41	06:47 20:29 21:13	05:54 21:13 21:45	05:29 21:45 21:39	05:45 21:39 20:56	06:26 20:56 19:52	07:12 19:52 18:48	07:57 18:48 16:55	10:01 (WEA 1) 10:08 (WEA 1) 7	08:26 16:37 44	09:53 (WEA 1) 10:37 (WEA 1)
16	08:28 17:06 39	10:09 (WEA 1) 10:48 (WEA 1) 17:57	07:46 06:50 18:42	06:45 20:30 21:15	05:53 21:15 21:46	05:29 21:46 21:39	05:46 21:39 20:54	06:28 20:54 19:50	07:13 19:50 18:46	07:58 18:46 16:54	09:56 (WEA 1) 10:12 (WEA 1) 16	08:27 16:37 45	09:53 (WEA 1) 10:38 (WEA 1)
17	08:27 17:07 37	10:10 (WEA 1) 10:47 (WEA 1) 17:58	07:45 06:48 18:44	06:43 20:32 21:16	05:51 21:16 21:46	05:29 21:46 21:38	05:48 21:38 20:52	06:29 20:52 19:48	07:15 19:48 18:44	08:00 18:44 16:53	09:54 (WEA 1) 10:15 (WEA 1) 21	08:28 16:38 44	09:54 (WEA 1) 10:38 (WEA 1)
18	08:26 17:09 36	10:11 (WEA 1) 10:47 (WEA 1) 18:00	07:43 06:46 18:45	06:41 20:33 21:17	05:50 21:17 21:46	05:29 21:46 21:37	05:49 21:37 20:50	06:31 20:50 19:46	07:16 19:46 18:42	08:01 18:42 16:52	09:51 (WEA 1) 10:17 (WEA 1) 24	08:29 16:38 44	09:55 (WEA 1) 10:38 (WEA 1)
19	08:25 17:10 35	10:12 (WEA 1) 10:47 (WEA 1) 18:02	07:41 06:44 18:47	06:39 20:35 21:19	05:49 21:19 21:47	05:29 21:47 21:36	05:50 21:36 20:48	06:32 20:48 19:44	07:17 19:44 18:40	08:03 18:40 16:51	09:51 (WEA 1) 10:18 (WEA 1) 27	08:29 16:38 44	09:55 (WEA 1) 10:39 (WEA 1)
20	08:24 17:12 33	10:13 (WEA 1) 10:46 (WEA 1) 18:03	07:39 06:42 18:48	06:37 20:36 21:20	05:47 21:20 21:47	05:29 21:47 21:35	05:51 21:35 20:46	06:34 20:46 19:41	07:19 20:46 18:38	08:05 18:38 16:50	09:51 (WEA 1) 10:20 (WEA 1) 29	08:30 16:39 44	09:55 (WEA 1) 10:39 (WEA 1)
21	08:23 17:13 32	10:14 (WEA 1) 10:46 (WEA 1) 18:05	07:37 06:40 18:50	06:35 20:38 21:21	05:46 21:21 21:47	05:30 21:47 21:33	05:52 21:33 20:44	06:35 20:44 19:39	07:20 19:39 18:36	08:06 18:36 16:49	09:50 (WEA 1) 10:22 (WEA 1) 32	08:30 16:39 44	09:56 (WEA 1) 10:40 (WEA 1)
22	08:22 17:15 29	10:16 (WEA 1) 10:45 (WEA 1) 18:07	07:35 06:38 18:52	06:33 20:39 21:23	05:45 21:23 21:48	05:30 21:48 21:32	05:53 21:32 20:42	06:37 20:42 19:37	07:22 19:37 18:34	08:08 18:34 16:48	09:49 (WEA 1) 10:22 (WEA 1) 33	08:31 16:40 44	09:56 (WEA 1) 10:40 (WEA 1)
23	08:21 17:16 27	10:17 (WEA 1) 10:44 (WEA 1) 18:08	07:33 06:35 18:53	06:31 20:41 21:24	05:44 21:24 21:48	05:30 21:48 21:31	05:55 21:31 20:40	06:38 20:40 19:35	07:23 19:35 18:33	08:09 18:33 16:47	09:49 (WEA 1) 10:24 (WEA 1) 35	08:31 16:40 44	09:57 (WEA 1) 10:41 (WEA 1)
24	08:20 17:18 24	10:19 (WEA 1) 10:43 (WEA 1) 18:10	07:31 06:33 18:55	06:29 20:42 21:25	05:43 21:25 21:48	05:30 21:48 21:30	05:56 21:30 20:38	06:39 20:38 19:33	07:25 19:33 18:31	08:11 18:31 16:46	09:49 (WEA 1) 10:25 (WEA 1) 36	08:32 16:40 44	09:57 (WEA 1) 10:41 (WEA 1)
25	08:19 17:20 21	10:20 (WEA 1) 10:41 (WEA 1) 18:12	07:29 06:31 18:56	06:27 20:44 21:26	05:42 21:26 21:48	05:31 21:48 21:29	05:57 21:29 20:36	06:41 20:36 19:30	07:26 19:30 17:29	08:13 17:29 16:45	09:48 (WEA 1) 10:25 (WEA 1) 37	08:32 16:41 44	09:58 (WEA 1) 10:42 (WEA 1)
26	08:18 17:21 16	10:23 (WEA 1) 10:43 (WEA 1) 18:13	07:28 06:29 18:58	06:25 20:45 21:28	05:41 21:28 21:48	05:31 21:48 21:27	05:58 21:27 20:34	06:42 20:34 19:28	07:28 19:28 17:27	08:14 17:27 16:44	09:48 (WEA 1) 10:27 (WEA 1) 39	08:32 16:41 44	09:58 (WEA 1) 10:42 (WEA 1)
27	08:17 17:23 7	10:28 (WEA 1) 10:35 (WEA 1) 18:15	07:26 06:27 18:59	06:23 20:47 21:29	05:40 21:29 21:48	05:31 21:48 21:26	06:00 21:26 20:32	06:44 20:32 19:26	07:29 19:26 17:25	08:05 17:25 16:43	09:48 (WEA 1) 10:27 (WEA 1) 39	08:33 16:43 45	09:58 (WEA 1) 10:43 (WEA 1)
28	08:16 17:24		07:24 06:25	06:22 20:48	05:39 21:30	05:32 21:30	06:01 21:25	06:45 20:30	07:31 19:24	08:06 17:23	09:48 (WEA 1) 10:28 (WEA 1)	08:33 16:43 44	09:59 (WEA 1) 10:43 (WEA 1)
29	08:14 17:26		07:22 06:20	06:20 20:50	05:38 21:31	05:32 21:31	06:02 21:23	06:47 20:28	07:32 19:22	08:08 17:22	09:48 (WEA 1) 10:28 (WEA 1)	08:33 16:44 44	09:59 (WEA 1) 10:43 (WEA 1)
30	08:13 17:28		07:20 06:18	06:18 20:51	05:37 21:32	05:33 21:32	06:04 21:22	06:48 20:26	07:34 19:20	08:09 17:20	09:48 (WEA 1) 10:30 (WEA 1)	08:33 16:45 45	09:59 (WEA 1) 10:44 (WEA 1)
31	08:12 17:29		07:18 20:05		05:36 21:33		06:05 21:21	06:50 20:24	07:22 17:18			08:33 16:46 44	10:00 (WEA 1) 10:44 (WEA 1)
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255	
astr.max.mögl.Beschattung	973										497		1357
Red.Sonnenscheinwahrsch.	0,15										0,15		0,13
Reduktion Betriebsdauer	0,93										0,93		0,93
Reduktion Windrichtung	0,54										0,54		0,54
Gesamte Reduktion	0,07										0,08		0,06
Met.wahrsch.Beschattung	71										38		86

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-16 - 231A, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar		Februar		März		April		Mai		Juni		Juli		August		September		Oktober		November		Dezember	
1	08:33 16:47 44	09:51 (WEA 1) 10:35 (WEA 1) 17:31	08:10 18:18 20:07	07:22 18:18 20:07	07:16 20:07 21:34	06:16 20:53 21:34	05:36 21:34 21:47	05:34 21:47 21:19	06:06 20:22 21:19	06:51 20:22 21:19	07:35 19:18 17:16										08:11 16:40 44	09:37 (WEA 1) 10:21 (WEA 1) 10:38 (WEA 1)		
2	08:33 16:48 44	09:51 (WEA 1) 10:35 (WEA 1) 17:33	08:09 18:20 20:09	07:20 18:20 20:09	07:14 20:09 21:35	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 21:15	06:53 20:20 21:15	07:37 19:15 17:15										08:12 16:40 44	09:38 (WEA 1) 10:22 (WEA 1) 10:38 (WEA 1)		
3	08:33 16:49 44	09:52 (WEA 1) 10:36 (WEA 1) 17:34	08:08 18:21 20:10	07:18 18:21 20:10	07:12 20:10 21:36	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 21:13	06:54 20:18 21:13	07:38 19:13 17:13										08:13 16:39 44	09:38 (WEA 1) 10:22 (WEA 1) 10:38 (WEA 1)		
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5	08:33 16:51 44	09:52 (WEA 1) 10:36 (WEA 1) 17:38	08:05 18:25 20:13	07:13 18:25 20:13	07:08 20:13 21:38	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 21:09	06:57 20:14 21:09	07:41 19:09 17:10										08:16 16:38 44	09:38 (WEA 1) 10:22 (WEA 1) 10:38 (WEA 1)		
6	08:33 16:52 44	09:53 (WEA 1) 10:37 (WEA 1) 17:40	08:03 18:26 20:15	07:11 18:26 20:15	07:05 20:15 21:40	06:08 21:00 21:39	05:32 21:39 21:46	05:37 21:46 21:11	06:13 20:12 21:07	06:58 20:12 21:07	07:43 19:07 17:08										08:17 16:38 44	09:39 (WEA 1) 10:23 (WEA 1) 10:39 (WEA 1)		
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31	08:12 17:29		07:182																					



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-17 - 202, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 2	09:45 (WEA 1) 10:28 (WEA 1) 3	10:05 (WEA 1) 10:28 (WEA 1) 4	07:22 20:07 5	07:16 20:07 6	06:16 20:53 7	05:36 21:47 8	05:34 21:47 9	06:06 21:19 10	06:51 20:22 11	07:35 19:18 12	07:24 17:16 13
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19	08:31 17:05 20	09:48 (WEA 1) 10:33 (WEA 1) 21	10:00 10:25 (WEA 1) 22	08:00 17:43 23	07:07 20:18 24	06:04 21:03 25	05:39 21:41 26	05:39 21:45 27	06:16 20:07 28	07:01 19:03 29	07:46 17:05 30	07:35 17:05 31
20	08:31 17:06 21	09:48 (WEA 1) 10:33 (WEA 1) 22	10:00 10:25 (WEA 1) 23	08:00 17:43 24	07:07 20:18 25	06:04 21:03 26	05:39 21:41 27	05:39 21:45 28	06:16 20:07 29	07:01 19:03 30	07:46 17:05 31	07:35 17:05 1
21	08:31 17:07 22	09:48 (WEA 1) 10:33 (WEA 1) 23	10:00 10:25 (WEA 1) 24	08:00 17:43 25	07:07 20:18 26	06:04 21:03 27	05:39 21:41 28	05:39 21:45 29	06:16 20:07 30	07:01 19:03 31	07:46 17:05 1	07:35 17:05 2
22	08:31 17:08 23	09:48 (WEA 1) 10:33 (WEA 1) 24	10:00 10:25 (WEA 1) 25	08:00 17:43 26	07:07 20:18 27	06:04 21:03 28	05:39 21:41 29	05:39 21:45 30	06:16 20:07 31	07:01 19:03 1	07:46 17:05 2	07:35 17:05 3
23	08:31 17:09 24	09:48 (WEA 1) 10:33 (WEA 1) 25	10:00 10:25 (WEA 1) 26	08:00 17:43 27	07:07 20:18 28	06:04 21:03 29	05:39 21:41 30	05:39 21:45 31	06:16 20:07 1	07:01 19:03 2	07:46 17:05 3	07:35 17:05 4
24	08:31 17:10 25	09:48 (WEA 1) 10:33 (WEA 1) 26	10:00 10:25 (WEA 1) 27	08:00 17:43 28	07:07 20:18 29	06:04 21:03 30	05:39 21:41 31	05:39 21:45 1	06:16 20:07 2	07:01 19:03 3	07:46 17:05 4	07:35 17:05 5
25	08:31 17:11 26	09:48 (WEA 1) 10:33 (WEA 1) 27	10:00 10:25 (WEA 1) 28	08:00 17:43 29	07:07 20:18 30	06:04 21:03 31	05:39 21:41 1	05:39 21:45 2	06:16 20:07 3	07:01 19:03 4	07:46 17:05 5	07:35 17:05 6
26	08:31 17:12 27	09:48 (WEA 1) 10:33 (WEA 1) 28	10:00 10:25 (WEA 1) 29	08:00 17:43 30	07:07 20:18 31	06:04 21:03 1	05:39 21:41 2	05:39 21:45 3	06:16 20:07 4	07:01 19:03 5	07:46 17:05 6	07:35 17:05 7
27	08:31 17:13 28	09:48 (WEA 1) 10:33 (WEA 1) 29	10:00 10:25 (WEA 1) 30	08:00 17:43 31	07:07 20:18 1	06:04 21:03 2	05:39 21:41 3	05:39 21:45 4	06:16 20:07 5	07:01 19:03 6	07:46 17:05 7	07:35 17:05 8
28	08:31 17:14 29	09:48 (WEA 1) 10:33 (WEA 1) 30	10:00 10:25 (WEA 1) 31	08:00 17:43 1	07:07 20:18 2	06:04 21:03 3	05:39 21:41 4	05:39 21:45 5	06:16 20:07 6	07:01 19:03 7	07:46 17:05 8	07:35 17:05 9
29	08:31 17:15 30	09:48 (WEA 1) 10:33 (WEA 1) 31	10:00 10:25 (WEA 1) 1	08:00 17:43 2	07:07 20:18 3	06:04 21:03 4	05:39 21:41 5	05:39 21:45 6	06:16 20:07 7	07:01 19:03 8	07:46 17:05 9	07:35 17:05 10
30	08:31 17:16 31	09:48 (WEA 1) 10:33 (WEA 1) 1	10:00 10:25 (WEA 1) 2	08:00 17:43 3	07:07 20:18 4	06:04 21:03 5	05:39 21:41 6	05:39 21:45 7	06:16 20:07 8	07:01 19:03 9	07:46 17:05 10	07:35 17:05 11
31	08:31 17:17 1	09:48 (WEA 1) 10:33 (WEA 1) 2	10:00 10:25 (WEA 1) 3	08:00 17:43 4	07:07 20:18 5	06:04 21:03 6	05:39 21:41 7	05:39 21:45 8	06:16 20:07 9	07:01 19:03 10	07:46 17:05 11	07:35 17:05 12
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	1290	52	0,15	0,24	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63
Red.Sonnenscheinwahrsch.	0,15	0,24	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63	0,93	0,53
Reduktion Betriebsdauer	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63
Reduktion Windrichtung	0,53	0,07	0,63	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63	0,93
Gesamte Reduktion	0,07	0,63	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63	0,93	0,53
Met.wahrsch.Beschattung	93	6	0,12	0,24	0,93	0,53	0,07	0,63	0,93	0,53	0,07	0,63

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-18 - 229, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33 16:47	09:41 (WEA 1) 10:23 (WEA 1)	10:03 (WEA 1) 10:21 (WEA 1)	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	07:35 20:22	07:24 17:16	08:11 16:40
2	08:33 16:48	09:42 (WEA 1) 10:24 (WEA 1)	10:06 (WEA 1) 10:17 (WEA 1)	07:20 18:20	07:14 20:09	06:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	07:37 20:20	07:26 17:15	08:12 16:40
3	08:33 16:49	09:42 (WEA 1) 10:24 (WEA 1)	10:08 10:17 (WEA 1)	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 17:13	08:13 16:39
4	08:33 16:50	09:42 (WEA 1) 10:24 (WEA 1)	10:06 10:17 (WEA 1)	07:18 18:23	07:10 20:12	06:11 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 17:11	08:14 16:39
5	08:33 16:51	09:43 (WEA 1) 10:25 (WEA 1)	10:05 10:17 (WEA 1)	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 17:10	08:16 16:38
6	08:33 16:52	09:43 (WEA 1) 10:26 (WEA 1)	10:03 10:17 (WEA 1)	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 17:07	08:17 16:38
7	08:33 16:54	09:43 (WEA 1) 10:26 (WEA 1)	10:02 10:17 (WEA 1)	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 17:07	08:18 16:38
8	08:32 16:55	09:44 (WEA 1) 10:27 (WEA 1)	10:00 10:17 (WEA 1)	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 17:05	08:19 16:38
9	08:32 16:56	09:44 (WEA 1) 10:27 (WEA 1)	10:03 10:17 (WEA 1)	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 17:04	08:20 16:37
10	08:31 16:57	09:45 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 17:02	08:21 16:37
11	08:31 16:59	09:45 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:22 16:37
12	08:30 17:00	09:45 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 20:04	07:52 18:54	08:23 16:37
13	08:30 17:01	09:46 (WEA 1) 10:29 (WEA 1)	10:03 10:17 (WEA 1)	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 20:04	07:54 18:52	08:24 16:37
14	08:29 17:03	09:46 (WEA 1) 10:29 (WEA 1)	10:03 10:17 (WEA 1)	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 20:04	07:55 18:50	08:25 16:37
15	08:28 17:04	09:46 (WEA 1) 10:29 (WEA 1)	10:03 10:17 (WEA 1)	06:53 18:41	06:47 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 20:04	07:57 18:48	08:26 16:37
16	08:28 17:06	09:47 (WEA 1) 10:29 (WEA 1)	10:03 10:17 (WEA 1)	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	05:46 21:39	06:28 20:54	07:13 20:04	07:58 18:46	08:27 16:37
17	08:27 17:07	09:47 (WEA 1) 10:29 (WEA 1)	10:03 10:17 (WEA 1)	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 20:04	07:59 18:44	08:28 16:37
18	08:26 17:09	09:47 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 20:04	07:58 18:42	08:28 16:38
19	08:25 17:10	09:48 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 20:04	08:03 18:40	08:29 16:38
20	08:24 17:12	09:49 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	05:51 21:35	06:34 20:46	07:19 20:04	08:05 18:38	08:30 16:39
21	08:23 17:13	09:49 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:33	06:35 20:44	07:20 20:04	08:06 18:36	08:31 16:39
22	08:22 17:15	09:50 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 20:04	08:08 18:34	08:31 16:39
23	08:21 17:16	09:51 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 20:04	08:09 18:33	08:31 16:40
24	08:20 17:18	09:52 (WEA 1) 10:30 (WEA 1)	10:03 10:17 (WEA 1)	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 20:04	08:11 18:31	08:32 16:41
25	08:19 17:20	09:52 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 20:04	08:13 18:29	08:32 16:41
26	08:18 17:21	09:53 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 20:04	08:14 18:27	08:32 16:42
27	08:17 17:23	09:55 (WEA 1) 10:28 (WEA 1)	10:03 10:17 (WEA 1)	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 20:04	08:16 18:25	08:33 16:43
28	08:16 17:24	09:56 (WEA 1) 10:27 (WEA 1)	10:03 10:17 (WEA 1)	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 20:04	08:17 18:23	08:33 16:43
29	08:14 17:26	09:57 (WEA 1) 10:26 (WEA 1)	10:03 10:17 (WEA 1)	07:22 20:02	06:20 20:50	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 20:04	08:19 18:22	08:33 16:44
30	08:13 17:28	09:59 (WEA 1) 10:25 (WEA 1)	10:03 10:17 (WEA 1)	07:20 20:04	06:18 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 20:04	08:21 18:20	08:33 16:45
31	08:12 17:29	10:00 (WEA 1) 10:23 (WEA 1)	10:03 10:17 (WEA 1)	07:18 20:05	06:16 20:55	05:36 21:33	05:36 21:48	06:05 21:21	06:50 20:24	07:34 20:04	08:22 18:18	08:33 16:46
Sonnenscheinstunden	269	283		368	412	475	486	491	447	379	335	275
astr.max.mögl.Beschattung	1221	29										786
Red.Sonnenscheinwahrsch.	0,15	0,24										0,15
Reduktion Betriebsdauer	0,93	0,93										0,93
Reduktion Windrichtung	0,53	0,53										0,53
Gesamte Reduktion	0,07	0,12										0,07
Met.wahrsch.Beschattung	87	3										58

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)



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-19 - 198K, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

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

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







## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-21 - 219, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

		Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember													
1	08:34 16:47	33	09:29 (WEA 1) 10:02 (WEA 1)	08:10 17:31	33	09:39 (WEA 1) 10:12 (WEA 1)	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:11 16:40	39	09:12 (WEA 1) 09:51 (WEA 1)								
2	08:33 16:48	34	09:29 (WEA 1) 10:03 (WEA 1)	08:09 17:33	31	09:40 (WEA 1) 10:11 (WEA 1)	07:20 18:20	07:14 20:09	06:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40	38	09:14 (WEA 1) 09:52 (WEA 1)								
3	08:33 16:49	34	09:30 (WEA 1) 10:04 (WEA 1)	08:08 17:34	28	09:42 (WEA 1) 10:10 (WEA 1)	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39	38	09:14 (WEA 1) 09:52 (WEA 1)								
4	08:33 16:50	35	09:29 (WEA 1) 10:04 (WEA 1)	08:06 17:36	25	09:43 (WEA 1) 10:08 (WEA 1)	07:16 18:23	07:10 20:12	06:11 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:11	08:14 16:39	38	09:14 (WEA 1) 09:52 (WEA 1)								
5	08:33 16:51	35	09:30 (WEA 1) 10:05 (WEA 1)	08:05 17:38	22	09:45 (WEA 1) 10:07 (WEA 1)	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10	08:16 16:38	36	09:15 (WEA 1) 09:51 (WEA 1)								
6	08:33 16:52	36	09:30 (WEA 1) 10:06 (WEA 1)	08:03 17:40	18	09:47 (WEA 1) 10:05 (WEA 1)	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:17 16:38	36	09:16 (WEA 1) 09:52 (WEA 1)								
7	08:33 16:54	36	09:30 (WEA 1) 10:06 (WEA 1)	08:02 17:41	9	09:51 (WEA 1) 10:00 (WEA 1)	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:35	35	09:17 (WEA 1) 09:52 (WEA 1)								
8	08:32 16:55	38	09:30 (WEA 1) 10:08 (WEA 1)	08:00 17:43			07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38	35	09:17 (WEA 1) 09:52 (WEA 1)								
9	08:32 16:56	38	09:30 (WEA 1) 10:08 (WEA 1)	07:58 17:45			07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:34 17:04	08:20 16:37	34	09:18 (WEA 1) 09:52 (WEA 1)								
10	08:31 16:57	38	09:31 (WEA 1) 10:09 (WEA 1)	07:57 17:46			07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:58	07:39 17:02	08:21 16:37	34	09:18 (WEA 1) 09:52 (WEA 1)								
11	08:31 16:59	39	09:30 (WEA 1) 10:09 (WEA 1)	07:55 17:48			07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:22 16:37	33	09:19 (WEA 1) 09:52 (WEA 1)								
12	08:30 17:00	40	09:30 (WEA 1) 10:10 (WEA 1)	07:53 17:50			06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59	08:23 16:37	33	09:20 (WEA 1) 09:53 (WEA 1)								
13	08:30 17:01	40	09:31 (WEA 1) 10:11 (WEA 1)	07:52 17:51			06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	07:44 17:01	08:24 16:37	32	09:21 (WEA 1) 09:53 (WEA 1)								
14	08:29 17:03	40	09:31 (WEA 1) 10:11 (WEA 1)	07:50 17:53			06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	07:45 17:03	08:25 16:37	32	09:22 (WEA 1) 09:53 (WEA 1)								
15	08:28 17:04	41	09:31 (WEA 1) 10:12 (WEA 1)	07:48 17:55			06:53 18:41	06:47 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56	08:26 16:37	31	09:22 (WEA 1) 09:53 (WEA 1)								
16	08:28 17:06	41	09:31 (WEA 1) 10:12 (WEA 1)	07:46 17:57			06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	05:46 21:39	06:28 20:54	07:13 19:50	07:58 18:46	07:48 17:04	08:27 16:37	31	09:23 (WEA 1) 09:54 (WEA 1)								
17	08:27 17:07	41	09:31 (WEA 1) 10:12 (WEA 1)	07:45 17:58			06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	07:50 17:04	08:28 16:38	30	09:24 (WEA 1) 09:54 (WEA 1)								
18	08:26 17:09	42	09:31 (WEA 1) 10:13 (WEA 1)	07:43 18:00			06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	07:51 17:05	08:28 16:38	30	09:24 (WEA 1) 09:54 (WEA 1)								
19	08:25 17:10	42	09:32 (WEA 1) 10:13 (WEA 1)	07:41 18:02			06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	07:53 17:05	08:29 16:37	30	09:25 (WEA 1) 09:55 (WEA 1)								
20	08:24 17:12	42	09:32 (WEA 1) 10:14 (WEA 1)	07:39 18:03			06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 17:06	08:30 16:37	30	09:25 (WEA 1) 09:55 (WEA 1)								
21	08:23 17:13	42	09:32 (WEA 1) 10:14 (WEA 1)	07:37 18:05			06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:33	06:35 20:44	07:20 19:39	08:06 18:36	07:56 17:06	08:30 16:37	30	09:26 (WEA 1) 09:56 (WEA 1)								
22	08:22 17:15	41	09:33 (WEA 1) 10:14 (WEA 1)	07:35 18:07			06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	07:58 17:08	08:31 16:38	30	09:26 (WEA 1) 09:56 (WEA 1)								
23	08:21 17:16	42	09:33 (WEA 1) 10:15 (WEA 1)	07:33 18:08			06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	07:59 17:09	08:31 16:40	30	09:27 (WEA 1) 09:57 (WEA 1)								
24	08:20 17:18	41	09:34 (WEA 1) 10:15 (WEA 1)	07:31 18:10			06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 19:33	08:11 18:31	08:01 17:10	08:32 16:41	30	09:27 (WEA 1) 09:57 (WEA 1)								
25	08:19 17:20	41	09:34 (WEA 1) 10:14 (WEA 1)	07:30 18:12			06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:30	08:02 18:29	07:13 17:12	08:02 16:41	30	09:28 (WEA 1) 09:58 (WEA 1)								
26	08:18 17:21	40	09:34 (WEA 1) 10:14 (WEA 1)	07:28 18:13			06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 19:28	08:04 18:27	07:14 17:13	08:04 16:42	30	09:28 (WEA 1) 09:58 (WEA 1)								
27	08:17 17:23	40	09:35 (WEA 1) 10:15 (WEA 1)	07:26 18:15			06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 19:26	08:05 18:25	07:16 17:15	08:05 16:43	31	09:28 (WEA 1) 09:59 (WEA 1)								
28	08:16 17:24	39	09:36 (WEA 1) 10:15 (WEA 1)	07:24 18:17			06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	08:06 18:24	07:17 17:14	08:06 16:43	31	09:28 (WEA 1) 09:59 (WEA 1)								
29	08:14 17:26	38	09:36 (WEA 1) 10:14 (WEA 1)	07:22 18:18			06:22 19:02	06:20 20:50	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 19:22	08:07 18:22	07:19 17:16	08:08 16:42	31	09:28 (WEA 1) 09:59 (WEA 1)								
30	08:13 17:28	36	09:38 (WEA 1) 10:14 (WEA 1)	07:20 18:19			07:20 19:04	06:18 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	08:09 18:21	07:21 17:17	08:09 16:43	31	09:28 (WEA 1) 09:59 (WEA 1)								
31	08:12 17:29	35	09:38 (WEA 1) 10:13 (WEA 1)	07:18 18:20			07:18 19:05	06:16 20:52	05:36 21:33	06:05 21:23	06:50 21:21	07:22 20:24	08:10 19:18	08:10 18:22	07:22 17:18	08:10 16:46	32	09:29 (WEA 1) 09:59 (WEA 1)								
Sonnenscheinstunden	269		283				368		412		475		486		491		447		379		335		275		255	
astr.max.mögl.Beschattung	1198		166																				972		1013	
Red.Sonnenscheinwahrsch.	0,15		0,24																				0,15		0,13	
Reduktion Betriebsdauer	0,93		0,93																				0,93		0,93	
Reduktion Windrichtung	0,51		0,51																				0,51		0,51	
Gesamte Reduktion	0,07		0,11																				0,07		0,06	
Met.wahrsch.Beschattung	83		19																				70		61	

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)







## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-23 - 211, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:25 (WEA 1) 10:23 (WEA 2)	08:10 17:31	09:23 (WEA 1) 10:01 (WEA 1)	07:22 18:18	06:16 20:07	05:36 20:53	05:34 21:34	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16
2	08:33 16:48	09:25 (WEA 1) 10:23 (WEA 2)	08:09 17:33	09:23 (WEA 1) 10:01 (WEA 1)	07:20 18:18	06:14 20:09	05:35 20:54	05:34 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	09:25 (WEA 1) 10:23 (WEA 2)	08:08 17:35	09:25 (WEA 1) 10:01 (WEA 1)	07:18 18:21	06:13 20:10	05:34 20:56	05:35 21:36	06:09 21:47	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	09:23 (WEA 1) 10:22 (WEA 2)	08:06 17:36	09:25 (WEA 1) 10:00 (WEA 1)	07:16 18:23	06:11 20:12	05:33 20:57	05:36 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	09:23 (WEA 1) 10:22 (WEA 2)	08:05 17:36	09:26 (WEA 1) 10:00 (WEA 1)	07:13 18:25	06:08 20:13	05:36 20:59	05:37 21:38	06:12 21:46	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	09:23 (WEA 1) 10:22 (WEA 2)	08:03 17:40	09:27 (WEA 1) 10:00 (WEA 1)	07:11 18:26	07:05 20:15	06:08 20:57	05:37 21:39	06:13 21:46	06:58 20:12	07:43 19:07	07:32 17:08
7	08:33 16:54	09:22 (WEA 1) 10:21 (WEA 2)	08:02 17:40	09:28 (WEA 1) 10:00 (WEA 1)	07:09 18:29	07:03 20:18	06:06 20:59	05:38 21:41	06:15 21:45	07:00 20:09	07:44 19:05	07:34 17:07
8	08:33 16:55	09:22 (WEA 1) 10:21 (WEA 2)	08:00 17:43	09:30 (WEA 1) 10:01 (WEA 1)	07:07 18:29	07:01 20:18	06:04 20:59	05:39 21:41	06:16 21:45	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	09:22 (WEA 1) 10:21 (WEA 2)	07:58 17:45	09:31 (WEA 1) 10:01 (WEA 1)	07:05 18:31	06:59 20:19	06:03 21:05	05:40 21:41	06:18 21:44	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	09:22 (WEA 1) 10:21 (WEA 2)	07:57 17:46	09:33 (WEA 1) 10:01 (WEA 1)	07:03 18:33	06:57 20:21	06:01 21:06	05:40 21:42	06:19 21:43	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	09:22 (WEA 1) 10:21 (WEA 2)	07:55 17:48	09:36 (WEA 1) 10:01 (WEA 1)	07:01 18:34	06:55 20:22	06:00 21:08	05:41 21:43	06:21 21:43	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	09:21 (WEA 1) 10:20 (WEA 2)	07:53 17:50	09:37 (WEA 1) 10:01 (WEA 1)	06:59 18:36	06:53 20:24	05:58 21:09	05:42 21:43	06:22 21:42	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	09:21 (WEA 1) 10:20 (WEA 2)	07:52 17:51	09:37 (WEA 1) 10:01 (WEA 1)	06:57 18:37	06:51 20:25	05:57 21:11	05:43 21:44	06:23 21:41	07:09 19:57	07:54 18:52	07:44 16:58
14	08:29 17:03	09:21 (WEA 1) 10:20 (WEA 2)	07:50 17:53	09:38 (WEA 1) 10:01 (WEA 1)	06:55 18:39	06:49 20:27	05:55 21:12	05:44 21:45	06:25 21:42	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	09:21 (WEA 1) 10:20 (WEA 2)	07:48 17:55	09:38 (WEA 1) 10:01 (WEA 1)	06:53 18:41	06:47 20:29	05:54 21:13	05:45 21:45	06:26 21:39	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	09:20 (WEA 1) 10:20 (WEA 2)	07:46 17:57	09:39 (WEA 1) 10:01 (WEA 1)	06:50 18:42	06:45 20:30	05:53 21:15	05:46 21:46	06:28 21:39	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	09:20 (WEA 1) 10:20 (WEA 2)	07:43 18:00	09:40 (WEA 1) 10:01 (WEA 1)	06:46 18:44	06:41 20:32	05:50 21:16	05:49 21:46	06:31 21:38	07:16 19:48	08:01 18:44	07:51 16:53
18	08:26 17:09	09:20 (WEA 1) 10:20 (WEA 2)	07:43 18:01	09:41 (WEA 1) 10:01 (WEA 1)	06:46 18:45	06:41 20:33	05:50 21:17	05:49 21:46	06:31 21:37	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	09:20 (WEA 1) 10:20 (WEA 2)	07:41 18:02	09:42 (WEA 1) 10:01 (WEA 1)	06:44 18:47	06:39 20:35	05:49 21:19	05:50 21:47	06:32 21:36	07:17 19:44	08:03 18:40	07:53 16:51
20	08:24 17:12	09:20 (WEA 1) 10:20 (WEA 2)	07:39 18:03	09:43 (WEA 1) 10:01 (WEA 1)	06:42 18:48	06:37 20:36	05:47 21:20	05:51 21:47	06:34 21:35	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	09:20 (WEA 1) 10:20 (WEA 2)	07:37 18:05	09:44 (WEA 1) 10:01 (WEA 1)	06:40 18:50	06:35 20:38	05:46 21:21	05:52 21:47	06:35 21:34	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	09:20 (WEA 1) 10:20 (WEA 2)	07:35 18:07	09:45 (WEA 1) 10:01 (WEA 1)	06:38 18:52	06:33 20:39	05:45 21:23	05:53 21:48	06:37 21:32	07:22 19:37	08:08 18:35	07:58 16:48
23	08:21 17:16	09:21 (WEA 1) 10:20 (WEA 2)	07:33 18:08	09:46 (WEA 1) 10:01 (WEA 1)	06:35 18:53	06:31 20:41	05:44 21:24	05:55 21:48	06:38 21:31	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	09:21 (WEA 1) 10:20 (WEA 2)	07:31 18:10	09:47 (WEA 1) 10:01 (WEA 1)	06:33 18:55	06:29 20:42	05:43 21:25	05:56 21:48	06:39 21:30	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	09:20 (WEA 1) 10:20 (WEA 2)	07:30 18:12	09:48 (WEA 1) 10:01 (WEA 1)	06:31 18:56	06:27 20:44	05:42 21:26	05:57 21:48	06:41 21:29	07:26 19:30	07:13 18:29	08:02 16:45
26	08:18 17:21	09:21 (WEA 1) 10:20 (WEA 2)	07:28 18:13	09:49 (WEA 1) 10:01 (WEA 1)	06:29 18:58	06:25 20:45	05:41 21:28	05:58 21:48	06:42 21:27	07:28 19:28	07:14 18:27	08:04 16:44
27	08:17 17:23	09:21 (WEA 1) 10:20 (WEA 2)	07:26 18:15	09:50 (WEA 1) 10:01 (WEA 1)	06:27 18:59	06:23 20:47	05:40 21:29	06:00 21:48	06:44 21:26	07:29 19:26	07:16 18:25	08:05 16:43
28	08:16 17:24	09:22 (WEA 1) 10:20 (WEA 2)	07:24 18:17	09:51 (WEA 1) 10:01 (WEA 1)	06:25 19:01	06:22 20:48	05:39 21:30	06:01 21:48	06:45 21:25	07:31 19:24	07:17 18:23	08:06 16:42
29	08:14 17:26	09:22 (WEA 1) 10:20 (WEA 2)	07:22 18:19	09:52 (WEA 1) 10:01 (WEA 1)	06:22 19:02	06:20 20:50	05:38 21:31	06:02 21:48	06:47 21:23	07:32 19:22	07:19 18:22	08:08 16:42
30	08:13 17:28	09:22 (WEA 1) 10:20 (WEA 2)	07:20 18:20	09:53 (WEA 1) 10:01 (WEA 1)	06:20 19:04	06:18 20:51	05:37 21:32	06:04 21:48	06:48 21:22	07:34 19:20	07:21 18:20	08:09 16:41
31	08:12 17:29	09:22 (WEA 1) 10:01 (WEA 1)	07:18 18:21	09:54 (WEA 1) 10:01 (WEA 1)	06:18 19:05	06:16 20:51	05:36 21:33	06:05 21:49	06:50 21:21	07:22 19:18	07:19 18:19	08:09 16:40
Sonneneinstrahlung	269	283	321	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	1053	1053	1053	1053	1053	1053	1053	1053	1053	1053	1053	1053
Red. Sonneneinstrahlung	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,52	0,52	0,52	0,52	0,52	0,52	0,52	0,52	0,52	0,52	0,52	0,52
Gesamte Reduktion	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07
Met. wahrsch. Beschattung	73	73	73	73	73	73	73	73	73	73	73	73

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-24 - 198E, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	09:50 (WEA 2) 10:17 (WEA 2)	08:10 17:31	09:07 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:39 (WEA 1) 16:40
2	08:33 16:48	09:51 (WEA 2) 10:17 (WEA 2)	08:09 17:33	09:06 (WEA 1) 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:38 (WEA 1) 16:40
3	08:33 16:49	09:52 (WEA 2) 10:17 (WEA 2)	08:08 17:35	09:07 (WEA 1) 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:38 (WEA 1) 16:39
4	08:33 16:50	09:52 (WEA 2) 10:17 (WEA 2)	08:06 17:36	09:07 (WEA 1) 18:23	07:10 20:12	06:11 20:57	05:33 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:11	08:37 (WEA 1) 16:39
5	08:33 16:51	09:52 (WEA 2) 10:17 (WEA 2)	08:08 17:38	09:07 (WEA 1) 18:25	07:13 20:13	06:13 20:59	05:33 21:38	06:12 21:46	06:57 20:14	07:41 19:09	07:30 17:10	08:37 (WEA 1) 16:38
6	08:33 16:52	09:54 (WEA 2) 10:18 (WEA 2)	08:03 17:40	09:07 (WEA 1) 18:26	07:11 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:37 (WEA 1) 16:38
7	08:33 16:54	09:55 (WEA 2) 10:18 (WEA 2)	08:02 17:41	09:07 (WEA 1) 18:28	07:09 20:16	06:06 21:02	05:32 21:40	06:15 21:19	07:00 20:09	07:44 19:05	07:34 17:07	08:37 (WEA 1) 16:38
8	08:33 16:55	09:56 (WEA 2) 10:19 (WEA 2)	08:00 17:43	09:09 (WEA 1) 18:29	07:07 20:18	06:04 21:03	05:31 21:41	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:37 (WEA 1) 16:38
9	08:33 16:56	09:57 (WEA 2) 10:20 (WEA 2)	08:00 17:45	09:09 (WEA 1) 18:31	07:05 20:19	06:03 21:05	05:31 21:41	06:18 21:44	07:03 20:05	07:47 19:01	07:37 17:04	08:37 (WEA 1) 16:37
10	08:31 16:57	09:59 (WEA 2) 10:22 (WEA 2)	08:00 17:46	09:09 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	06:19 21:43	07:04 20:03	07:49 18:58	07:39 17:02	08:37 (WEA 1) 16:37
11	08:31 16:59	10:00 (WEA 2) 10:25 (WEA 2)	07:55 17:48	09:10 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:30 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:38 (WEA 1) 16:37
12	08:30 17:00	10:01 (WEA 2) 10:26 (WEA 2)	07:53 17:50	09:12 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	06:22 21:42	07:07 20:01	07:52 18:54	07:42 16:59	08:38 (WEA 1) 16:37
13	08:30 17:01	10:04 (WEA 2) 10:29 (WEA 2)	07:52 17:51	09:12 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	06:23 21:09	07:09 20:01	07:54 18:52	07:44 16:58	08:38 (WEA 1) 16:37
14	08:29 17:03	10:13 (WEA 2) 10:34 (WEA 2)	07:51 17:50	09:14 (WEA 1) 18:39	06:55 20:27	05:55 21:12	05:30 21:45	06:25 21:08	07:10 20:01	07:55 18:50	07:45 16:57	08:39 (WEA 1) 16:37
15	08:28 17:04	10:16 (WEA 2) 10:37 (WEA 2)	07:48 17:55	09:15 (WEA 1) 18:41	06:47 20:29	05:49 21:13	05:29 21:45	06:26 21:06	07:12 20:01	07:57 18:52	07:48 16:56	08:40 (WEA 1) 16:37
16	08:28 17:06	10:17 (WEA 2) 10:38 (WEA 2)	07:46 17:57	09:17 (WEA 1) 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:28 21:09	07:13 20:01	07:58 18:46	07:48 16:54	08:40 (WEA 1) 16:37
17	08:27 17:07	10:18 (WEA 2) 10:39 (WEA 2)	07:45 17:58	09:18 (WEA 1) 18:43	06:44 20:31	05:52 21:16	05:29 21:47	06:29 21:10	07:14 20:02	07:59 18:44	07:47 16:53	08:41 (WEA 1) 16:37
18	08:26 17:08	10:19 (WEA 2) 10:40 (WEA 2)	07:43 18:00	09:19 (WEA 1) 18:44	06:43 20:32	05:51 21:17	05:29 21:48	06:30 21:11	07:15 20:03	08:00 18:41	07:51 16:52	08:42 (WEA 1) 16:38
19	08:25 17:10	10:20 (WEA 2) 10:41 (WEA 2)	07:41 18:02	09:20 (WEA 1) 18:45	06:42 20:33	05:50 21:18	05:29 21:49	06:31 21:12	07:16 20:04	08:01 18:42	07:51 16:53	08:42 (WEA 1) 16:38
20	08:24 17:12	10:21 (WEA 2) 10:42 (WEA 2)	07:39 18:03	09:21 (WEA 1) 18:46	06:41 20:34	05:49 21:19	05:29 21:50	06:32 21:13	07:17 20:05	08:03 18:43	07:53 16:54	08:42 (WEA 1) 16:38
21	08:23 17:13	10:22 (WEA 2) 10:43 (WEA 2)	07:37 18:05	09:22 (WEA 1) 18:47	06:40 20:35	05:48 21:20	05:29 21:51	06:33 21:14	07:18 20:06	08:04 18:44	07:54 16:55	08:43 (WEA 1) 16:39
22	08:22 17:15	10:23 (WEA 2) 10:44 (WEA 2)	07:35 18:07	09:23 (WEA 1) 18:48	06:39 20:36	05:47 21:21	05:29 21:52	06:34 21:15	07:19 20:07	08:05 18:45	07:55 16:56	08:44 (WEA 1) 16:39
23	08:21 17:16	10:24 (WEA 2) 10:45 (WEA 2)	07:33 18:08	09:24 (WEA 1) 18:49	06:38 20:37	05:46 21:22	05:29 21:53	06:35 21:16	07:20 20:08	08:06 18:46	07:56 16:57	08:45 (WEA 1) 16:39
24	08:20 17:18	10:25 (WEA 2) 10:46 (WEA 2)	07:31 18:10	09:25 (WEA 1) 18:50	06:37 20:38	05:45 21:23	05:29 21:54	06:36 21:17	07:21 20:09	08:07 18:47	07:57 16:58	08:46 (WEA 1) 16:40
25	08:19 17:20	10:26 (WEA 2) 10:47 (WEA 2)	07:30 18:12	09:26 (WEA 1) 18:51	06:36 20:39	05:44 21:24	05:29 21:55	06:37 21:18	07:22 20:10	08:08 18:48	07:58 16:59	08:47 (WEA 1) 16:41
26	08:18 17:21	10:27 (WEA 2) 10:48 (WEA 2)	07:28 18:13	09:27 (WEA 1) 18:52	06:35 20:40	05:43 21:25	05:29 21:56	06:38 21:19	07:23 20:11	08:09 18:49	07:59 17:00	08:48 (WEA 1) 16:41
27	08:17 17:22	10:28 (WEA 2) 10:49 (WEA 2)	07:26 18:14	09:28 (WEA 1) 18:53	06:34 20:41	05:42 21:26	05:29 21:57	06:39 21:20	07:24 20:12	08:10 18:49	07:59 17:01	08:49 (WEA 1) 16:42
28	08:16 17:23	10:29 (WEA 2) 10:50 (WEA 2)	07:24 18:15	09:29 (WEA 1) 18:54	06:33 20:42	05:41 21:27	05:29 21:58	06:40 21:21	07:25 20:13	08:11 18:50	07:59 17:02	08:50 (WEA 1) 16:42
29	08:14 17:24	10:30 (WEA 2) 10:51 (WEA 2)	07:22 18:16	09:30 (WEA 1) 18:55	06:32 20:43	05:40 21:28	05:29 21:59	06:41 21:22	07:26 20:14	08:12 18:51	07:59 17:03	08:51 (WEA 1) 16:43
30	08:13 17:25	10:31 (WEA 2) 10:52 (WEA 2)	07:20 18:17	09:31 (WEA 1) 18:56	06:31 20:44	05:39 21:29	05:29 22:00	06:42 21:23	07:27 20:15	08:13 18:52	07:59 17:04	08:52 (WEA 1) 16:43
31	08:12 17:26	10:32 (WEA 2) 10:53 (WEA 2)	07:18 18:18	09:32 (WEA 1) 18:57	06:30 20:45	05:38 21:30	05:29 22:01	06:43 21:24	07:28 20:16	08:14 18:53	07:59 17:05	08:53 (WEA 1) 16:44
Sonnenscheinstunden	269	283	562	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	785	0,15	0,24							180	929	808
Red. Sonnenscheinwahrsch.	0,15	0,15	0,24							0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	0,93
Reduktion Windrichtung	0,53	0,53	0,53							0,53	0,53	0,53
Gesamte Reduktion	0,07	0,12	0,12							0,14	0,07	0,06
Met. wahrsch. Beschattung	57	66								25	69	50

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-25 - 198C, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-26 - 89, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnenerscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-27 - 203, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-28 - 73, Rue de Sanem, 4664 Niederkorn

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:44 (WEA 2) 10:09 (WEA 2)	08:10 17:31	09:04 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	06:06 21:19	06:51 20:22	07:35 19:18	08:37 (WEA 1) 16:40	08:11 19:51 (WEA 2)
2	08:33 16:48	09:44 (WEA 2) 10:09 (WEA 2)	08:09 17:33	09:04 (WEA 1) 18:20	07:20 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	08:36 (WEA 1) 16:39	08:12 19:53 (WEA 2)
3	08:33 16:49	09:45 (WEA 2) 10:10 (WEA 2)	08:08 17:35	09:04 (WEA 1) 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	08:36 (WEA 1) 16:38	08:13 19:54 (WEA 2)
4	08:33 16:50	09:45 (WEA 2) 10:10 (WEA 2)	08:06 17:36	09:04 (WEA 1) 18:23	07:10 20:12	06:11 20:57	05:33 21:37	06:11 21:46	06:56 20:16	07:40 19:11	08:35 (WEA 1) 16:39	08:14 19:54 (WEA 2)
5	08:33 16:51	09:45 (WEA 2) 10:10 (WEA 2)	08:05 17:38	09:05 (WEA 1) 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:12 21:46	06:57 20:14	07:41 19:09	08:35 (WEA 1) 16:38	08:16 19:55 (WEA 2)
6	08:33 16:52	09:47 (WEA 2) 10:11 (WEA 2)	08:03 17:40	09:05 (WEA 1) 18:26	07:05 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	08:35 (WEA 1) 16:37	08:17 19:57 (WEA 2)
7	08:33 16:53	09:48 (WEA 2) 10:11 (WEA 2)	08:02 17:41	09:05 (WEA 1) 18:27	07:03 20:16	06:06 21:01	05:32 21:40	06:15 21:12	07:00 20:13	07:44 19:05	08:35 (WEA 1) 16:38	08:18 19:58 (WEA 2)
8	08:32 16:55	09:49 (WEA 2) 10:12 (WEA 2)	08:00 17:43	09:06 (WEA 1) 18:29	07:01 20:18	06:04 21:03	05:31 21:41	06:19 21:45	07:04 20:18	07:49 19:03	08:34 (WEA 1) 16:38	08:19 19:58 (WEA 2)
9	08:32 16:56	09:50 (WEA 2) 10:13 (WEA 2)	07:58 17:45	09:07 (WEA 1) 18:31	07:05 20:19	06:03 21:05	05:31 21:41	06:18 21:44	07:03 20:05	07:47 19:01	08:34 (WEA 1) 16:37	08:20 19:59 (WEA 2)
10	08:31 16:57	09:51 (WEA 2) 10:14 (WEA 2)	07:57 17:46	09:07 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	06:19 21:43	07:04 20:03	07:49 18:58	08:35 (WEA 1) 16:37	08:21 19:59 (WEA 2)
11	08:31 16:59	09:52 (WEA 2) 10:15 (WEA 2)	07:55 17:48	09:08 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:30 21:43	06:21 21:43	07:06 20:01	07:50 18:56	08:35 (WEA 1) 16:37	08:22 19:00 (WEA 2)
12	08:30 17:00	09:53 (WEA 2) 10:16 (WEA 2)	07:53 17:50	09:10 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	06:22 21:42	07:07 19:59	07:52 18:54	08:35 (WEA 1) 16:37	08:23 19:01 (WEA 2)
13	08:30 17:01	09:56 (WEA 2) 10:17 (WEA 2)	07:52 17:51	09:12 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	06:23 21:41	07:09 19:57	07:54 18:52	08:36 (WEA 1) 16:37	08:24 19:01 (WEA 2)
14	08:29 17:03	09:58 (WEA 2) 10:18 (WEA 2)	07:50 17:53	09:13 (WEA 1) 18:39	06:49 20:27	05:55 21:12	05:30 21:45	06:25 21:40	07:10 19:54	07:55 18:50	08:36 (WEA 1) 16:37	08:25 19:01 (WEA 2)
15	08:28 17:04	09:59 (WEA 2) 10:19 (WEA 2)	07:48 17:55	09:16 (WEA 1) 18:41	06:47 20:29	05:54 21:13	05:29 21:45	06:26 21:39	07:12 19:52	07:57 18:48	08:37 (WEA 1) 16:37	08:26 19:02 (WEA 2)
16	08:28 17:06	09:13 (WEA 1) 09:22 (WEA 1)	07:46 17:57	09:28 (WEA 1) 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:28 21:39	07:13 19:50	07:58 18:46	08:37 (WEA 1) 16:37	08:27 19:03 (WEA 2)
17	08:27 17:07	09:11 (WEA 1) 09:25 (WEA 1)	07:45 17:58	09:26 (WEA 1) 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:29 21:38	07:15 19:48	08:00 18:44	08:38 (WEA 1) 16:38	08:28 19:04 (WEA 2)
18	08:26 17:09	09:10 (WEA 1) 09:27 (WEA 1)	07:43 18:00	09:25 (WEA 1) 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:31 21:40	07:16 19:46	08:01 18:42	08:39 (WEA 1) 16:38	08:29 19:04 (WEA 2)
19	08:25 17:10	09:08 (WEA 1) 09:29 (WEA 1)	07:41 18:02	09:24 (WEA 1) 18:47	06:39 20:35	05:49 21:19	05:29 21:47	06:32 21:36	07:17 19:44	08:03 18:40	08:40 (WEA 1) 16:38	08:29 19:04 (WEA 2)
20	08:24 17:12	09:07 (WEA 1) 09:30 (WEA 1)	07:39 18:03	09:23 (WEA 1) 18:48	06:37 20:36	05:47 21:20	05:30 21:47	06:34 21:35	07:19 19:41	08:05 18:38	08:41 (WEA 1) 16:39	08:30 19:04 (WEA 2)
21	08:23 17:13	09:07 (WEA 1) 09:32 (WEA 1)	07:37 18:05	09:22 (WEA 1) 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:35 21:34	07:20 19:39	08:06 18:36	08:43 (WEA 1) 16:39	08:31 19:05 (WEA 2)
22	08:22 17:15	09:06 (WEA 1) 09:33 (WEA 1)	07:35 18:07	09:21 (WEA 1) 18:52	06:33 20:39	05:45 21:23	05:30 21:48	06:37 21:32	07:22 19:37	08:08 18:35	08:44 (WEA 1) 16:39	08:32 19:05 (WEA 2)
23	08:21 17:16	09:06 (WEA 1) 09:34 (WEA 1)	07:33 18:08	09:20 (WEA 1) 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:38 21:31	07:23 19:35	08:09 18:33	08:45 (WEA 1) 16:40	08:31 19:06 (WEA 2)
24	08:20 17:18	09:05 (WEA 1) 09:36 (WEA 1)	07:31 18:10	09:19 (WEA 1) 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:39 21:30	07:25 19:33	08:11 18:31	08:47 (WEA 1) 16:41	08:32 19:07 (WEA 2)
25	08:19 17:20	09:04 (WEA 1) 09:36 (WEA 1)	07:30 18:12	09:18 (WEA 1) 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:41 21:29	07:26 19:30	07:13 18:29	08:49 (WEA 1) 16:41	08:32 19:07 (WEA 2)
26	08:18 17:21	09:04 (WEA 1) 09:37 (WEA 1)	07:28 18:13	09:17 (WEA 1) 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:42 21:27	07:28 19:28	07:14 18:27	08:50 (WEA 1) 16:42	08:33 19:08 (WEA 2)
27	08:17 17:23	09:04 (WEA 1) 09:38 (WEA 1)	07:26 18:15	09:16 (WEA 1) 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:44 21:26	07:29 19:26	07:16 18:25	08:51 (WEA 1) 16:43	08:34 19:09 (WEA 2)
28	08:16 17:24	09:04 (WEA 1) 09:39 (WEA 1)	07:24 18:17	09:15 (WEA 1) 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:45 21:25	07:31 19:24	07:17 18:23	08:52 (WEA 1) 16:44	08:35 19:10 (WEA 2)
29	08:14 17:26	09:04 (WEA 1) 09:39 (WEA 1)	07:22 18:19	09:14 (WEA 1) 19:02	06:20 20:50	05:38 21:31	05:32 21:48	06:47 21:23	07:32 19:22	07:19 18:23	08:53 (WEA 1) 16:44	08:36 19:11 (WEA 2)
30	08:13 17:28	09:04 (WEA 1) 09:40 (WEA 1)	07:20 18:20	09:13 (WEA 1) 19:04	06:18 20:51	05:37 21:32	05:33 21:48	06:48 21:22	07:34 19:20	07:21 18:26	08:54 (WEA 1) 16:45	08:37 19:12 (WEA 2)
31	08:12 17:29	09:04 (WEA 1) 09:41 (WEA 1)	07:18 18:21	09:12 (WEA 1) 19:05	06:16 20:52	05:36 21:33	05:34 21:49	06:49 21:23	07:35 19:21	07:22 18:27	08:55 (WEA 1) 16:46	08:38 19:13 (WEA 2)
Sonnscheinstunden												269
astr. max. mögl. Beschattung												721
Red. Sonnscheinwahrsch.												0,15
Reduktion Betriebsdauer												0,93
Reduktion Windrichtung												0,53
Gesamte Reduktion												0,07
Met. wahrsch. Beschattung												52

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)



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: ZusatzbelastungSchattenrezeptor: N-29 - 189, Rue Pierre Gansen, 4570 Niederkorn  
 Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
 1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
 300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	09:37 (WEA 2) 10:05 (WEA 2)	08:10 17:31	08:57 (WEA 1) 18:18	07:22 20:07	07:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	08:27 (WEA 1) 16:40
2	08:33 16:48	09:37 (WEA 2) 10:05 (WEA 2)	08:09 17:31	08:57 (WEA 1) 18:20	07:20 20:09	07:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:27 (WEA 1) 16:39
3	08:33 16:49	09:38 (WEA 2) 10:07 (WEA 2)	08:08 17:35	08:57 (WEA 1) 18:21	07:18 20:10	07:12 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:27 (WEA 1) 16:38
4	08:33 16:50	09:38 (WEA 2) 10:06 (WEA 2)	08:06 17:36	08:56 (WEA 1) 18:23	07:16 20:12	07:10 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:26 (WEA 1) 16:38
5	08:33 16:51	09:38 (WEA 2) 10:07 (WEA 2)	08:05 17:38	08:57 (WEA 1) 18:25	07:13 20:13	07:08 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:26 (WEA 1) 16:38
6	08:33 16:52	09:40 (WEA 2) 10:07 (WEA 2)	08:03 17:40	08:56 (WEA 1) 18:26	07:11 20:15	07:05 20:58	05:32 21:39	05:37 21:47	06:13 21:11	06:58 20:12	07:43 19:07	08:27 (WEA 1) 16:38
7	08:33 16:54	09:40 (WEA 2) 10:07 (WEA 2)	08:02 17:41	08:56 (WEA 1) 18:28	07:09 20:16	07:03 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	08:27 (WEA 1) 16:38
8	08:33 16:55	09:41 (WEA 2) 10:08 (WEA 2)	08:00 17:43	08:57 (WEA 1) 18:29	07:07 20:18	07:01 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:27 (WEA 1) 16:38
9	08:33 16:56	09:41 (WEA 2) 10:08 (WEA 2)	07:58 17:45	08:57 (WEA 1) 18:31	07:05 20:19	06:59 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:28 (WEA 1) 16:37
10	08:31 16:57	09:42 (WEA 2) 10:08 (WEA 2)	07:57 17:46	08:57 (WEA 1) 18:33	07:03 20:21	06:57 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:58	08:28 (WEA 1) 16:37
11	08:31 16:59	09:43 (WEA 2) 10:09 (WEA 2)	07:55 17:48	08:57 (WEA 1) 18:34	07:01 20:22	06:55 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:29 (WEA 1) 16:37
12	08:30 17:00	09:43 (WEA 2) 10:10 (WEA 2)	07:53 17:50	08:58 (WEA 1) 18:36	06:59 20:24	06:53 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:29 (WEA 1) 16:37
13	08:30 17:01	09:45 (WEA 2) 10:10 (WEA 2)	07:52 17:51	08:59 (WEA 1) 18:37	06:57 20:25	06:51 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:30 (WEA 1) 16:37
14	08:29 17:03	09:46 (WEA 2) 10:11 (WEA 2)	07:50 17:53	08:59 (WEA 1) 18:39	06:55 20:27	06:49 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	08:31 (WEA 1) 16:37
15	08:28 17:04	09:47 (WEA 2) 10:12 (WEA 2)	07:48 17:55	09:00 (WEA 1) 18:41	06:47 20:29	06:43 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	08:33 (WEA 1) 16:37
16	08:28 17:06	09:48 (WEA 2) 10:13 (WEA 2)	07:46 17:57	09:01 (WEA 1) 18:42	06:45 20:30	06:40 21:15	05:29 21:46	05:46 21:39	06:28 20:54	07:13 19:50	07:58 18:46	08:34 (WEA 1) 16:37
17	08:27 17:07	09:50 (WEA 2) 10:14 (WEA 2)	07:45 17:58	09:04 (WEA 1) 18:44	06:43 20:32	06:38 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	08:35 (WEA 1) 16:37
18	08:26 17:09	09:52 (WEA 2) 10:15 (WEA 2)	07:43 18:00	09:05 (WEA 1) 18:46	06:41 20:33	06:36 21:17	05:29 21:46	05:50 21:39	06:31 20:50	07:16 19:46	08:01 18:42	08:38 (WEA 1) 16:38
19	08:25 17:10	09:55 (WEA 2) 10:16 (WEA 2)	07:41 18:02	09:08 (WEA 1) 18:47	06:40 20:35	06:35 21:19	05:29 21:47	05:57 21:36	06:32 20:48	07:17 19:44	08:03 18:40	08:39 (WEA 1) 16:38
20	08:24 17:12	09:59 (WEA 2) 10:17 (WEA 2)	07:39 18:03	09:22 (WEA 1) 18:48	06:42 20:36	06:37 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	08:43 (WEA 1) 16:39
21	08:23 17:13	10:00 (WEA 2) 10:18 (WEA 2)	07:37 18:05	09:23 (WEA 1) 18:49	06:40 20:37	06:35 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	08:51 (WEA 1) 16:39
22	08:22 17:15	10:01 (WEA 2) 10:19 (WEA 2)	07:35 18:07	09:24 (WEA 1) 18:50	06:38 20:38	06:33 21:22	05:30 21:47	05:53 21:34	06:37 20:44	07:22 19:39	08:08 18:36	09:02 (WEA 1) 16:40
23	08:21 17:16	10:02 (WEA 2) 10:20 (WEA 2)	07:33 18:08	09:25 (WEA 1) 18:51	06:36 20:39	06:31 21:23	05:30 21:48	05:55 21:35	06:38 20:42	07:23 19:37	08:09 18:35	09:03 (WEA 1) 16:40
24	08:20 17:18	10:03 (WEA 2) 10:21 (WEA 2)	07:31 18:10	09:26 (WEA 1) 18:52	06:35 20:40	06:30 21:24	05:30 21:48	05:56 21:32	06:39 20:43	07:25 19:38	08:11 18:33	09:04 (WEA 1) 16:41
25	08:19 17:20	10:04 (WEA 2) 10:22 (WEA 2)	07:30 18:12	09:27 (WEA 1) 18:53	06:34 20:41	06:29 21:25	05:30 21:48	05:57 21:33	06:41 20:38	07:26 19:33	08:12 18:31	09:05 (WEA 1) 16:41
26	08:18 17:21	10:05 (WEA 2) 10:23 (WEA 2)	07:28 18:13	09:28 (WEA 1) 18:54	06:33 20:42	06:28 21:26	05:30 21:48	05:58 21:32	06:42 20:36	07:28 19:30	08:14 18:29	09:06 (WEA 1) 16:41
27	08:17 17:22	10:06 (WEA 2) 10:24 (WEA 2)	07:26 18:14	09:29 (WEA 1) 18:55	06:32 20:43	06:27 21:27	05:30 21:48	06:00 21:31	06:44 20:34	07:29 19:28	08:16 18:27	09:07 (WEA 1) 16:42
28	08:16 17:23	10:07 (WEA 2) 10:25 (WEA 2)	07:24 18:15	09:30 (WEA 1) 18:56	06:31 20:44	06:26 21:28	05:30 21:48	06:01 21:32	06:45 20:32	07:31 19:26	08:17 18:28	09:08 (WEA 1) 16:42
29	08:15 17:24	10:08 (WEA 2) 10:26 (WEA 2)	07:22 18:16	09:31 (WEA 1) 18:57	06:30 20:45	06:25 21:29	05:30 21:48	06:02 21:33	06:46 20:31	07:32 19:25	08:18 18:29	09:09 (WEA 1) 16:42
30	08:14 17:25	10:09 (WEA 2) 10:27 (WEA 2)	07:21 18:17	09:32 (WEA 1) 18:58	06:29 20:46	06:24 21:30	05:30 21:48	06:03 21:34	06:47 20:30	07:33 19:24	08:19 18:30	09:10 (WEA 1) 16:42
31	08:13 17:26	10:10 (WEA 2) 10:28 (WEA 2)	07:20 18:18	09:33 (WEA 1) 18:59	06:28 20:47	06:23 21:31	05:30 21:48	06:04 21:35	06:48 20:29	07:34 19:23	08:20 18:31	09:11 (WEA 1) 16:42
32	08:12 17:27	10:11 (WEA 2) 10:29 (WEA 2)	07:19 18:19	09:34 (WEA 1) 19:00	06:27 20:48	06:22 21:32	05:30 21:48	06:05 21:36	06:49 20:28	07:35 19:22	08:21 18:32	09:12 (WEA 1) 16:42
33	08:12 17:28	10:12 (WEA 2) 10:30 (WEA 2)	07:18 18:20	09:35 (WEA 1) 19:01	06:26 20:49	06:21 21:33	05:30 21:48	06:06 21:37	06:50 20:27	07:36 19:21	08:22 18:33	09:13 (WEA 1) 16:42
Sonnenscheinstunden	269	283	610	368	412	475	486	491	447	379	335	275
astr. max.mögl. Beschattung	668	610	890	255	255	255	255	255	255	255	255	890
Red. Sonnenscheinwahrsch.	0,15	0,24	0,13	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,53	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,54	0,52
Gesamte Reduktion	0,07	0,12	0,06	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,06
Met. wahrsch. Beschattung	48	73	54	36	36	36	36	36	36	36	36	54

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

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





## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-30 - 65, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-31 - 53, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:32 (WEA 2) 10:00 (WEA 2)	08:10 17:31	08:55 (WEA 1) 18:18	07:22 20:07	07:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	08:25 (WEA 1) 16:40
2	08:33 16:48	09:33 (WEA 2) 10:00 (WEA 2)	08:09 17:33	08:54 (WEA 1) 18:20	07:20 20:09	07:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:25 (WEA 1) 16:40
3	08:33 16:49	09:34 (WEA 2) 10:01 (WEA 2)	08:08 17:35	08:55 (WEA 1) 18:21	07:12 20:10	07:12 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:25 (WEA 1) 16:39
4	08:33 16:50	09:33 (WEA 2) 10:00 (WEA 2)	08:06 17:36	08:54 (WEA 1) 18:23	07:10 20:12	07:10 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:24 (WEA 1) 16:39
5	08:33 16:51	09:34 (WEA 2) 10:01 (WEA 2)	08:05 17:38	08:55 (WEA 1) 18:25	07:08 20:13	07:08 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:24 (WEA 1) 16:39
6	08:33 16:52	09:35 (WEA 2) 10:02 (WEA 2)	08:03 17:40	08:55 (WEA 1) 18:26	07:11 20:15	07:11 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	08:25 (WEA 1) 16:38
7	08:33 16:54	09:35 (WEA 2) 10:01 (WEA 2)	08:02 17:41	08:55 (WEA 1) 18:27	07:09 20:16	07:09 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	08:25 (WEA 1) 16:38
8	08:33 16:55	09:36 (WEA 2) 10:02 (WEA 2)	08:00 17:43	08:55 (WEA 1) 18:30	07:07 20:18	07:07 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:25 (WEA 1) 16:38
9	08:33 16:56	09:37 (WEA 2) 10:03 (WEA 2)	08:00 17:44	08:56 (WEA 1) 18:31	07:05 20:19	07:05 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:25 (WEA 1) 16:37
10	08:31 16:57	09:38 (WEA 2) 10:04 (WEA 2)	07:57 17:46	08:56 (WEA 1) 18:33	07:03 20:21	07:03 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:59	08:26 (WEA 1) 16:37
11	08:31 16:59	09:39 (WEA 2) 10:05 (WEA 2)	07:55 17:48	08:56 (WEA 1) 18:34	07:01 20:22	07:01 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:27 (WEA 1) 16:37
12	08:30 17:00	09:40 (WEA 2) 10:06 (WEA 2)	07:53 17:50	08:57 (WEA 1) 18:36	06:59 20:24	06:59 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:27 (WEA 1) 16:37
13	08:30 17:01	09:41 (WEA 2) 10:07 (WEA 2)	07:52 17:51	08:58 (WEA 1) 18:37	06:57 20:25	06:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:28 (WEA 1) 16:37
14	08:29 17:03	09:42 (WEA 2) 10:08 (WEA 2)	07:50 17:53	08:59 (WEA 1) 18:39	06:55 20:27	06:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	08:29 (WEA 1) 16:37
15	08:28 17:04	09:43 (WEA 2) 10:09 (WEA 2)	07:48 17:55	09:00 (WEA 1) 18:41	06:47 20:29	06:47 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	08:30 (WEA 1) 16:37
16	08:28 17:06	09:44 (WEA 2) 10:10 (WEA 2)	07:46 17:57	09:02 (WEA 1) 18:42	06:45 20:30	06:45 21:15	05:29 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	08:31 (WEA 1) 16:37
17	08:27 17:07	09:45 (WEA 2) 10:11 (WEA 2)	07:45 17:58	09:05 (WEA 1) 18:44	06:43 20:32	06:43 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	08:33 (WEA 1) 16:38
18	08:26 17:09	09:46 (WEA 2) 10:12 (WEA 2)	07:43 18:00	09:10 (WEA 1) 18:45	06:41 20:33	06:41 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	08:35 (WEA 1) 16:38
19	08:25 17:10	09:47 (WEA 2) 10:13 (WEA 2)	07:41 18:02	09:11 (WEA 1) 18:46	06:39 20:35	06:39 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	08:36 (WEA 1) 16:38
20	08:24 17:12	09:48 (WEA 2) 10:14 (WEA 2)	07:39 18:03	09:12 (WEA 1) 18:47	06:37 20:36	06:37 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	08:39 (WEA 1) 16:39
21	08:23 17:13	09:49 (WEA 2) 10:15 (WEA 2)	07:37 18:05	09:13 (WEA 1) 18:48	06:35 20:38	06:35 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	08:40 (WEA 1) 16:39
22	08:22 17:15	09:50 (WEA 2) 10:16 (WEA 2)	07:35 18:07	09:14 (WEA 1) 18:49	06:33 20:39	06:33 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	08:41 (WEA 1) 16:39
23	08:21 17:16	09:51 (WEA 2) 10:17 (WEA 2)	07:33 18:08	09:15 (WEA 1) 18:50	06:31 20:40	06:31 21:24	05:30 21:48	05:55 21:30	06:38 20:40	07:23 19:35	08:09 18:33	08:42 (WEA 1) 16:40
24	08:20 17:18	09:52 (WEA 2) 10:18 (WEA 2)	07:31 18:10	09:16 (WEA 1) 18:51	06:29 20:42	06:29 21:25	05:30 21:48	05:56 21:31	06:39 20:38	07:25 19:33	08:11 18:31	08:43 (WEA 1) 16:41
25	08:19 17:20	09:53 (WEA 2) 10:19 (WEA 2)	07:30 18:12	09:17 (WEA 1) 18:52	06:27 20:44	06:27 21:26	05:30 21:48	05:57 21:29	06:41 20:36	07:26 19:30	07:13 18:29	08:44 (WEA 1) 16:41
26	08:18 17:21	09:54 (WEA 2) 10:20 (WEA 2)	07:28 18:13	09:18 (WEA 1) 18:53	06:25 20:45	06:25 21:28	05:30 21:48	05:58 21:27	06:42 20:34	07:28 19:28	07:14 18:27	08:45 (WEA 1) 16:42
27	08:17 17:23	09:55 (WEA 2) 10:21 (WEA 2)	07:26 18:15	09:19 (WEA 1) 18:54	06:23 20:46	06:23 21:30	05:30 21:48	06:00 21:26	06:44 20:32	07:29 19:26	07:16 18:24	08:46 (WEA 1) 16:43
28	08:16 17:24	09:56 (WEA 2) 10:22 (WEA 2)	07:24 18:17	09:20 (WEA 1) 18:55	06:22 20:47	06:22 21:31	05:30 21:48	06:01 21:25	06:45 20:30	07:31 19:24	07:17 18:27	08:47 (WEA 1) 16:43
29	08:14 17:26	09:57 (WEA 2) 10:23 (WEA 2)	07:22 18:19	09:21 (WEA 1) 18:56	06:20 20:48	06:20 21:32	05:30 21:48	06:02 21:23	06:47 20:28	07:32 19:22	07:19 18:28	08:48 (WEA 1) 16:44
30	08:13 17:28	09:58 (WEA 2) 10:24 (WEA 2)	07:20 18:20	09:22 (WEA 1) 18:57	06:18 20:49	06:18 21:33	05:30 21:48	06:04 21:22	06:48 20:26	07:34 19:20	07:21 18:29	08:49 (WEA 1) 16:45
31	08:12 17:29	09:59 (WEA 2) 10:25 (WEA 2)	07:18 18:21	09:23 (WEA 1) 19:00	06:16 20:50	06:16 21:34	05:30 21:48	06:06 21:24	06:50 20:24	07:22 19:18	07:22 18:31	08:50 (WEA 1) 16:46
Sonnenscheinstunden	269	283	514	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	637	514	185									690
Red. Sonnenscheinwahrsch.	0,15	0,24	0,28									0,15
Reduktion Betriebsdauer	0,93	0,93	0,93									0,93
Reduktion Windrichtung	0,53	0,54	0,54									0,52
Gesamte Reduktion	0,07	0,12	0,14									0,06
Met. wahrsch. Beschattung	45	61	26									51

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-32 - 38, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:32 (WEA 2) 10:00 (WEA 2)	08:10 17:31	08:54 (WEA 1) 18:18	07:22 20:07	06:16 20:53	05:36 21:34	06:06 21:19	06:51 20:22	07:35 19:18	08:23 (WEA 1) 17:16	08:11 16:40
2	08:33 16:48	09:32 (WEA 2) 10:01 (WEA 2)	08:09 17:33	08:53 (WEA 1) 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	08:23 (WEA 1) 17:15	08:12 16:40
3	08:33 16:49	09:33 (WEA 2) 10:01 (WEA 2)	08:08 17:35	08:54 (WEA 1) 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	08:23 (WEA 1) 17:13	08:13 16:39
4	08:33 16:50	09:33 (WEA 2) 10:01 (WEA 2)	08:06 17:36	08:53 (WEA 1) 18:23	07:10 20:12	06:11 20:57	05:33 21:37	06:11 21:46	06:56 20:16	07:40 19:11	08:22 (WEA 1) 17:11	08:14 16:39
5	08:33 16:51	09:33 (WEA 2) 10:01 (WEA 2)	08:05 17:38	08:53 (WEA 1) 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:12 21:46	06:57 20:14	07:41 19:09	08:23 (WEA 1) 17:10	08:16 16:39
6	08:33 16:52	09:34 (WEA 2) 10:02 (WEA 2)	08:03 17:40	08:53 (WEA 1) 18:26	07:11 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	08:23 (WEA 1) 17:08	08:17 16:38
7	08:33 16:52	09:34 (WEA 2) 10:02 (WEA 2)	08:02 17:40	08:53 (WEA 1) 18:26	07:09 20:15	06:06 21:00	05:32 21:39	06:13 21:11	07:00 20:12	07:44 19:07	08:24 (WEA 1) 17:08	08:18 16:38
8	08:33 16:55	09:34 (WEA 2) 10:02 (WEA 2)	08:00 17:43	08:53 (WEA 1) 18:30	07:07 20:18	06:04 21:03	05:31 21:41	06:16 21:45	07:01 20:18	07:46 19:03	08:24 (WEA 1) 17:05	08:19 16:38
9	08:32 16:56	09:35 (WEA 2) 10:03 (WEA 2)	07:58 17:45	08:53 (WEA 1) 18:30	07:05 20:19	06:03 21:05	05:31 21:41	06:18 21:44	07:03 20:05	07:47 19:01	08:24 (WEA 1) 17:04	08:20 16:37
10	08:31 16:57	09:37 (WEA 2) 10:03 (WEA 2)	07:57 17:46	08:53 (WEA 1) 18:33	07:03 20:21	06:01 21:06	05:31 21:42	06:19 21:43	07:04 20:03	07:49 18:59	08:25 (WEA 1) 17:02	08:21 16:37
11	08:31 16:59	09:37 (WEA 2) 10:03 (WEA 2)	07:55 17:48	08:53 (WEA 1) 18:34	07:01 20:22	06:00 21:08	05:30 21:43	06:21 21:43	07:06 20:01	07:50 18:56	08:26 (WEA 1) 17:01	08:22 16:37
12	08:30 17:00	09:38 (WEA 2) 10:04 (WEA 2)	07:53 17:50	08:54 (WEA 1) 18:36	06:59 20:24	05:58 21:09	05:30 21:43	06:22 21:42	07:07 20:01	07:52 18:54	08:26 (WEA 1) 16:59	08:23 16:37
13	08:30 17:01	09:39 (WEA 2) 10:04 (WEA 2)	07:52 17:51	08:55 (WEA 1) 18:37	06:57 20:25	05:57 21:11	05:30 21:44	06:23 21:41	07:09 20:03	07:54 18:52	08:28 (WEA 1) 16:58	08:24 16:37
14	08:29 17:03	09:40 (WEA 2) 10:05 (WEA 2)	07:50 17:53	08:55 (WEA 1) 18:39	06:49 20:27	05:55 21:12	05:30 21:45	06:25 21:40	07:10 20:01	07:55 18:50	08:29 (WEA 1) 16:57	08:25 16:37
15	08:28 17:04	09:41 (WEA 2) 10:06 (WEA 2)	07:48 17:55	08:56 (WEA 1) 18:41	06:47 20:29	05:54 21:13	05:29 21:45	06:26 21:39	07:12 20:02	07:57 18:48	08:31 (WEA 1) 16:56	08:26 16:37
16	08:28 17:06	09:42 (WEA 2) 10:06 (WEA 2)	07:46 17:57	08:57 (WEA 1) 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:28 21:39	07:13 20:04	07:58 18:46	08:32 (WEA 1) 16:54	08:27 16:37
17	08:27 17:07	09:43 (WEA 2) 10:07 (WEA 2)	07:45 17:58	08:59 (WEA 1) 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:29 21:38	07:15 20:05	08:00 18:44	08:34 (WEA 1) 16:53	08:28 16:38
18	08:26 17:09	09:45 (WEA 2) 10:09 (WEA 2)	07:43 18:00	09:01 (WEA 1) 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:31 21:37	07:16 20:04	08:01 18:42	08:37 (WEA 1) 16:52	08:28 16:38
19	08:25 17:10	09:47 (WEA 2) 10:11 (WEA 2)	07:41 18:02	09:04 (WEA 1) 18:47	06:39 20:35	05:49 21:19	05:29 21:47	06:32 21:36	07:17 20:04	08:03 18:40	08:39 (WEA 1) 16:51	08:29 16:38
20	08:24 17:12	09:50 (WEA 2) 10:14 (WEA 2)	07:39 18:03	09:17 (WEA 1) 18:47	06:37 20:36	05:47 21:20	05:30 21:47	06:34 21:35	07:19 20:06	08:05 18:38	08:40 (WEA 1) 16:50	08:30 16:39
21	08:23 17:13	09:55 (WEA 2) 10:19 (WEA 2)	07:37 18:05	09:22 (WEA 1) 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:35 21:34	07:20 20:04	08:06 18:36	08:41 (WEA 1) 16:49	08:30 16:39
22	08:22 17:15	09:55 (WEA 2) 10:19 (WEA 2)	07:35 18:07	09:22 (WEA 1) 18:50	06:33 20:39	05:45 21:23	05:30 21:48	06:37 21:32	07:22 20:03	08:08 18:35	08:42 (WEA 1) 16:48	08:31 16:39
23	08:21 17:16	09:55 (WEA 2) 10:19 (WEA 2)	07:33 18:08	09:22 (WEA 1) 18:50	06:31 20:41	05:44 21:24	05:30 21:48	06:38 21:31	07:23 20:04	08:09 18:33	08:43 (WEA 1) 16:47	08:32 16:40
24	08:20 17:18	09:55 (WEA 2) 10:19 (WEA 2)	07:31 18:10	09:22 (WEA 1) 18:50	06:29 20:42	05:43 21:25	05:30 21:48	06:39 21:30	07:25 20:05	08:11 18:31	08:44 (WEA 1) 16:46	08:32 16:41
25	08:19 17:20	09:55 (WEA 2) 10:19 (WEA 2)	07:30 18:12	09:22 (WEA 1) 18:50	06:27 20:44	05:42 21:26	05:30 21:48	06:41 21:29	07:26 20:06	08:13 18:29	08:45 (WEA 1) 16:45	08:33 16:41
26	08:18 17:21	09:55 (WEA 2) 10:19 (WEA 2)	07:28 18:13	09:22 (WEA 1) 18:50	06:25 20:45	05:41 21:28	05:30 21:48	06:42 21:27	07:28 20:06	08:14 18:27	08:46 (WEA 1) 16:44	08:34 16:42
27	08:17 17:22	09:55 (WEA 2) 10:19 (WEA 2)	07:26 18:14	09:22 (WEA 1) 18:50	06:23 20:46	05:40 21:29	05:30 21:48	06:44 21:26	07:29 20:07	08:15 18:28	08:47 (WEA 1) 16:43	08:35 16:42
28	08:16 17:23	09:55 (WEA 2) 10:19 (WEA 2)	07:24 18:15	09:22 (WEA 1) 18:50	06:22 20:47	05:39 21:30	05:30 21:48	06:45 21:25	07:31 20:08	08:16 18:29	08:48 (WEA 1) 16:42	08:36 16:42
29	08:14 17:24	09:55 (WEA 2) 10:19 (WEA 2)	07:22 18:17	09:22 (WEA 1) 18:50	06:20 20:48	05:38 21:30	05:30 21:48	06:47 21:25	07:32 20:10	08:17 18:30	08:49 (WEA 1) 16:41	08:37 16:42
30	08:13 17:25	09:55 (WEA 2) 10:19 (WEA 2)	07:20 18:18	09:22 (WEA 1) 18:50	06:18 20:49	05:37 21:31	05:30 21:48	06:48 21:23	07:34 20:12	08:18 18:31	08:50 (WEA 1) 16:40	08:38 16:42
31	08:12 17:26	09:55 (WEA 2) 10:19 (WEA 2)	07:18 18:19	09:22 (WEA 1) 18:50	06:16 20:50	05:35 21:32	05:30 21:48	06:49 21:24	07:35 20:14	08:19 18:32	08:51 (WEA 1) 16:39	08:39 16:42
Summe	269	283	583	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	638	583	583							252	679	873
Red. Sonnscheinwahrsch.	0,15	0,24	0,24							0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	0,93
Reduktion Windrichtung	0,53	0,55	0,55							0,54	0,54	0,52
Gesamte Reduktion	0,07	0,12	0,12							0,14	0,07	0,06
Met. wahrsch. Beschattung	45	70	70							35	51	52

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-33 - 183, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	09:28 (WEA 2) 17:31	08:10 17:31	08:52 (WEA 1) 18:22	07:22 20:07	07:16 20:53	06:36 21:34	05:34 21:47	06:06 20:22	06:51 19:18	07:35 17:16	08:18 (WEA 1) 16:40
2	08:33 16:48	09:29 (WEA 2) 17:33	08:09 17:33	08:51 (WEA 1) 18:20	07:20 20:09	07:14 20:54	06:35 21:35	05:34 21:47	06:08 21:18	06:53 20:15	07:37 19:15	08:18 (WEA 1) 16:40
3	08:33 16:49	09:29 (WEA 2) 17:35	08:08 17:35	08:50 (WEA 1) 18:21	07:18 20:10	07:12 20:56	06:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:18 (WEA 1) 16:39
4	08:33 16:50	09:29 (WEA 2) 17:36	08:06 17:36	08:49 (WEA 1) 18:22	07:16 20:11	07:10 20:57	06:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:18 (WEA 1) 16:39
5	08:33 16:51	09:30 (WEA 2) 17:37	08:05 17:37	08:50 (WEA 1) 18:23	07:13 20:12	07:08 20:59	06:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:19 (WEA 1) 16:38
6	08:33 16:52	09:31 (WEA 2) 17:38	08:03 17:38	08:49 (WEA 1) 18:24	07:11 20:15	07:05 20:58	06:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	08:19 (WEA 1) 16:38
7	08:33 16:53	09:32 (WEA 2) 17:39	08:02 17:39	08:48 (WEA 1) 18:25	07:09 20:16	07:03 20:59	06:32 21:40	05:38 21:45	06:15 21:09	07:00 20:09	07:44 19:05	08:20 (WEA 1) 16:37
8	08:33 16:54	09:33 (WEA 2) 17:41	08:00 17:41	08:47 (WEA 1) 18:26	07:07 20:17	07:01 20:59	06:31 21:41	05:39 21:46	06:16 21:07	07:01 20:07	07:46 19:03	08:20 (WEA 1) 16:37
9	08:33 16:55	09:34 (WEA 2) 17:42	07:58 17:42	08:46 (WEA 1) 18:27	07:05 20:18	06:59 21:03	06:31 21:42	05:40 21:45	06:19 21:08	07:04 20:07	07:49 19:03	08:21 (WEA 1) 16:37
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-34 - 194, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-35 - 173, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-36 - 28, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:25 (WEA 2) 09:53 (WEA 1)	08:10 17:31	08:50 (WEA 1) 18:18	07:22 20:07	07:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	08:16 (WEA 1) 16:40
2	08:33 16:48	09:25 (WEA 2) 09:53 (WEA 1)	08:09 17:33	08:49 (WEA 1) 18:20	07:14 20:09	07:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:16 (WEA 1) 16:40
3	08:33 16:49	09:26 (WEA 2) 09:54 (WEA 1)	08:08 17:35	08:48 (WEA 1) 18:21	07:12 20:10	07:12 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:17 (WEA 1) 16:39
4	08:33 16:50	09:26 (WEA 2) 09:54 (WEA 1)	08:06 17:36	08:47 (WEA 1) 18:23	07:10 20:12	07:10 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:16 (WEA 1) 16:39
5	08:33 16:51	09:26 (WEA 2) 09:55 (WEA 1)	08:05 17:38	08:48 (WEA 1) 18:25	07:08 20:13	07:08 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:17 (WEA 1) 16:39
6	08:33 16:52	09:27 (WEA 2) 09:55 (WEA 1)	08:03 17:40	08:47 (WEA 1) 18:26	07:11 20:15	07:11 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	08:17 (WEA 1) 16:38
7	08:33 16:52	09:27 (WEA 2) 09:55 (WEA 1)	08:02 17:41	08:46 (WEA 1) 18:26	07:09 20:15	07:09 21:00	05:32 21:39	05:38 21:46	06:15 21:11	07:00 20:12	07:44 19:07	08:18 (WEA 1) 16:38
8	08:33 16:55	09:27 (WEA 2) 09:56 (WEA 1)	08:00 17:43	08:47 (WEA 1) 18:30	07:07 20:18	07:07 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:18 (WEA 1) 16:38
9	08:32 16:56	09:28 (WEA 2) 09:56 (WEA 1)	08:00 17:45	08:46 (WEA 1) 18:31	07:05 20:19	07:05 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:18 (WEA 1) 16:37
10	08:31 16:57	09:29 (WEA 2) 09:57 (WEA 1)	07:57 17:46	08:46 (WEA 1) 18:33	07:03 20:21	07:03 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:59	08:19 (WEA 1) 16:37
11	08:31 16:59	09:29 (WEA 2) 09:57 (WEA 1)	07:55 17:48	08:46 (WEA 1) 18:34	07:01 20:22	07:01 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:22 (WEA 1) 16:37
12	08:30 17:00	09:30 (WEA 2) 09:58 (WEA 1)	07:53 17:50	08:47 (WEA 1) 18:36	06:59 20:24	06:59 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:23 (WEA 1) 16:37
13	08:30 17:01	09:31 (WEA 2) 09:59 (WEA 1)	07:52 17:51	08:47 (WEA 1) 18:37	06:57 20:25	06:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:25 (WEA 1) 16:37
14	08:29 17:03	09:32 (WEA 2) 09:59 (WEA 1)	07:50 17:53	08:47 (WEA 1) 18:39	06:55 20:27	06:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	08:26 (WEA 1) 16:37
15	08:28 17:04	09:32 (WEA 2) 09:59 (WEA 1)	07:48 17:55	08:48 (WEA 1) 18:41	06:47 20:29	06:47 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	08:27 (WEA 1) 16:37
16	08:28 17:06	09:33 (WEA 2) 09:59 (WEA 1)	07:46 17:57	08:48 (WEA 1) 18:42	06:45 20:30	06:45 21:15	05:29 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	08:28 (WEA 1) 16:37
17	08:27 17:07	09:34 (WEA 2) 09:59 (WEA 1)	07:45 17:58	08:50 (WEA 1) 18:44	06:43 20:32	06:43 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	08:29 (WEA 1) 16:38
18	08:26 17:09	09:35 (WEA 2) 09:59 (WEA 1)	07:43 18:00	08:51 (WEA 1) 18:45	06:41 20:33	06:41 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	08:31 (WEA 1) 16:38
19	08:25 17:10	09:36 (WEA 2) 09:59 (WEA 1)	07:41 18:02	08:52 (WEA 1) 18:47	06:39 20:35	06:39 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	08:32 (WEA 1) 16:38
20	08:24 17:12	09:37 (WEA 2) 09:59 (WEA 1)	07:39 18:03	08:54 (WEA 1) 18:48	06:37 20:36	06:37 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	08:33 (WEA 1) 16:39
21	08:23 17:13	09:38 (WEA 2) 09:59 (WEA 1)	07:37 18:05	08:56 (WEA 1) 18:50	06:35 20:38	06:35 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	08:34 (WEA 1) 16:39
22	08:22 17:15	09:41 (WEA 2) 09:59 (WEA 1)	07:35 18:07	08:57 (WEA 1) 18:52	06:33 20:39	06:33 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	08:35 (WEA 1) 16:39
23	08:21 17:16	09:42 (WEA 2) 09:59 (WEA 1)	07:33 18:08	08:58 (WEA 1) 18:53	06:31 20:41	06:31 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	08:36 (WEA 1) 16:40
24	08:20 17:18	09:43 (WEA 2) 09:59 (WEA 1)	07:31 18:10	08:59 (WEA 1) 18:54	06:29 20:42	06:29 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 19:33	08:11 18:31	08:37 (WEA 1) 16:41
25	08:19 17:20	09:44 (WEA 2) 09:59 (WEA 1)	07:30 18:12	09:00 (WEA 1) 18:56	06:27 20:44	06:27 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:30	07:13 18:29	08:38 (WEA 1) 16:41
26	08:18 17:21	09:45 (WEA 2) 09:59 (WEA 1)	07:28 18:13	09:01 (WEA 1) 18:58	06:25 20:45	06:25 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 19:28	07:14 18:27	08:39 (WEA 1) 16:42
27	08:17 17:23	09:46 (WEA 2) 09:59 (WEA 1)	07:26 18:15	09:02 (WEA 1) 18:59	06:23 20:47	06:23 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 19:26	07:16 18:25	08:40 (WEA 1) 16:43
28	08:16 17:24	09:47 (WEA 2) 09:59 (WEA 1)	07:24 18:17	09:03 (WEA 1) 19:01	06:22 20:48	06:22 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	07:17 18:23	08:41 (WEA 1) 16:43
29	08:14 17:26	09:48 (WEA 2) 09:59 (WEA 1)	07:22 18:19	09:04 (WEA 1) 19:02	06:20 20:50	06:20 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 19:22	07:19 18:22	08:42 (WEA 1) 16:44
30	08:13 17:28	09:49 (WEA 2) 09:59 (WEA 1)	07:20 18:21	09:05 (WEA 1) 19:04	06:18 20:51	06:18 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	07:21 18:24	08:43 (WEA 1) 16:45
31	08:12 17:29	09:50 (WEA 2) 09:59 (WEA 1)	07:18 18:24	09:06 (WEA 1) 19:05	06:16 20:56	06:16 21:33	05:34 21:49	06:05 21:21	06:49 20:24	07:35 19:21	07:22 18:25	08:44 (WEA 1) 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	620	618									618	860
Red. Sonnenscheinwahrsch.	0,15	0,24									0,15	0,13
Reduktion Betriebsdauer	0,93	0,93									0,93	0,93
Reduktion Windrichtung	0,52	0,55									0,54	0,51
Gesamte Reduktion	0,07	0,12									0,07	0,06
Met. wahrsch. Beschattung	43	75								45	46	51

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-37 - 18, Rue de Sanem, 4664 Niederkorn

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Jun	Jul	Aug	Sep	Okt	Nov	Dez	
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-38 - 18, Rue de Sanem, 4664 Niederkorn

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:17 (WEA 2) 17:31	08:10 18:18	08:48 (WEA 1) 18:18	07:22 20:07	07:16 20:53	05:36 21:34	05:34 21:47	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16
2	08:33 16:48	09:17 (WEA 2) 17:33	08:09 18:18	08:45 (WEA 1) 18:20	07:20 20:09	07:14 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15
3	08:33 16:49	09:18 (WEA 2) 17:35	08:08 18:21	08:44 (WEA 1) 18:21	07:18 20:10	07:12 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	09:17 (WEA 2) 17:36	08:06 18:23	08:42 (WEA 1) 18:23	07:16 20:12	07:10 20:57	05:33 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	09:18 (WEA 2) 17:33	08:05 18:25	08:42 (WEA 1) 18:25	07:13 20:13	07:08 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	09:19 (WEA 2) 17:40	08:03 18:26	08:41 (WEA 1) 18:26	07:11 20:15	07:05 20:58	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08
7	08:33 16:53	09:18 (WEA 2) 17:41	08:02 18:27	08:40 (WEA 1) 18:27	07:09 20:16	07:03 20:58	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	09:19 (WEA 2) 17:43	08:00 18:29	08:40 (WEA 1) 18:30	07:07 20:18	07:01 20:59	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	09:19 (WEA 2) 17:45	08:00 18:31	08:39 (WEA 1) 18:31	07:05 20:19	06:59 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04
10	08:31 16:57	09:20 (WEA 2) 17:46	07:57 18:32	08:38 (WEA 1) 18:33	07:03 20:21	06:57 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02
11	08:31 16:59	09:20 (WEA 2) 17:48	07:55 18:32	08:38 (WEA 1) 18:34	07:01 20:22	06:55 20:22	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	09:21 (WEA 2) 17:50	07:53 18:33	08:38 (WEA 1) 18:36	06:59 20:24	06:53 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	09:21 (WEA 2) 17:51	07:52 18:33	08:38 (WEA 1) 18:37	06:57 20:25	06:51 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	07:44 16:58
14	08:29 17:03	09:21 (WEA 2) 17:50	07:50 18:32	08:38 (WEA 1) 18:39	06:55 20:27	06:49 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	09:22 (WEA 2) 17:55	07:48 18:32	08:38 (WEA 1) 18:41	06:47 20:29	06:47 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56
16	08:28 17:06	09:22 (WEA 2) 17:57	07:46 18:31	08:38 (WEA 1) 18:42	06:45 20:30	06:45 21:15	05:29 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	09:23 (WEA 2) 18:00	07:43 18:29	08:40 (WEA 1) 18:45	06:43 20:33	06:43 21:17	05:29 21:46	05:48 21:37	06:29 20:50	07:15 19:46	08:00 18:42	07:50 16:52
18	08:26 17:09	09:24 (WEA 2) 18:01	07:41 18:30	08:40 (WEA 1) 18:44	06:44 20:32	06:39 21:16	05:29 21:46	05:50 21:38	06:32 20:52	07:17 19:48	08:03 18:44	07:51 16:53
19	08:25 17:10	09:24 (WEA 2) 18:02	07:41 18:30	08:41 (WEA 1) 18:47	06:44 20:35	06:39 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	07:51 16:51
20	08:24 17:12	09:25 (WEA 2) 18:03	07:39 18:25	08:42 (WEA 1) 18:48	06:42 20:36	06:37 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	07:55 16:50
21	08:23 17:13	09:26 (WEA 2) 18:05	07:37 18:22	08:43 (WEA 1) 18:50	06:35 20:38	06:35 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:52
22	08:22 17:15	09:27 (WEA 2) 18:07	07:35 18:23	08:45 (WEA 1) 18:52	06:33 20:39	06:33 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	07:58 16:51
23	08:21 17:16	09:28 (WEA 2) 18:08	07:33 18:20	08:47 (WEA 1) 18:53	06:31 20:41	06:31 21:24	05:30 21:48	05:55 21:30	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:52
24	08:20 17:18	09:30 (WEA 2) 18:10	07:31 18:12	08:49 (WEA 1) 18:55	06:29 20:42	06:29 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 19:31	08:11 18:31	08:01 16:46
25	08:19 17:20	09:32 (WEA 2) 18:12	07:30 18:12	08:50 (WEA 1) 18:56	06:27 20:44	06:27 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:30	08:13 18:30	08:09 16:45
26	08:18 17:21	09:34 (WEA 2) 18:13	07:28 18:13	08:51 (WEA 1) 18:58	06:25 20:45	06:25 21:28	05:31 21:48	05:58 21:27	06:42 20:34	07:28 19:28	08:14 18:32	08:10 16:44
27	08:17 17:23	09:36 (WEA 2) 18:15	07:26 18:15	08:52 (WEA 1) 18:59	06:23 20:47	06:23 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 19:26	08:15 18:32	08:11 16:43
28	08:16 17:24	09:38 (WEA 2) 18:17	07:24 18:17	08:53 (WEA 1) 19:01	06:22 20:48	06:22 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	08:16 18:33	08:12 16:43
29	08:14 17:26	09:40 (WEA 2) 18:19	07:22 18:19	08:54 (WEA 1) 19:02	06:20 20:50	06:20 21:31	05:32 21:48	06:02 21:23	06:47 20:38	07:32 19:22	08:19 18:34	08:13 16:44
30	08:13 17:28	09:42 (WEA 2) 18:21	07:20 18:21	08:55 (WEA 1) 19:03	06:18 20:51	06:18 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	08:20 18:35	08:15 16:45
31	08:12 17:29	09:44 (WEA 2) 18:23	07:18 18:23	08:56 (WEA 1) 19:05	06:16 20:53	06:16 21:33	05:34 21:48	06:05 21:21	06:50 20:24	07:22 19:18	08:21 18:36	08:16 16:46
Sonnenscheinstunden	269	283	598	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	615	598	598							369	567	759
Red. Sonnenscheinwahrsch.	0,15	0,24	0,24							0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	0,93
Reduktion Windrichtung	0,51	0,56	0,56							0,53	0,53	0,51
Gesamte Reduktion	0,07	0,12	0,12							0,14	0,07	0,06
Met. wahrsch. Beschattung	42	73	73							53	41	44

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-39 - 8, Rue de Sanem, 4664 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	09:14 (WEA 2) 09:37 (WEA 2)	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:06 21:47	06:51 20:22	07:35 19:18	07:24 17:16	08:05 (WEA 1) 08:33 (WEA 1)
2	08:33 16:48	09:15 (WEA 2) 09:37 (WEA 2)	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:47	06:53 20:20	07:37 19:15	07:26 17:15	08:06 (WEA 1) 08:32 (WEA 1)
3	08:33 16:49	09:15 (WEA 2) 09:38 (WEA 2)	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:47	06:54 20:18	07:38 19:13	07:27 17:13	08:07 (WEA 1) 08:32 (WEA 1)
4	08:33 16:50	09:15 (WEA 2) 09:38 (WEA 2)	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:33 21:37	06:06 21:46	06:56 20:16	07:40 19:11	07:29 17:11	08:07 (WEA 1) 08:30 (WEA 1)
5	08:33 16:51	09:15 (WEA 2) 09:39 (WEA 2)	08:05 17:37	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:06 21:46	06:57 20:14	07:41 19:09	07:31 17:10	08:09 (WEA 1) 08:28 (WEA 1)
6	08:33 16:52	09:16 (WEA 2) 09:40 (WEA 2)	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	06:03 21:46	06:58 20:12	07:43 19:07	07:32 17:08	08:12 (WEA 1) 08:27 (WEA 1)
7	08:33 16:54	09:16 (WEA 2) 09:41 (WEA 2)	08:02 17:41	07:09 18:26	07:03 20:15	06:06 21:02	05:32 21:40	06:03 21:45	07:00 20:09	07:44 19:05	07:34 17:07	08:15 (WEA 1) 08:30 (WEA 1)
8	08:33 16:55	09:16 (WEA 2) 09:42 (WEA 2)	08:00 17:43	07:07 18:28	07:01 20:18	06:04 21:03	05:31 21:41	06:06 21:45	07:01 20:07	07:46 19:03	07:35 17:05	08:24 (WEA 1) 08:39 (WEA 1)
9	08:33 16:56	09:16 (WEA 2) 09:43 (WEA 2)	07:58 17:44	07:05 18:30	06:59 20:22	06:03 21:08	05:31 21:43	06:08 21:47	07:03 20:01	07:47 19:01	07:37 17:04	08:30 (WEA 1) 08:45 (WEA 1)
10	08:33 16:57	09:16 (WEA 2) 09:44 (WEA 2)	07:57 17:45	07:03 18:31	06:57 20:21	06:01 21:06	05:31 21:42	06:09 21:43	07:04 20:03	07:49 18:59	07:39 17:02	08:46 (WEA 1) 09:01 (WEA 1)
11	08:33 16:59	09:16 (WEA 2) 09:45 (WEA 2)	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	09:02 (WEA 1) 09:17 (WEA 1)
12	08:33 17:00	09:16 (WEA 2) 09:46 (WEA 2)	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59	09:18 (WEA 1) 09:33 (WEA 1)
13	08:33 17:01	09:17 (WEA 2) 09:47 (WEA 2)	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	06:23 20:59	07:09 19:57	07:54 18:52	07:44 16:58	09:34 (WEA 1) 09:49 (WEA 1)
14	08:29 17:03	09:17 (WEA 2) 09:48 (WEA 2)	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57	09:50 (WEA 1) 10:05 (WEA 1)
15	08:28 17:04	09:17 (WEA 2) 09:49 (WEA 2)	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:29 21:45	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:58	10:06 (WEA 1) 10:21 (WEA 1)
16	08:28 17:06	09:18 (WEA 2) 09:50 (WEA 2)	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54	10:22 (WEA 1) 10:37 (WEA 1)
17	08:27 17:07	09:18 (WEA 2) 09:51 (WEA 2)	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:29 20:52	07:15 19:48	08:00 18:44	07:47 16:59	10:38 (WEA 1) 10:53 (WEA 1)
18	08:26 17:09	09:19 (WEA 2) 09:52 (WEA 2)	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:31 20:50	07:16 19:46	08:01 18:42	07:46 16:52	10:54 (WEA 1) 11:09 (WEA 1)
19	08:25 17:10	09:20 (WEA 2) 09:53 (WEA 2)	07:41 18:02	06:39 18:47	06:39 20:35	05:49 21:19	05:29 21:47	06:32 20:48	07:17 19:44	08:03 18:40	07:45 16:54	11:10 (WEA 1) 11:25 (WEA 1)
20	08:24 17:12	09:21 (WEA 2) 09:54 (WEA 2)	07:39 18:03	06:37 18:48	06:37 20:36	05:47 21:20	05:30 21:47	06:34 20:51	07:19 19:41	08:05 18:38	07:44 16:56	11:26 (WEA 1) 11:41 (WEA 1)
21	08:23 17:13	09:22 (WEA 2) 09:55 (WEA 2)	07:37 18:05	06:35 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:35 20:44	07:20 19:39	08:06 18:36	07:43 16:57	11:42 (WEA 1) 11:57 (WEA 1)
22	08:22 17:15	09:23 (WEA 2) 09:56 (WEA 2)	07:35 18:07	06:33 18:52	06:33 20:39	05:45 21:23	05:30 21:48	06:37 20:42	07:22 19:37	08:08 18:35	07:42 16:59	12:03 (WEA 1) 12:18 (WEA 1)
23	08:21 17:16	09:24 (WEA 2) 09:57 (WEA 2)	07:33 18:08	06:31 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:38 20:40	07:23 19:35	08:09 18:33	07:41 16:52	12:19 (WEA 1) 12:34 (WEA 1)
24	08:20 17:18	09:25 (WEA 2) 09:58 (WEA 2)	07:31 18:10	06:29 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:39 20:38	07:25 19:33	08:11 18:31	07:40 16:54	12:35 (WEA 1) 12:50 (WEA 1)
25	08:19 17:20	09:26 (WEA 2) 09:59 (WEA 2)	07:30 18:12	06:27 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:41 20:36	07:26 19:30	07:13 18:32	07:39 16:56	12:51 (WEA 1) 13:06 (WEA 1)
26	08:18 17:21	09:27 (WEA 2) 09:59 (WEA 2)	07:28 18:13	06:25 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:42 20:34	07:28 19:28	07:14 18:32	07:38 16:57	13:07 (WEA 1) 13:22 (WEA 1)
27	08:17 17:23	09:28 (WEA 2) 09:59 (WEA 2)	07:26 18:15	06:23 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:44 20:32	07:29 19:26	07:16 18:35	07:39 16:58	13:13 (WEA 1) 13:28 (WEA 1)
28	08:16 17:24	09:29 (WEA 2) 09:59 (WEA 2)	07:24 18:17	06:22 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:45 20:25	07:31 19:24	07:17 18:32	07:40 16:59	13:29 (WEA 1) 13:44 (WEA 1)
29	08:14 17:26	09:30 (WEA 2) 09:59 (WEA 2)	07:22 18:15	06:20 19:02	06:20 20:50	05:38 21:31	05:32 21:48	06:47 20:23	07:32 19:22	07:19 18:32	07:41 16:59	13:45 (WEA 1) 13:60 (WEA 1)
30	08:13 17:28	09:31 (WEA 2) 09:59 (WEA 2)	07:20 18:13	06:18 19:04	06:18 20:51	05:37 21:32	05:33 21:48	06:48 20:26	07:34 19:20	07:21 18:31	07:42 16:59	13:51 (WEA 1) 14:06 (WEA 1)
31	08:12 17:29	09:32 (WEA 2) 09:59 (WEA 2)	07:18 18:12	06:16 19:05	06:16 20:53	05:36 21:33	05:34 21:49	06:50 20:24	07:22 19:18	07:22 18:33	07:43 16:59	14:07 (WEA 1) 14:22 (WEA 1)
Sonnenscheinstunden	269	283	590	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	672	590	590	458	486	491	447	447	379	335	275	255
Red. Sonnenscheinwahrsch.	0,15	0,24	0,13	0,28	0,24	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,51	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56
Gesamte Reduktion	0,07	0,12	0,06	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14
Met. wahrsch. Beschattung	46	72	40	66	66	66	66	66	66	66	66	66

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-40 - 7, Rue de Sanem, 4664 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:12 (WEA 2) 17:31	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:01 (WEA 1) 16:40
2	08:33 16:48	09:12 (WEA 2) 17:33	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:03 (WEA 1) 16:40
3	08:33 16:49	09:12 (WEA 2) 17:38	08:08 17:38	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:05 (WEA 1) 16:39
4	08:33 16:50	09:11 (WEA 2) 17:36	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:11	08:07 (WEA 1) 16:39
5	08:33 16:51	09:12 (WEA 2) 17:38	08:08 17:38	07:18 18:25	07:12 20:13	06:13 20:59	05:34 21:38	06:09 21:46	06:54 20:14	07:38 19:09	07:27 17:10	08:05 (WEA 1) 16:39
6	08:33 16:52	09:12 (WEA 2) 17:40	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:01 (WEA 1) 16:38
7	08:33 16:54	09:11 (WEA 2) 17:41	08:02 17:41	07:09 18:37	07:03 20:16	06:06 21:02	05:32 21:40	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:01 (WEA 1) 16:38
8	08:32 16:55	09:12 (WEA 2) 17:43	08:00 17:43	07:07 18:53	07:01 20:18	06:04 21:03	05:31 21:41	06:16 21:45	07:01 20:07	07:46 19:03	07:35 17:05	08:01 (WEA 1) 16:38
9	08:32 16:56	09:11 (WEA 2) 17:45	07:58 17:45	07:05 18:54	06:59 20:19	06:03 21:05	05:31 21:41	06:18 21:44	07:03 20:05	07:47 19:01	07:37 17:04	08:01 (WEA 1) 16:37
10	08:31 16:57	09:12 (WEA 2) 17:46	07:57 17:46	07:03 18:53	06:57 20:21	06:01 21:06	05:31 21:42	06:19 21:43	07:04 20:03	07:49 18:59	07:39 17:02	08:01 (WEA 1) 16:37
11	08:31 16:59	09:12 (WEA 2) 17:48	07:55 17:48	07:01 18:56	06:55 20:22	06:00 21:08	05:30 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:01 (WEA 1) 16:37
12	08:30 17:00	09:11 (WEA 2) 17:50	07:53 17:50	06:59 18:58	06:53 20:24	05:58 21:09	05:30 21:43	06:22 21:42	07:07 20:01	07:52 18:54	07:42 16:59	08:01 (WEA 1) 16:37
13	08:30 17:01	09:12 (WEA 2) 17:51	07:52 17:51	06:57 18:58	06:51 20:25	05:57 21:11	05:30 21:44	06:23 20:59	07:09 19:57	07:54 18:52	07:44 16:58	08:01 (WEA 1) 16:37
14	08:29 17:03	09:12 (WEA 2) 17:50	07:50 17:50	06:55 18:59	06:49 20:27	05:55 21:12	05:30 21:45	06:25 20:58	07:10 19:54	07:55 18:50	07:45 16:57	08:01 (WEA 1) 16:37
15	08:28 17:04	09:12 (WEA 2) 17:51	07:48 17:51	06:53 18:58	06:47 20:29	05:54 21:13	05:29 21:45	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:56	08:01 (WEA 1) 16:37
16	08:28 17:06	09:12 (WEA 2) 17:51	07:46 17:51	06:50 18:58	06:45 20:30	05:53 21:15	05:29 21:46	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54	08:01 (WEA 1) 16:37
17	08:27 17:07	09:13 (WEA 2) 17:58	07:43 17:58	06:46 18:58	06:41 20:32	05:50 21:16	05:29 21:46	06:31 20:52	07:16 19:48	08:01 18:44	07:51 16:53	08:01 (WEA 1) 16:37
18	08:26 17:09	09:13 (WEA 2) 18:00	07:43 18:00	06:46 18:58	06:41 20:33	05:50 21:17	05:29 21:46	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52	08:01 (WEA 1) 16:37
19	08:25 17:10	09:13 (WEA 2) 18:01	07:41 18:01	06:44 18:58	06:39 20:34	05:49 21:18	05:29 21:47	06:32 20:50	07:17 19:46	08:03 18:40	07:53 16:51	08:01 (WEA 1) 16:37
20	08:24 17:12	09:13 (WEA 2) 18:03	07:39 18:03	06:42 18:58	06:37 20:36	05:47 21:20	05:30 21:47	06:34 20:51	07:19 19:41	08:05 18:38	07:55 16:50	08:01 (WEA 1) 16:37
21	08:23 17:13	09:14 (WEA 2) 18:05	07:37 18:05	06:40 18:58	06:35 20:38	05:46 21:21	05:30 21:47	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49	08:01 (WEA 1) 16:37
22	08:22 17:15	09:15 (WEA 2) 18:07	07:35 18:07	06:38 18:58	06:33 20:39	05:45 21:23	05:30 21:48	06:37 20:42	07:22 19:37	08:08 18:35	07:55 16:48	08:01 (WEA 1) 16:37
23	08:21 17:16	09:15 (WEA 2) 18:08	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47	08:01 (WEA 1) 16:37
24	08:20 17:18	09:16 (WEA 2) 18:10	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:39 20:38	07:25 19:33	08:11 18:31	08:01 (WEA 1) 16:46	08:01 (WEA 1) 16:37
25	08:19 17:20	09:17 (WEA 2) 18:12	07:30 18:12	06:32 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:41 20:57	07:26 19:30	08:13 18:29	07:58 (WEA 1) 16:45	08:01 (WEA 1) 16:37
26	08:18 17:21	09:17 (WEA 2) 18:13	07:28 18:13	06:33 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:42 20:54	07:28 19:28	08:14 18:27	07:58 (WEA 1) 16:44	08:01 (WEA 1) 16:37
27	08:17 17:23	09:19 (WEA 2) 18:15	07:26 18:15	06:36 18:59	06:23 20:47	05:40 21:29	05:31 21:48	06:44 20:32	07:29 19:26	08:16 18:25	07:58 (WEA 1) 16:43	08:01 (WEA 1) 16:37
28	08:16 17:24	09:20 (WEA 2) 18:17	07:24 18:17	06:42 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:45 20:25	07:31 19:24	08:17 18:23	07:58 (WEA 1) 16:42	08:01 (WEA 1) 16:37
29	08:14 17:26	09:21 (WEA 2) 18:18	07:23 18:18	06:43 19:02	06:20 20:50	05:38 21:31	05:32 21:48	06:47 20:23	07:32 19:22	08:19 18:22	07:59 (WEA 1) 16:42	08:01 (WEA 1) 16:37
30	08:13 17:28	09:24 (WEA 2) 18:20	07:22 18:20	06:44 19:03	06:18 20:51	05:37 21:32	05:33 21:48	06:48 20:26	07:34 19:20	08:20 18:27	07:59 (WEA 1) 16:41	08:01 (WEA 1) 16:37
31	08:12 17:29	09:30 (WEA 2) 18:26	07:21 18:26	06:45 19:04	06:19 20:56	05:38 21:33	05:34 21:49	06:49 20:27	07:35 19:22	08:21 18:28	08:00 (WEA 1) 16:46	08:01 (WEA 1) 16:37
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	673	544								476	525	446
Red. Sonnenscheinwahrsch.	0,15	0,24								0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93								0,93	0,93	0,93
Reduktion Windrichtung	0,52	0,56								0,56	0,53	0,52
Gesamte Reduktion	0,07	0,12								0,14	0,07	0,06
Met. wahrsch. Beschattung	47	67								69	38	27

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)







## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-42 - 165, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Juli	August	September	Oktober	November	Dezember	
1	08:34 16:47 08:33	09:18 (WEA 2) 09:43 (WEA 2) 08:09	08:10 17:31 08:09	07:22 18:18 07:20	07:16 20:07 07:14	06:16 20:53 06:15	05:36 21:34 05:35	05:34 21:47 05:34	06:06 21:19 06:08	06:51 20:22 06:53	07:35 19:18 07:37	08:07 (WEA 1) 17:16 08:08 (WEA 1)	08:11 16:40 08:12
2	16:48 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
3	16:49 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
4	16:49 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
5	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
6	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
7	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
8	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
9	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
10	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
11	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
12	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
13	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
14	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
15	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
16	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
17	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
18	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
19	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
20	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
21	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
22	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
23	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
24	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
25	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
26	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
27	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
28	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
29	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
30	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
31	16:50 08:33	09:19 (WEA 2) 08:08	08:05 17:31 08:08	07:13 18:18 07:12	07:08 20:09 07:12	06:09 20:54 06:13	05:33 21:35 05:34	05:36 21:47 05:35	06:12 21:18 06:09	06:57 20:20 06:54	07:41 19:15 07:38	08:11 (WEA 1) 17:15 08:09 (WEA 1)	08:16 16:40 08:13
Sonnenscheinstunden	269	283	647	412	475	486	491	447	379	335	275	255	
astr. max. mögl. Beschattung	670										563	763	
Red. Sonnenscheinwahrsch.	0,15		0,24								0,15	0,13	
Reduktion Betriebsdauer	0,93		0,93								0,93	0,93	
Reduktion Windrichtung	0,51		0,56								0,53	0,51	
Gesamte Reduktion	0,07		0,12								0,07	0,06	
Met. wahrsch. Beschattung	45		79								41	45	

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-43 - 174, Rue Pierre Gansen, 4570 Nieder Korn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	Marz	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember			
1	08:34	09:15 (WEA 2)	08:10	07:22	06:16	05:36	05:34	06:06	06:51	07:35	07:24	08:58 (WEA 1)			
16:47	21	09:36 (WEA 2)	17:31	18:18	20:53	21:34	21:47	21:19	20:22	19:18	17:16	25	08:04 (WEA 1)	08:11	08:58 (WEA 2)
2	08:33	09:15 (WEA 2)	08:09	07:20	06:15	05:35	05:34	06:08	06:53	07:37	07:26	08:06 (WEA 1)	08:12	08:59 (WEA 2)	
16:48	22	09:37 (WEA 2)	17:33	18:20	20:59	21:37	21:46	21:18	20:20	19:15	17:15	22	08:28 (WEA 1)	08:10	08:59 (WEA 2)
3	08:33	09:16 (WEA 2)	08:08	07:18	06:13	05:34	05:35	06:09	06:54	07:38	07:27	08:08 (WEA 1)	08:13	09:00 (WEA 2)	
16:49	22	09:38 (WEA 2)	17:35	18:21	20:10	20:56	21:36	21:47	21:16	20:18	17:13	19	08:27 (WEA 1)	08:39	09:00 (WEA 2)
4	08:33	09:15 (WEA 2)	08:06	07:16	06:11	05:33	05:36	06:11	06:56	07:40	07:29	08:09 (WEA 1)	08:14	09:00 (WEA 2)	
16:50	23	09:38 (WEA 2)	17:36	18:23	20:12	20:57	21:37	21:46	21:15	20:16	17:11	15	08:24 (WEA 1)	08:39	09:00 (WEA 2)
5	08:33	09:15 (WEA 2)	08:05	07:13	06:08	05:29	05:33	06:06	06:52	07:41	07:31	08:13 (WEA 1)	08:16	09:00 (WEA 2)	
16:51	24	09:39 (WEA 2)	17:38	18:25	20:13	20:59	21:38	21:46	21:13	20:14	17:10	7	08:20 (WEA 1)	08:39	09:00 (WEA 2)
6	08:33	09:16 (WEA 2)	08:03	07:11	06:06	05:28	05:32	06:03	06:58	07:43	07:32	08:17	09:02 (WEA 2)		
16:52	24	09:40 (WEA 2)	17:40	18:26	20:15	21:00	21:39	21:46	21:11	20:12	17:08	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
7	08:33	09:15 (WEA 2)	08:02	07:09	06:03	05:26	05:30	06:03	06:58	07:44	07:34	08:18	09:05 (WEA 2)		
16:54	25	09:40 (WEA 2)	17:41	18:28	20:16	21:02	21:40	21:45	21:10	20:09	17:05	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
8	08:32	09:16 (WEA 2)	08:00	07:07	06:01	05:24	05:28	06:01	06:56	07:41	07:31	08:19	09:03 (WEA 2)		
16:55	26	09:42 (WEA 2)	17:43	18:30	20:18	21:03	21:41	21:45	21:08	20:07	17:03	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
9	08:32	09:16 (WEA 2)	07:58	07:05	06:03	05:31	05:40	06:18	07:03	07:47	07:37	08:19	09:04 (WEA 2)		
16:56	26	09:42 (WEA 2)	17:45	18:31	20:19	21:05	21:41	21:44	21:06	20:05	17:04	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
10	08:31	09:16 (WEA 2)	07:57	07:03	06:01	05:24	05:28	06:01	06:56	07:41	07:31	08:19	09:04 (WEA 2)		
16:57	27	09:43 (WEA 2)	17:46	18:33	20:21	21:06	21:42	21:43	21:05	20:03	17:02	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
11	08:31	09:16 (WEA 2)	07:55	07:01	06:05	06:00	05:30	05:41	06:21	07:06	07:50	07:40	08:22	09:05 (WEA 2)	
16:59	27	09:43 (WEA 2)	17:48	18:34	20:22	21:08	21:43	21:43	21:03	20:01	17:01	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
12	08:30	09:16 (WEA 2)	07:53	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:06 (WEA 2)		
17:00	28	09:44 (WEA 2)	17:50	18:36	20:24	21:09	21:43	21:42	21:01	19:59	17:01	14	09:04 (WEA 1)	08:39	09:02 (WEA 2)
13	08:30	09:17 (WEA 2)	07:52	07:03	06:02	05:27	05:30	06:03	06:59	07:50	07:54	08:19	09:07 (WEA 2)		
17:01	28	09:45 (WEA 2)	17:51	18:37	20:25	21:11	21:44	21:41	20:59	19:57	17:01	14	09:04 (WEA 1)	08:39	09:07 (WEA 2)
14	08:29	09:17 (WEA 2)	07:50	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:07 (WEA 2)		
17:03	28	09:45 (WEA 2)	17:53	18:39	20:27	21:12	21:45	21:40	20:58	19:54	17:01	14	09:04 (WEA 1)	08:39	09:07 (WEA 2)
15	08:28	09:17 (WEA 2)	07:48	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:08 (WEA 2)		
17:04	28	09:45 (WEA 2)	17:55	18:41	20:29	21:13	21:45	21:39	20:56	19:52	17:01	14	09:04 (WEA 1)	08:39	09:07 (WEA 2)
16	08:28	09:17 (WEA 2)	07:46	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:08 (WEA 2)		
17:06	29	09:46 (WEA 2)	17:57	18:42	20:30	21:15	21:46	21:39	20:54	19:50	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
17	08:27	09:18 (WEA 2)	07:45	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:09 (WEA 2)		
17:07	28	09:46 (WEA 2)	17:58	18:44	20:32	21:16	21:46	21:38	20:52	19:48	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
18	08:26	09:18 (WEA 2)	07:43	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:09 (WEA 2)		
17:09	28	09:46 (WEA 2)	18:00	18:45	20:33	21:17	21:46	21:37	20:50	19:46	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
19	08:25	09:18 (WEA 2)	07:41	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:11 (WEA 2)		
17:10	28	09:46 (WEA 2)	18:02	18:47	20:35	21:19	21:47	21:36	20:48	19:44	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
20	08:24	09:19 (WEA 2)	07:39	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:11 (WEA 2)		
17:12	27	09:46 (WEA 2)	18:03	18:48	20:36	21:20	21:47	21:35	20:46	19:41	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
21	08:23	09:19 (WEA 2)	07:37	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:12 (WEA 2)		
17:13	28	09:47 (WEA 2)	18:05	18:50	20:38	21:21	21:47	21:34	20:44	19:39	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
22	08:22	09:20 (WEA 2)	07:35	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:12 (WEA 2)		
17:15	27	09:47 (WEA 2)	18:07	18:52	20:39	21:23	21:48	21:32	20:42	19:37	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
23	08:21	09:21 (WEA 2)	07:33	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:13 (WEA 2)		
17:16	26	09:47 (WEA 2)	18:08	18:53	20:41	21:24	21:48	21:31	20:40	19:35	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
24	08:20	09:22 (WEA 2)	07:31	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:14 (WEA 2)		
17:18	25	09:47 (WEA 2)	18:10	18:55	20:42	21:25	21:48	21:30	20:38	19:33	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
25	08:19	09:22 (WEA 2)	07:30	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:14 (WEA 2)		
17:20	24	09:46 (WEA 2)	18:12	18:56	20:44	21:26	21:48	21:29	20:36	19:30	17:01	14	09:04 (WEA 1)	08:39	09:08 (WEA 2)
26	08:18	09:23 (WEA 2)	07:26	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:15 (WEA 2)		
17:21	22	09:45 (WEA 2)	18:13	18:58	20:45	21:28	21:48	21:27	20:34	19:28	17:01	14	09:04 (WEA 1)	08:39	09:15 (WEA 2)
27	08:17	09:25 (WEA 2)	07:26	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:16 (WEA 2)		
17:23	20	09:45 (WEA 2)	18:15	18:59	20:47	21:29	21:48	21:26	20:32	19:26	17:01	14	09:04 (WEA 1)	08:39	09:15 (WEA 2)
28	08:16	09:27 (WEA 2)	07:24	07:03	06:01	05:24	05:28	06:01	06:56	07:42	07:32	08:19	09:16 (WEA 2)		
17:24	17	09:44 (WEA 2)	18:17	19:01	20:48	21:30	21:48	21:25	20:30	19:24	17:01	14	09:04 (WEA 1)	08:39	09:15 (WEA 2)
29	08:14	09:28 (WEA 2)		07:23	06:20	05:38	05:32	06:02	06:47	07:32	07:19	08:02 (WEA 1)	08:08	08:57 (WEA 2)	08:33
17:26	14	09:42 (WEA 2)		20:02	20:50	21:31	21:48	21:23	20:28	19:22	17:01	14	09:04 (WEA 1)	08:39	09:14 (WEA 2)
30	08:13	09:31 (WEA 2)		07:20	06:18	05:37	05:33	06:04	06:48	07:34	07:21	08:02 (WEA 1)	08:09	08:58 (WEA 2)	08:33
17:28	9	09:40 (WEA 2)		20:04	20:51	21:32	21:48	21:22	20:26	19:20	17:01	14	09:04 (WEA 1)	08:39	09:14 (WEA 2)
31	08:12			07:18	06:16	05:36		06:05	06:50	07:35	07:22	08:03 (WEA 1)		08:58 (WEA 2)	08:33
17:29				20:05	21:23	21:33		20:21	20:24	19:18	17:18	27	08:30 (WEA 1)	08:39	09:15 (WEA 2)
Sonnenscheinstunden	269		283	368	412	475	486	491	447	379	335	275		255	
astr. max. mögl. Beschattung	731		626	9							552			635	
Red. Sonnenscheinwahrsch.	0,15		0,24	0,35							0,28			0,13	
Reduktion Betriebsdauer	0,93		0,93	0,93							0,93			0,93	
Reduktion Windrichtung	0,51		0,56	0,56							0,56			0,51	
Gesamte Reduktion	0,07		0,12	0,18							0,14			0,06	
Met. wahrsch. Beschattung	50		77	2							79			38	

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	Zeit
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-44 - 151, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:13 (WEA 2) 17:31	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:06 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:03 (WEA 1) 16:40
2	08:33 16:48	09:13 (WEA 2) 17:33	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:04 (WEA 1) 16:40
3	08:33 16:49	09:13 (WEA 2) 17:35	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:06 (WEA 1) 16:39
4	08:33 16:50	09:13 (WEA 2) 17:36	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:11	08:08 (WEA 1) 16:39
5	08:33 16:51	09:13 (WEA 2) 17:38	08:05 17:38	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:12 21:46	06:57 20:14	07:41 19:09	07:31 17:10	08:07 (WEA 1) 16:39
6	08:33 16:52	09:14 (WEA 2) 17:40	08:03 17:40	07:11 18:26	07:05 20:15	06:08 20:53	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:07 (WEA 1) 16:38
7	08:33 16:53	09:14 (WEA 2) 17:41	08:02 17:41	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
8	08:33 16:55	09:14 (WEA 2) 17:43	08:02 17:43	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
9	08:33 16:56	09:14 (WEA 2) 17:45	08:02 17:45	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
10	08:31 16:57	09:14 (WEA 2) 17:46	08:02 17:46	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
11	08:31 16:59	09:14 (WEA 2) 17:48	08:02 17:48	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
12	08:30 17:00	09:14 (WEA 2) 17:50	08:02 17:50	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
13	08:30 17:01	09:14 (WEA 2) 17:51	08:02 17:51	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
14	08:29 17:03	09:14 (WEA 2) 17:53	08:02 17:53	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
15	08:28 17:04	09:14 (WEA 2) 17:55	08:02 17:55	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
16	08:28 17:06	09:14 (WEA 2) 17:57	08:02 17:57	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
17	08:27 17:07	09:14 (WEA 2) 17:58	08:02 17:58	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
18	08:26 17:09	09:14 (WEA 2) 18:00	08:02 18:00	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
19	08:25 17:10	09:14 (WEA 2) 18:02	08:02 18:02	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
20	08:24 17:12	09:14 (WEA 2) 18:03	08:02 18:03	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
21	08:23 17:13	09:14 (WEA 2) 18:05	08:02 18:05	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
22	08:22 17:15	09:14 (WEA 2) 18:07	08:02 18:07	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
23	08:21 17:16	09:14 (WEA 2) 18:08	08:02 18:08	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
24	08:20 17:18	09:14 (WEA 2) 18:10	08:02 18:10	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
25	08:19 17:20	09:14 (WEA 2) 18:12	08:02 18:12	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
26	08:18 17:21	09:14 (WEA 2) 18:13	08:02 18:13	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
27	08:17 17:23	09:14 (WEA 2) 18:15	08:02 18:15	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
28	08:16 17:24	09:14 (WEA 2) 18:17	08:02 18:17	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
29	08:14 17:26	09:14 (WEA 2) 18:19	08:02 18:19	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
30	08:13 17:28	09:14 (WEA 2) 18:21	08:02 18:21	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
31	08:12 17:29	09:14 (WEA 2) 18:23	08:02 18:23	07:09 18:26	07:03 20:15	06:06 20:53	05:32 21:39	06:15 21:11	07:00 20:12	07:44 19:07	07:34 17:08	08:08 (WEA 1) 16:38
Sonnenscheinstunden	269	283	588	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	701	588	518	518	518	518	518	518	518	518	518	518
Red. Sonnenscheinwahrsch.	0,15	0,24	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,52	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56
Gesamte Reduktion	0,07	0,12	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Met. wahrsch. Beschattung	49	72	32	75	38	32	32	32	32	32	32	32

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)



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-45 - 160, Rue Pierre Gansen, 4570 Niederkorn  
 Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
 1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
 300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

	Januar	Februar	Marz	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	09:14 (WEA 2)	08:10	09:21 (WEA 2)	07:22	08:27 (WEA 1)	07:16	06:16	05:36	05:34	06:06	06:51
2	16:47	7 09:21 (WEA 2)	17:31	14 09:35 (WEA 2)	18:18	22 08:49 (WEA 1)	20:07	20:53	21:34	21:47	17:16	8 08:05 (WEA 1)
3	08:33	09:14 (WEA 2)	08:09	09:23 (WEA 2)	07:20	08:28 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53
4	16:48	9 09:23 (WEA 2)	17:33	10 09:33 (WEA 2)	18:20	19 08:47 (WEA 1)	20:09	20:54	21:35	21:47	17:18	20:20
5	08:33	09:13 (WEA 2)	08:08	07:18	08:31 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:35
6	16:49	12 09:25 (WEA 2)	17:35	18:21	13 08:44 (WEA 1)	20:10	20:56	21:36	21:47	21:16	17:13	16:40
7	08:33	09:12 (WEA 2)	08:06	07:16	08:30 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
8	16:50	13 09:25 (WEA 2)	17:36	18:23	14 08:45 (WEA 1)	20:12	20:57	21:37	21:46	21:15	17:11	16:39
9	08:33	09:12 (WEA 2)	08:05	07:13	08:30 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
10	16:51	15 09:27 (WEA 2)	17:38	18:25	15 08:46 (WEA 1)	20:13	20:59	21:38	21:46	21:13	17:10	16:39
11	08:33	09:12 (WEA 2)	08:03	07:11	08:30 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:58	07:43
12	16:52	17 09:29 (WEA 2)	17:40	18:26	16 08:47 (WEA 1)	20:15	21:00	21:39	21:46	21:11	17:08	16:38
13	08:33	09:11 (WEA 2)	08:02	07:09	08:30 (WEA 1)	07:03	06:06	05:32	05:38	06:15	07:00	07:47
14	16:54	18 09:29 (WEA 2)	17:41	18:28	17 08:48 (WEA 1)	20:16	21:02	21:40	21:45	21:10	17:07	16:38
15	08:32	09:11 (WEA 2)	08:00	07:07	08:30 (WEA 1)	07:01	06:04	05:31	05:39	06:16	07:01	07:46
16	16:55	20 09:31 (WEA 2)	17:43	18:30	18 08:49 (WEA 1)	20:18	21:03	21:41	21:45	21:08	17:07	16:38
17	08:32	09:11 (WEA 2)	07:58	07:05	08:30 (WEA 1)	06:59	06:03	05:31	05:40	06:18	07:03	07:47
18	16:56	20 09:31 (WEA 2)	17:45	18:31	19 08:49 (WEA 1)	20:19	21:05	21:41	21:44	21:06	17:04	16:37
19	08:31	09:11 (WEA 2)	07:57	07:03	08:30 (WEA 1)	06:57	06:01	05:31	05:40	06:19	07:07	07:47
20	16:57	22 09:33 (WEA 2)	17:46	18:33	20 08:44 (WEA 1)	20:21	21:06	21:42	21:43	21:05	17:02	16:37
21	08:31	09:11 (WEA 2)	07:55	07:01	08:30 (WEA 1)	06:55	06:00	05:30	05:41	06:21	07:06	07:50
22	16:59	22 09:33 (WEA 2)	17:48	18:34	21 08:47 (WEA 1)	20:22	21:08	21:43	21:43	21:03	17:01	16:36
23	08:30	09:10 (WEA 2)	07:53	06:59	08:30 (WEA 1)	06:53	05:58	05:30	05:42	06:22	07:07	07:52
24	17:00	24 09:34 (WEA 2)	17:50	18:36	22 08:50 (WEA 1)	20:24	21:09	21:43	21:42	21:01	17:00	16:37
25	08:30	09:11 (WEA 2)	07:52	06:57	08:30 (WEA 1)	06:51	05:57	05:30	05:43	06:23	07:09	07:54
26	17:01	24 09:35 (WEA 2)	17:51	18:37	23 08:51 (WEA 1)	20:25	21:11	21:44	21:41	20:59	17:01	16:37
27	08:29	09:11 (WEA 2)	07:50	06:55	08:30 (WEA 1)	06:49	05:55	05:30	05:44	06:25	07:10	07:55
28	17:03	25 09:36 (WEA 2)	17:53	18:39	24 08:52 (WEA 1)	20:27	21:12	21:45	21:40	20:58	17:01	16:37
29	08:28	09:11 (WEA 2)	07:48	06:53	08:30 (WEA 1)	06:47	05:54	05:29	05:45	06:26	07:12	07:57
30	17:04	25 09:36 (WEA 2)	17:55	18:41	25 08:53 (WEA 1)	20:29	21:13	21:45	21:39	20:56	17:02	16:37
31	08:28	09:11 (WEA 2)	07:46	06:50	08:30 (WEA 1)	06:45	05:53	05:29	05:47	06:28	07:17	07:58
32	17:06	26 09:37 (WEA 2)	17:57	18:42	26 08:54 (WEA 1)	20:30	21:15	21:46	21:39	20:54	17:03	16:36
33	08:27	09:11 (WEA 2)	07:45	06:48	08:30 (WEA 1)	06:43	05:51	05:29	05:48	06:29	07:15	08:00
34	17:07	26 09:37 (WEA 2)	17:58	18:44	27 08:55 (WEA 1)	20:32	21:16	21:46	21:38	20:52	17:04	16:37
35	08:26	09:11 (WEA 2)	07:43	06:46	08:30 (WEA 1)	06:41	05:50	05:29	05:49	06:31	07:16	07:51
36	17:09	27 09:38 (WEA 2)	18:00	18:45	28 08:56 (WEA 1)	20:33	21:17	21:46	21:37	20:50	17:04	16:38
37	08:25	09:11 (WEA 2)	07:41	06:44	08:30 (WEA 1)	06:39	05:49	05:29	05:50	06:32	07:17	08:03
38	17:10	27 09:38 (WEA 2)	18:02	18:47	29 08:56 (WEA 1)	20:35	21:19	21:47	21:36	20:48	17:04	16:38
39	08:24	09:11 (WEA 2)	07:39	06:42	08:30 (WEA 1)	06:37	05:47	05:30	05:51	06:34	07:19	08:03
40	17:12	28 09:39 (WEA 2)	18:03	18:48	30 08:56 (WEA 1)	20:36	21:20	21:47	21:35	20:46	17:04	16:39
41	08:23	09:11 (WEA 2)	07:37	06:40	08:30 (WEA 1)	06:35	05:46	05:30	05:52	06:35	07:20	08:06
42	17:13	28 09:39 (WEA 2)	18:05	18:50	31 08:56 (WEA 1)	20:38	21:21	21:47	21:34	20:44	17:04	16:39
43	08:22	09:12 (WEA 2)	07:35	06:38	08:30 (WEA 1)	06:33	05:45	05:30	05:53	06:37	07:22	08:07
44	17:15	28 09:40 (WEA 2)	18:07	18:52	32 08:55 (WEA 1)	20:39	21:23	21:48	21:32	20:42	17:04	16:39
45	08:21	09:12 (WEA 2)	07:33	06:35	08:30 (WEA 1)	06:31	05:44	05:30	05:55	06:38	07:23	08:09
46	17:16	28 09:40 (WEA 2)	18:08	18:53	33 08:55 (WEA 1)	20:41	21:24	21:48	21:31	20:40	17:04	16:40
47	08:20	09:13 (WEA 2)	07:31	06:33	08:30 (WEA 1)	06:29	05:43	05:30	05:56	06:39	07:25	08:10
48	17:18	27 09:40 (WEA 2)	18:10	18:55	34 08:55 (WEA 1)	20:42	21:25	21:48	21:30	20:38	17:04	16:41
49	08:19	09:13 (WEA 2)	07:30	06:31	08:30 (WEA 1)	06:27	05:42	05:31	05:57	06:41	07:26	07:51
50	17:20	26 09:39 (WEA 2)	18:12	18:51	35 08:54 (WEA 1)	20:44	21:26	21:48	21:29	20:36	17:04	16:41
51	08:18	09:14 (WEA 2)	07:28	06:29	08:30 (WEA 1)	06:25	05:41	05:31	05:58	06:42	07:27	08:14
52	17:21	26 09:40 (WEA 2)	18:13	18:58	36 08:53 (WEA 1)	20:45	21:28	21:48	21:27	20:34	17:04	16:42
53	08:17	09:15 (WEA 2)	07:26	06:27	08:30 (WEA 1)	06:23	05:40	05:31	06:00	06:44	07:29	07:16
54	17:23	25 09:40 (WEA 2)	18:15	18:58	37 08:52 (WEA 1)	20:47	21:29	21:48	21:26	20:32	17:04	16:43
55	08:16	09:16 (WEA 2)	07:24	06:25	08:30 (WEA 1)	06:22	05:39	05:32	06:07	06:45	07:31	07:27
56	17:24	24 09:40 (WEA 2)	18:17	19:01	38 08:51 (WEA 1)	20:48	21:30	21:48	21:25	20:30	17:04	16:42
57	08:14	09:16 (WEA 2)		07:23	39 08:51 (WEA 1)	20:50	21:31	21:48	21:23	20:28	17:04	16:43
58	17:26	22 09:38 (WEA 2)		07:20	40 08:13 (WEA 1)	20:50	21:31	21:48	21:23	20:28	17:04	16:43
59	08:13	09:18 (WEA 2)		07:20	41 08:12 (WEA 1)	20:51	21:32	21:48	21:22	20:29	17:04	16:43
60	17:28	20 09:38 (WEA 2)		07:18	42 08:12 (WEA 1)	20:51	21:32	21:48	21:22	20:29	17:04	16:43
61	08:12	09:19 (WEA 2)		07:18	43 08:12 (WEA 1)	20:52	21:33	21:48	21:23	20:30	17:04	16:43
62	17:29	17 09:36 (WEA 2)		07:18	44 08:12 (WEA 1)	20:53	21:34	21:48	21:24	20:31	17:04	16:43
63	08:11	09:36 (WEA 2)		07:18	45 08:11 (WEA 1)	20:54	21:35	21:48	21:25	20:32	17:04	16:43
64	17:30	18 09:37 (WEA 2)		07:18	46 08:11 (WEA 1)	20:55	21:36	21:48	21:26	20:33	17:04	16:43
65	08:10	09:37 (WEA 2)		07:18	47 08:10 (WEA 1)	20:56	21:37	21:48	21:27	20:34	17:04	16:43
66	17:31	19 09:38 (WEA 2)		07:18	48 08:10 (WEA 1)	20:57	21:38	21:48	21:28	20:35	17:04	16:43
67	08:09	09:38 (WEA 2)		07:18	49 08:09 (WEA 1)	20:58	21:39	21:48	21:29	20:36	17:04	16:43
68	17:32	20 09:39 (WEA 2)		07:18	50 08:08 (WEA 1)	20:59	21:40	21:48	21:30	20:37	17:04	16:43
69	08:08	09:39 (WEA 2)		07:18	51 08:07 (WEA 1)	21:00	21:41	21:48	21:31	20:38	17:04	16:43
70	17:33	21 09:40 (WEA 2)		07:18	52 08:06 (WEA 1)	21:01	21:42	21:48	21:32	20:39	17:04	16:43
71	08:07	09:40 (WEA 2)		07:18	53 08:05 (WEA 1)	21:02	21:43	21:48	21:33	20:40	17:04	16:43
72	17:34	22 09:41 (WEA 2)		07:18	54 08:04 (WEA 1)	21:03	21:44	21:48	21:34	20:41	17:04	16:43
73	08:06	09:41 (WEA 2)		07:18	55 08:03 (WEA 1)	21:04	21:45	21:48	21:35	20:42	17:04	16:43
74	17:35	23 09:42 (WEA 2)		07:18	56 08:02 (WEA 1)	21:05	21:46	21:48	21:36	20:43	17:04	16:43
75	08:05	09:42 (WEA 2)		07:18	57 08:01 (WEA 1)	21:06	21:47	21:48	21:37	20:44	17:04	16:43
76	17:36	24 09:43 (WEA 2)		07:18	58 08:00 (WEA 1)	21:07	21:48	21:48	21:38	20:45	17:04	16:43
77	08:04	09:43 (WEA 2)		07:18	59 07:59 (WEA 1)	21:08	21:49	21:48	21:39	20:46	17:04	16:43
78	17:37	25 09:44 (WEA 2)		07:18	60 07:58 (WEA 1)	21:09	21:50	21:48	21:40	20:47	17:04	16:43
79	08:03	09:44 (WEA 2)		07:18	61 07:57 (WEA 1)	21:10	21:51	21:48	21:41	20:48	17:04	16:43
80	17:38	26 09:45 (WEA 2)		07:18	62 07:56 (WEA 1)	21:11	21:52	21:48	21:42	20:49	17:04	16:43
81	08:02	09:45 (WEA 2)		07:18	63 07:55 (WEA 1)	21:12	21:53	21:48	21:43	20:50	17:04	16:43
82	17:39	27 09:46 (WEA 2)		07:18	64 07:54 (WEA 1)	21:13	21:54	21:48	21:44	20:51	17:04	16:43
83	08:01	09:46 (WEA 2)		07:18	65 07:53 (WEA 1)	21:14	21:55	21:48	21:45	20:52	17	



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-46 - 1, Rue de Sanem, 4664 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

	Januar	Februar	Marz	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	08:10	09:17 (WEA 2)	07:22	08:27 (WEA 1)	07:16	06:16	05:36	05:34	06:06	06:51	07:35
2	16:47	17:31	15 09:32 (WEA 2)	18:18	08:45 (WEA 1)	20:07	20:53	21:34	21:47	21:19	20:22	19:18
3	08:33	08:09	09:19 (WEA 2)	07:20	08:29 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
4	16:48	17:33	10 09:29 (WEA 2)	18:20	08:42 (WEA 1)	20:09	20:54	21:35	21:47	21:18	20:20	19:15
5	08:33	08:08	07:18	07:12	06:13	05:34	05:35	06:09	06:54	07:38	08:13	08:53 (WEA 2)
6	16:49	17:35	18:21	20:10	20:56	21:36	21:47	21:16	20:18	19:13	17:13	16:39
7	08:33	09:11 (WEA 2)	08:06	07:16	07:10	06:11	05:34	06:36	06:11	06:56	07:40	08:14
8	16:50	17:36	18:23	20:12	20:57	21:37	21:46	21:15	20:16	19:11	17:11	16:39
9	08:33	09:11 (WEA 2)	08:05	07:13	07:08	06:09	05:33	05:36	06:12	06:57	07:41	08:16
10	16:51	17:37	18:24	20:13	20:59	21:38	21:46	21:13	20:14	19:09	17:10	16:39
11	08:33	09:10 (WEA 2)	08:03	07:11	07:05	06:08	05:32	05:37	06:13	06:58	07:43	08:17
12	16:52	17:38	18:25	20:14	21:00	21:39	21:46	21:11	20:12	19:07	17:08	16:38
13	08:33	09:09 (WEA 2)	08:02	07:09	07:03	06:06	05:32	05:38	06:15	07:00	07:44	08:18
14	16:54	17:40	18:26	20:16	21:02	21:40	21:45	21:10	20:09	19:05	17:07	16:38
15	08:32	09:09 (WEA 2)	08:00	07:07	07:01	06:05	05:31	05:39	06:16	07:01	07:46	08:19
16	16:55	17:41	18:27	20:18	21:03	21:41	21:45	21:08	20:07	19:03	17:05	16:38
17	08:32	09:09 (WEA 2)	07:58	07:05	06:59	06:03	05:29	05:40	06:18	07:03	07:47	08:20
18	16:56	17:42	18:28	20:19	21:05	21:41	21:44	21:06	20:05	19:01	17:04	16:38
19	08:31	09:09 (WEA 2)	07:57	07:03	06:57	06:01	05:31	05:40	06:19	07:04	07:49	08:21
20	16:57	17:43	18:29	20:21	21:06	21:42	21:43	21:05	20:03	18:59	17:02	16:37
21	08:31	09:08 (WEA 2)	07:55	07:01	06:55	06:00	05:30	05:41	06:21	07:06	07:50	08:22
22	16:59	17:45	18:31	20:22	21:08	21:43	21:43	21:03	20:01	18:56	17:01	16:37
23	08:30	09:08 (WEA 2)	07:53	07:03	06:53	05:58	05:30	05:42	06:22	07:07	07:52	08:23
24	17:00	17:46	18:32	20:24	21:09	21:43	21:42	21:01	19:59	18:54	17:00	16:37
25	08:30	09:08 (WEA 2)	07:52	07:02	06:51	05:57	05:30	05:43	06:23	07:09	07:54	08:24
26	17:01	17:47	18:33	20:25	21:11	21:44	21:41	20:59	19:57	18:52	17:00	16:37
27	08:29	09:08 (WEA 2)	07:50	07:00	06:49	05:55	05:30	05:44	06:25	07:10	07:55	08:25
28	17:03	17:49	18:35	20:27	21:12	21:45	21:40	20:58	19:54	18:50	17:00	16:37
29	08:28	09:08 (WEA 2)	07:48	07:00	06:47	05:54	05:29	05:45	06:26	07:12	07:57	08:26
30	17:04	17:50	18:36	20:29	21:13	21:45	21:39	20:56	19:52	18:48	17:00	16:37
31	08:28	09:08 (WEA 2)	07:46	07:00	06:45	05:53	05:29	05:47	06:28	07:13	07:58	08:27
32	17:06	17:52	18:38	20:30	21:15	21:46	21:39	20:54	19:50	18:46	17:00	16:37
33	08:27	09:07 (WEA 2)	07:45	07:00	06:43	05:51	05:29	05:48	06:29	07:15	08:00	08:27
34	17:07	17:53	18:39	20:32	21:16	21:46	21:38	20:52	19:48	18:44	17:00	16:38
35	08:26	09:07 (WEA 2)	07:43	07:00	06:41	05:50	05:29	05:49	06:31	07:16	08:01	08:28
36	17:09	17:55	18:41	20:33	21:17	21:46	21:37	20:50	19:46	18:42	17:00	16:38
37	08:25	09:08 (WEA 2)	07:41	07:00	06:39	05:49	05:29	05:50	06:32	07:17	08:03	08:29
38	17:10	17:56	18:42	20:35	21:19	21:47	21:36	20:48	19:44	18:40	17:00	16:38
39	08:24	09:08 (WEA 2)	07:39	07:00	06:37	05:47	05:30	05:51	06:34	07:19	08:05	08:30
40	17:12	17:58	18:44	20:36	21:20	21:47	21:35	20:46	19:41	18:38	17:00	16:39
41	08:23	09:08 (WEA 2)	07:37	07:00	06:35	05:46	05:30	05:52	06:35	07:20	08:06	08:30
42	17:13	17:59	18:45	20:38	21:21	21:47	21:34	20:44	19:39	18:36	17:00	16:39
43	08:22	09:08 (WEA 2)	07:35	07:00	06:33	05:45	05:30	05:53	06:37	07:22	08:08	08:31
44	17:15	18:01	18:47	20:39	21:23	21:48	21:32	20:42	19:37	18:35	17:00	16:39
45	08:21	09:09 (WEA 2)	07:33	07:00	06:31	05:44	05:30	05:55	06:38	07:23	08:09	08:31
46	17:16	18:02	18:48	20:41	21:24	21:48	21:31	20:40	19:35	18:33	17:00	16:40
47	08:20	09:10 (WEA 2)	07:31	07:00	06:29	05:43	05:30	05:56	06:39	07:25	08:11	08:32
48	17:18	18:04	18:50	20:42	21:25	21:48	21:30	20:38	19:33	18:31	17:00	16:41
49	08:19	09:10 (WEA 2)	07:30	07:00	06:27	05:42	05:31	05:57	06:41	07:26	08:13	08:32
50	17:20	18:06	18:52	20:44	21:26	21:48	21:29	20:36	19:30	18:27	17:00	16:41
51	08:18	09:10 (WEA 2)	07:28	07:00	06:25	05:41	05:31	05:58	06:42	07:28	08:14	08:32
52	17:21	18:07	18:53	20:45	21:28	21:48	21:27	20:34	19:28	18:25	17:00	16:42
53	08:17	09:11 (WEA 2)	07:26	07:00	06:23	05:40	05:31	06:00	06:44	07:29	08:16	08:33
54	17:23	18:09	18:55	20:47	21:29	21:48	21:26	20:32	19:26	18:23	17:00	16:43
55	08:16	09:12 (WEA 2)	07:24	07:00	06:22	05:39	05:32	06:01	06:45	07:31	08:17	08:33
56	17:24	18:10	18:56	20:48	21:30	21:48	21:25	20:30	19:24	18:21	17:00	16:43
57	08:14	09:12 (WEA 2)	07:22	07:00	06:20	05:38	05:32	06:02	06:47	07:32	08:19	08:33
58	17:26	18:12	18:58	20:50	21:31	21:48	21:23	20:28	19:22	18:19	17:00	16:44
59	08:13	09:14 (WEA 2)	07:20	07:00	06:18	05:37	05:33	06:04	06:48	07:34	08:20	08:33
60	17:28	18:14	19:00	20:51	21:32	21:48	21:22	20:26	19:20	18:17	17:00	16:45
61	08:12	09:15 (WEA 2)	07:18	07:00	06:16	05:36	05:30	06:05	06:50	07:35	08:21	08:33
62	17:29	18:15	19:01	20:05	21:33	21:48	21:21	20:24	19:18	18:14	17:00	16:46
63	Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275
64	astr. max. mögl. Beschattung	598	522	368	412	475	486	491	447	379	335	275
65	Red. Sonnenscheinwahrsch.	0,98	0,24	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,15
66	Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
67	Reduktion Windrichtung	0,53	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,53
68	Gesamte Reduktion	0,07	0,12	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,18	0,07
69	Met. wahrsch. Beschattung	42	64	6	6	6	6	6	6	6	6	7

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)





# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-47 - 146, Rue Pierre Gansen, 4570 Nieder Korn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

	Januar	Februar	Marz	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	08:10	09:10 (WEA 2)	07:22	08:17 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51	07:35
2	16:47	17:31	22 09:32 (WEA 2)	18:18	28 08:45 (WEA 1)	20:07	20:53	21:34	21:47	21:19	20:22	19:18
3	08:33	08:09	09:11 (WEA 2)	07:20	08:18 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
4	16:48	17:33	19 09:30 (WEA 2)	18:20	25 08:43 (WEA 1)	20:09	20:54	21:35	21:47	21:18	20:20	19:15
5	08:33	08:08	09:13 (WEA 2)	07:18	08:19 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:38
6	16:49	17:35	17 09:30 (WEA 2)	18:21	23 08:42 (WEA 1)	20:10	20:56	21:36	21:47	21:16	20:18	19:13
7	08:33	08:06	09:14 (WEA 2)	07:16	08:21 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
8	16:50	17:36	14 09:28 (WEA 2)	18:23	19 08:40 (WEA 1)	20:12	20:57	21:37	21:46	21:15	20:16	19:11
9	08:33	08:05	09:18 (WEA 2)	07:13	08:23 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
10	16:51	17:38	7 09:25 (WEA 2)	18:25	14 08:37 (WEA 1)	20:13	20:59	21:38	21:46	21:13	20:14	19:09
11	08:33	08:03	09:21 (WEA 2)	07:11	08:28 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:58	07:43
12	16:52	17:40		18:26	2 08:30 (WEA 1)	20:15	21:00	21:39	21:46	21:11	20:12	19:07
13	08:33	08:02		07:09	07:03	06:06	05:32	05:36	05:38	06:15	07:00	07:44
14	16:54	17:41		18:28	20:16	21:02	21:40	21:45	21:10	20:09	19:05	
15	08:32	08:00		07:07	07:01	06:05	05:31	05:39	06:16	07:01	07:46	
16	16:55	17:43		18:30	20:18	21:03	21:41	21:45	21:08	20:07	19:03	10 09:10 (WEA 1)
17	08:32	07:58	9 09:10 (WEA 2)	17:45	06:59	06:03	05:31	05:40	06:18	07:03	07:47	08:56 (WEA 1)
18	16:56	17:45	7 09:17 (WEA 2)	17:45	18:31	20:19	21:05	21:41	21:44	21:06	20:05	19:01 09:13 (WEA 1)
19	08:31	07:57	09:09 (WEA 2)	17:45	07:03	06:57	06:01	05:31	05:40	06:19	07:04	08:54 (WEA 1)
20	16:57	17:46	11 09:20 (WEA 2)	17:46	18:33	20:21	21:06	21:42	21:43	21:05	20:03	18:59 09:15 (WEA 1)
21	08:31	07:55	09:08 (WEA 2)	17:45	07:01	06:55	06:00	05:30	05:41	06:21	07:06	08:53 (WEA 1)
22	16:59	17:48	13 09:21 (WEA 2)	17:48	18:34	20:22	21:08	21:43	21:43	21:03	20:01	18:56 09:17 (WEA 1)
23	08:30	07:53	09:07 (WEA 2)	17:53	06:59	06:53	05:58	05:30	05:42	06:22	07:07	07:52 08:51 (WEA 1)
24	17:00	17:50	15 09:22 (WEA 2)	17:50	18:36	20:24	21:09	21:43	21:42	21:01	19:59	18:54 09:17 (WEA 1)
25	08:30	07:52	09:07 (WEA 2)	17:52	06:57	06:51	05:57	05:30	05:43	06:23	07:09	07:54 08:50 (WEA 1)
26	17:01	17:51	9 08:37 (WEA 1)	18:37	20:25	21:11	21:44	21:41	20:59	19:57	18:52	28 09:18 (WEA 1)
27	08:29	07:50	09:07 (WEA 2)	17:50	06:55	06:49	05:55	05:30	05:44	06:25	07:10	07:55 08:49 (WEA 1)
28	17:03	17:53	18 09:25 (WEA 2)	17:53	18:39	20:27	21:12	21:45	21:40	20:58	19:54	18:50 09:18 (WEA 1)
29	08:28	07:48	09:06 (WEA 2)	17:48	06:53	06:47	05:54	05:29	05:45	06:26	07:12	07:57 08:48 (WEA 1)
30	17:04	17:55	20 09:26 (WEA 2)	17:55	18:41	20:29	21:13	21:45	21:39	20:56	19:52	18:48 09:19 (WEA 1)
31	08:28	07:46	09:06 (WEA 2)	17:46	06:50	06:45	05:53	05:29	05:47	06:28	07:13	07:58 08:48 (WEA 1)
32	17:06	17:57	21 09:27 (WEA 2)	17:57	18:42	20:30	21:15	21:46	21:39	20:54	19:50	18:46 09:19 (WEA 1)
33	08:27	07:45	09:05 (WEA 2)	17:45	06:48	06:43	05:51	05:29	05:48	06:29	07:15	08:00 08:47 (WEA 1)
34	17:07	17:58	23 09:28 (WEA 2)	17:58	18:44	20:32	21:16	21:46	21:38	20:52	19:48	18:44 09:19 (WEA 1)
35	08:26	07:43	09:05 (WEA 2)	17:43	06:46	06:41	05:50	05:29	05:49	06:31	07:16	08:01 08:47 (WEA 1)
36	17:09	18:00	24 09:29 (WEA 2)	18:00	18:45	20:33	21:17	21:46	21:37	20:50	19:46	18:42 09:19 (WEA 1)
37	08:25	07:41	09:05 (WEA 2)	17:41	06:44	06:39	05:49	05:29	05:50	06:32	07:17	08:03 08:47 (WEA 1)
38	17:10	18:02	25 09:30 (WEA 2)	18:02	18:47	20:35	21:19	21:47	21:36	20:48	19:44	18:40 09:19 (WEA 1)
39	08:24	07:39	09:05 (WEA 2)	17:39	06:42	06:37	05:47	05:30	05:51	06:34	07:19	08:05 08:47 (WEA 1)
40	17:12	18:03	26 09:30 (WEA 2)	18:03	18:48	20:36	21:20	21:47	21:35	20:46	19:41	18:38 09:18 (WEA 1)
41	08:23	07:37	09:05 (WEA 2)	17:37	06:40	06:35	05:46	05:30	05:52	06:35	07:20	08:06 08:47 (WEA 1)
42	17:13	18:05	27 09:31 (WEA 2)	18:05	18:50	20:38	21:21	21:47	21:34	20:44	19:39	18:36 09:18 (WEA 1)
43	08:22	07:35	09:05 (WEA 2)	17:35	06:38	06:33	05:45	05:30	05:53	06:37	07:22	08:08 08:48 (WEA 1)
44	17:15	18:07	28 09:32 (WEA 2)	18:07	18:52	20:39	21:23	21:48	21:32	20:42	19:37	18:35 09:18 (WEA 1)
45	08:21	07:33	09:05 (WEA 2)	17:33	06:35	06:31	05:44	05:30	05:55	06:38	07:23	08:09 08:48 (WEA 1)
46	17:16	18:08	29 09:32 (WEA 2)	18:08	18:53	20:41	21:24	21:48	21:31	20:40	19:35	18:33 09:18 (WEA 1)
47	08:20	07:31	09:06 (WEA 2)	17:31	06:33	06:29	05:43	05:30	05:56	06:39	07:25	08:11 08:49 (WEA 1)
48	17:18	18:10	30 09:33 (WEA 2)	18:10	18:55	20:42	21:25	21:48	21:30	20:38	19:33	18:31 09:15 (WEA 1)
49	08:19	07:30	09:06 (WEA 2)	17:30	06:31	06:27	05:42	05:31	05:57	06:41	07:26	08:13 07:50 (WEA 1)
50	17:20	18:12	31 09:33 (WEA 2)	18:12	18:56	20:44	21:26	21:48	21:29	20:36	19:30	18:29 09:15 (WEA 1)
51	08:18	07:26	09:06 (WEA 2)	17:26	06:29	06:25	05:41	05:31	05:58	06:42	07:28	08:14 07:51 (WEA 1)
52	17:21	18:13	31 09:33 (WEA 2)	18:13	18:58	20:45	21:28	21:48	21:27	20:34	19:28	18:27 09:15 (WEA 1)
53	08:17	07:26	09:07 (WEA 2)	17:26	06:27	06:24	05:40	05:31	06:00	06:44	07:29	08:15 07:52 (WEA 1)
54	17:23	18:15	26 09:33 (WEA 2)	18:15	18:59	20:47	21:29	21:48	21:26	20:32	19:26	18:23 08:11 (WEA 1)
55	08:16	07:24	09:07 (WEA 2)	17:24	06:25	06:22	05:39	05:32	06:01	06:45	07:31	08:17 07:55 (WEA 1)
56	17:25	18:17	27 09:34 (WEA 2)	18:17	19:01	20:48	21:30	21:48	21:25	20:30	19:24	18:23 08:09 (WEA 1)
57	08:14	07:23	09:07 (WEA 2)	17:23	06:23	06:20	05:38	05:32	06:02	06:47	07:32	08:19 07:59 (WEA 1)
58	17:26	18:18	26 09:33 (WEA 2)	18:18	19:02	20:50	21:31	21:48	21:23	20:28	19:22	18:22 08:05 (WEA 1)
59	08:13	07:22	09:08 (WEA 2)	17:22	06:20	06:18	05:37	05:33	06:04	06:48	07:34	08:21 08:09 (WEA 1)
60	17:28	18:20	25 09:33 (WEA 2)	18:20	19:04	20:51	21:32	21:48	21:22	20:26	19:20	18:20 07:51 (WEA 1)
61	08:12	07:18	09:09 (WEA 2)	17:18	06:18	06:15	05:36		06:05	06:50	07:36	08:22 08:05 (WEA 1)
62	17:29	18:21	23 09:32 (WEA 2)	18:21	19:05	21:33	21:33	21:48	21:21	20:24	19:18	18:19 07:51 (WEA 1)
63	08:11	07:17	22 09:32 (WEA 2)	17:17	06:17	21:32	21:32	21:47	21:20	20:23	19:17	18:18 07:50 (WEA 1)
64	17:30	18:22	24 09:33 (WEA 2)	18:22	19:06	20:51	21:33	21:49	21:22	20:25	19:19	18:20 07:51 (WEA 1)
65	08:10	07:16	09:09 (WEA 2)	17:16	06:16	21:31	21:31	21:46	21:19	20:21	19:14	18:15 07:49 (WEA 1)
66	17:31	18:23	25 09:34 (WEA 2)	18:23	19:07	20:52	21:34	21:50	21:23	20:26	19:20	18:21 07:52 (WEA 1)
67	08:09	07:15	09:10 (WEA 2)	17:15	06:15	21:30	21:30	21:45	21:18	20:20	19:13	18:14 07:48 (WEA 1)
68	17:32	18:24	26 09:35 (WEA 2)	18:24	19:08	20:53	21:35	21:51	21:24	20:27	19:21	18:22 07:53 (WEA 1)
69	08:08	07:14	09:11 (WEA 2)	17:14	06:14	21:29	21:29	21:44	21:17	20:19	19:12	18:13 07:47 (WEA 1)
70	17:33	18:25	27 09:36 (WEA 2)	18:25	19:09	20:54	21:36	21:52	21:25	20:28	19:22	18:23 07:54 (WEA 1)
71	08:07	07:13	09:12 (WEA 2)	17:13	06:13	21:28	21:28	21:43	21:16	20:18	19:11	18:12 07:46 (WEA 1)
72	17:34	18:26	28 09:37 (WEA 2)	18:26	19:10	20:55	21:37	21:53	21:26	20:29	19:23	18:24 07:55 (WEA 1)
73	08:06	07:12	09:13 (WEA 2)	17:12	06:12	21:27	21:27	21:42	21:15	20:17	19:10	18:11 07:45 (WEA 1)
74	17:35	18:27	29 09:38 (WEA 2)	18:27	19:11	20:56	21:38	21:54	21:27	20:30	19:24	18:25 07:56 (WEA 1)
75	08:05	07:11	09:14 (WEA 2)	17:11	06:11	21:26	21:26	21:41	21:14	20:16	19:09	18:10 07:44 (WEA 1)
76	17:36	18:28	30 09:39 (WEA 2)	18:28	19:12	20:57	21:39	21:55	21:28	20:31	19:25	18:26 07:57 (WEA 1)
77	08:04	07:10	09:15 (WEA 2)	17:10	06:10	21:25	21:25	21				

Sonnenscheinstdauer	269	283	368	412	475	486	491	447	379	335	275	1656
astr. max. mögl. Beschattung	507	504	111							545	564	31
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	0,13
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	0,93
Reduktion Windrichtung	0,53	0,56	0,57							0,57	0,53	0,53
Gesamte Reduktion	0,07	0,12	0,18							0,07	0,07	0,06
Met. wahrsch. Beschattung	36	62	20							80	41	2



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-48 - 127, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	Marz	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34	08:10	09:06 (WEA 2)	07:22	08:15 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51	07:35
2	16:47	17:31	22 09:28 (WEA 2)	18:18	26 08:41 (WEA 1)	20:07	20:53	21:34	21:47	21:19	20:22	19:18
3	08:33	08:09	09:06 (WEA 2)	07:20	08:16 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
4	16:48	17:33	21 09:27 (WEA 2)	18:20	24 08:40 (WEA 1)	20:09	20:54	21:35	21:47	21:18	20:20	19:15
5	08:33	08:08	09:08 (WEA 2)	07:18	08:17 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:38
6	16:49	17:35	18 09:26 (WEA 2)	18:21	21 08:38 (WEA 1)	20:10	20:56	21:36	21:47	21:16	20:18	19:13
7	08:33	08:06	09:09 (WEA 2)	07:16	08:19 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
8	16:50	17:36	16 09:25 (WEA 2)	18:23	17 08:36 (WEA 1)	20:12	20:57	21:37	21:46	21:15	20:16	19:11
9	08:33	08:05	09:12 (WEA 2)	07:13	08:21 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
10	16:51	17:38	11 09:23 (WEA 2)	18:25	12 08:33 (WEA 1)	20:13	20:59	21:38	21:46	21:13	20:14	19:09
11	08:33	08:03	07:11	07:05	06:08	05:32	05:37	06:13	06:58	07:43	08:29	09:14
12	16:52	17:40	08:03	07:09	06:03	05:31	05:40	06:18	07:03	07:47	08:34	09:19
13	08:33	08:02	07:11	07:05	06:08	05:32	05:38	06:15	07:00	07:44	08:34	09:19
14	16:54	17:41	18:28	18:28	20:16	21:02	21:40	21:45	21:10	20:09	19:05	18:01
15	08:32	08:00	07:07	07:01	06:05	05:31	05:39	06:16	07:01	07:46	08:32	09:17
16	16:55	17:43	18:30	18:30	20:18	21:03	21:41	21:45	21:08	20:07	19:03	18:00
17	08:32	07:58	07:05	06:59	06:03	05:31	05:40	06:18	07:03	07:47	08:34	09:19
18	16:56	17:45	18:31	18:31	20:19	21:05	21:41	21:44	21:06	20:05	19:01	18:00
19	08:31	07:57	07:03	06:57	06:01	05:31	05:40	06:19	07:04	07:49	08:35	09:20
20	16:57	17:46	18:33	18:33	20:21	21:06	21:42	21:43	21:05	20:03	18:59	17:56
21	08:31	07:55	07:01	06:55	06:00	05:30	05:41	06:21	07:06	07:50	08:36	09:21
22	16:59	3 09:12 (WEA 2)	17:48	18:34	20:22	21:08	21:43	21:43	21:03	20:01	18:56	17:53
23	08:30	09:06 (WEA 2)	07:53	06:59	06:53	05:58	05:30	05:42	06:22	07:07	07:52	08:38
24	17:00	9 09:15 (WEA 2)	17:50	18:36	20:24	21:09	21:43	21:42	21:01	19:59	18:54	17:50
25	08:30	09:05 (WEA 2)	07:52	06:57	06:51	05:57	05:30	05:43	06:23	07:09	07:54	08:40
26	17:01	13 09:18 (WEA 2)	17:51	18:37	20:25	21:11	21:44	21:41	20:59	19:57	18:52	17:48
27	08:29	09:04 (WEA 2)	07:50	06:55	06:49	05:55	05:30	05:44	06:25	07:10	07:55	08:41
28	17:03	15 09:19 (WEA 2)	17:53	18:39	20:27	21:12	21:45	21:40	20:58	19:54	18:50	17:46
29	08:28	09:04 (WEA 2)	07:48	06:53	06:47	05:54	05:29	05:45	06:26	07:12	07:57	08:43
30	17:04	16 09:20 (WEA 2)	17:55	18:41	20:29	21:13	21:45	21:39	20:56	19:52	18:48	17:44
31	08:28	09:03 (WEA 2)	07:46	06:50	06:45	05:53	05:29	05:47	06:28	07:13	07:58	08:44
32	17:06	19 09:22 (WEA 2)	17:57	18:42	20:30	21:15	21:46	21:39	20:54	19:50	18:46	17:42
33	08:27	09:02 (WEA 2)	07:45	06:48	06:43	05:51	05:29	05:48	06:29	07:15	08:00	08:45
34	17:07	21 09:23 (WEA 2)	17:58	18:44	20:32	21:16	21:46	21:38	20:52	19:48	18:44	17:40
35	08:26	09:02 (WEA 2)	07:43	06:46	06:41	05:50	05:29	05:49	06:31	07:16	08:01	08:46
36	17:09	22 09:24 (WEA 2)	18:00	18:45	20:33	21:17	21:46	21:37	20:50	19:46	18:42	17:38
37	08:25	09:02 (WEA 2)	07:41	06:44	06:39	05:49	05:29	05:50	06:32	07:17	08:03	08:48
38	17:10	22 09:24 (WEA 2)	18:02	18:47	20:35	21:19	21:47	21:36	20:48	19:44	18:40	17:36
39	08:24	09:02 (WEA 2)	07:39	06:42	06:37	05:47	05:30	05:51	06:34	07:19	08:05	08:44
40	17:12	23 09:25 (WEA 2)	18:03	18:48	20:36	21:20	21:47	21:35	20:46	19:41	18:38	17:34
41	08:23	09:02 (WEA 2)	07:37	06:40	06:35	05:46	05:30	05:52	06:35	07:20	08:06	08:45
42	17:13	24 09:26 (WEA 2)	18:05	18:50	20:38	21:21	21:47	21:34	20:44	19:39	18:36	17:32
43	08:22	09:02 (WEA 2)	07:35	06:38	06:33	05:45	05:30	05:53	06:37	07:22	08:08	08:45
44	17:15	25 09:27 (WEA 2)	18:07	18:52	20:39	21:23	21:48	21:32	20:42	19:37	18:35	17:31
45	08:21	09:02 (WEA 2)	07:33	06:35	06:31	05:44	05:30	05:55	06:38	07:23	08:09	08:45
46	17:16	26 09:28 (WEA 2)	18:08	18:53	20:41	21:24	21:48	21:31	20:40	19:35	18:33	17:29
47	08:20	09:02 (WEA 2)	07:31	06:33	06:29	05:43	05:30	05:56	06:39	07:25	08:11	08:46
48	17:18	26 09:28 (WEA 2)	18:10	18:55	20:42	21:25	21:48	21:30	20:38	19:33	18:31	17:26
49	08:19	09:03 (WEA 2)	07:30	06:31	06:27	05:42	05:31	05:57	06:41	07:26	08:13	08:48
50	17:20	26 09:29 (WEA 2)	18:12	18:56	20:44	21:26	21:48	21:29	20:36	19:30	18:29	17:23
51	08:18	09:02 (WEA 2)	07:28	06:29	06:25	05:41	05:31	05:59	06:42	07:28	08:14	08:49
52	17:21	26 09:28 (WEA 2)	18:13	18:58	20:45	21:28	21:48	21:27	20:34	19:28	18:27	17:22
53	08:17	09:03 (WEA 2)	07:26	06:27	06:24	05:40	05:31	06:00	06:44	07:29	08:16	08:51
54	17:23	26 09:29 (WEA 2)	18:15	18:59	20:47	21:29	21:48	21:26	20:32	19:26	18:25	17:21
55	08:16	09:03 (WEA 2)	07:24	06:25	06:22	05:39	05:32	06:01	06:45	07:31	08:17	08:52
56	17:25	26 09:29 (WEA 2)	18:17	19:01	20:48	21:30	21:48	21:25	20:30	19:24	18:23	17:19
57	08:14	09:03 (WEA 2)	07:23	06:23	06:20	05:38	05:32	06:02	06:47	07:32	08:19	08:54
58	17:26	26 09:29 (WEA 2)	18:17	19:02	20:50	21:31	21:48	21:23	20:28	19:22	18:21	17:17
59	08:13	09:04 (WEA 2)	07:20	06:20	06:18	05:37	05:33	06:04	06:48	07:34	08:21	08:56
60	17:28	25 09:29 (WEA 2)	18:19	19:04	20:51	21:32	21:48	21:22	20:26	19:20	18:19	17:15
61	08:12	09:04 (WEA 2)	07:18	06:18	06:16	05:36	05:32	06:05	06:50	07:36	08:23	08:58
62	17:29	24 09:28 (WEA 2)	18:20	19:05	21:33	21:33	21:48	21:21	20:24	19:18	18:17	17:13
63	08:11	09:04 (WEA 2)	07:17	06:17	06:15	05:35	05:31	06:06	06:51	07:37	08:24	08:59
64	17:30	24 09:29 (WEA 2)	18:21	19:06	21:34	21:34	21:49	21:22	20:25	19:19	18:18	17:14
65	08:10	09:05 (WEA 2)	07:16	06:16	06:14	05:36	05:32	06:07	06:52	07:38	08:25	09:00
66	17:31	24 09:30 (WEA 2)	18:22	19:07	21:35	21:35	21:50	21:23	20:26	19:20	18:19	17:15
67	08:09	09:06 (WEA 2)	07:15	06:15	06:13	05:37	05:33	06:08	06:53	07:39	08:26	09:01
68	17:32	24 09:31 (WEA 2)	18:23	19:08	21:36	21:36	21:51	21:24	20:27	19:21	18:20	17:16
69	08:08	09:07 (WEA 2)	07:14	06:14	06:12	05:38	05:34	06:09	06:54	07:40	08:27	09:02
70	17:33	24 09:32 (WEA 2)	18:24	19:09	21:37	21:37	21:52	21:25	20:28	19:22	18:21	17:17
71	08:07	09:08 (WEA 2)	07:13	06:13	06:11	05:39	05:35	06:10	06:55	07:41	08:28	09:03
72	17:34	24 09:33 (WEA 2)	18:25	19:10	21:38	21:38	21:53	21:26	20:29	19:23	18:22	17:18
73	08:06	09:09 (WEA 2)	07:12	06:12	06:10	05:40	05:36	06:11	06:56	07:42	08:29	09:04
74	17:35	24 09:34 (WEA 2)	18:26	19:11	21:39	21:39	21:54	21:27	20:30	19:24	18:23	17:19
75	08:05	09:10 (WEA 2)	07:11	06:11	06:09	05:41	05:37	06:12	06:57	07:43	08:30	09:05
76	17:36	24 09:35 (WEA 2)	18:27	19:12	21:40	21:40	21:55	21:28	20:31	19:25	18:24	17:20
77	08:04	09:11 (WEA 2)	07:10	06:10	06:08	05:42	05:38	06:13	06:58	07:44	08:31	09:06
78	17:37	24 09:36 (WEA 2)	18:28	19:13	21:41	21:41	21:56	21:29	20:32	19:26	18:25	17:21
79	08:03	09:12 (WEA 2)	07:09	06:09	06:07	05:43	05:39	06:14	06:59	07:45	08:32	09:07
80	17:38	24 09:37 (WEA 2)	18:29	19:14	21:42	21:42	21:57	21:30	20:33	19:27	18:26	17:22
81	08:02	09:13 (WEA 2)	07:08	06:08	06:06	05:44	05:40	06:15	06:60	07:46	08:33	09:08
82	17:39	24										



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Beschreibung:

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Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-49 - 134, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	09:00 (WEA 2) 18:18	07:22 20:07	08:08 (WEA 1) 20:53	07:16 21:34	06:16 21:47	05:36 21:19	06:07 20:22	06:51 19:18	07:35 17:16	08:11 16:40
2	08:33 16:48	08:09 17:33	09:00 (WEA 2) 18:20	07:20 20:09	08:08 (WEA 1) 20:54	07:14 21:37	06:15 21:47	05:35 21:18	06:08 20:20	06:53 19:15	07:37 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	09:02 (WEA 2) 18:21	07:18 20:06	08:09 (WEA 1) 20:56	07:12 21:36	06:13 21:47	05:34 21:16	06:09 20:18	06:54 19:13	07:38 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	09:02 (WEA 2) 18:23	07:16 20:07	08:10 (WEA 1) 20:57	07:10 21:37	06:11 21:46	05:34 21:15	06:11 20:16	06:56 19:11	07:40 17:12	08:14 16:39
5	08:33 16:51	08:05 17:38	09:04 (WEA 2) 18:25	07:13 20:09	08:11 (WEA 1) 20:59	07:08 21:38	06:09 21:46	05:33 21:13	06:12 20:14	06:57 19:09	07:41 17:10	08:16 16:39
6	08:33 16:52	08:03 17:40	09:05 (WEA 2) 18:26	07:11 20:09	08:11 (WEA 1) 20:57	07:05 21:38	06:08 21:46	05:32 21:11	06:08 20:12	06:58 19:07	07:43 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	09:06 (WEA 2) 18:29	07:09 20:16	08:13 (WEA 1) 21:02	07:03 21:40	06:06 21:45	05:32 21:10	06:08 20:09	07:44 19:05	07:44 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	09:10 (WEA 2) 18:30	07:07 20:10	08:16 (WEA 1) 21:03	07:01 21:41	06:05 21:45	05:31 21:08	06:16 20:07	07:46 19:03	07:46 17:05	08:19 16:38
9	08:32 16:56	07:58 17:45	09:18 (WEA 2) 18:39	07:05 20:13	08:26 (WEA 1) 21:03	07:05 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:20 16:38
10	08:31 16:57	07:57 17:46	09:18 (WEA 2) 18:40	07:03 20:15	08:26 (WEA 1) 21:03	07:03 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:21 16:37
11	08:31 16:59	07:55 17:48	09:18 (WEA 2) 18:41	07:01 20:17	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:22 16:37
12	08:30 17:00	07:53 17:50	09:18 (WEA 2) 18:43	06:59 20:19	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:23 16:37
13	08:30 17:01	07:52 17:51	09:18 (WEA 2) 18:44	06:57 20:20	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:24 16:37
14	08:29 17:03	07:50 17:53	09:18 (WEA 2) 18:45	06:55 20:21	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:25 16:37
15	08:28 17:04	07:48 17:55	09:18 (WEA 2) 18:46	06:53 20:22	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:26 16:37
16	08:28 17:06	07:46 17:57	09:18 (WEA 2) 18:47	06:50 20:23	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:27 16:37
17	08:27 17:07	07:45 17:58	09:18 (WEA 2) 18:48	06:48 20:24	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:28 16:37
18	08:26 17:09	07:43 18:00	09:18 (WEA 2) 18:49	06:46 20:25	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:29 16:37
19	08:25 17:10	07:41 18:02	09:18 (WEA 2) 18:50	06:44 20:26	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:30 16:37
20	08:24 17:12	07:39 18:03	09:18 (WEA 2) 18:51	06:42 20:27	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:31 16:37
21	08:23 17:13	07:37 18:05	09:18 (WEA 2) 18:52	06:40 20:28	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:32 16:37
22	08:22 17:15	07:35 18:07	09:18 (WEA 2) 18:53	06:38 20:29	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:33 16:37
23	08:21 17:16	07:33 18:08	09:18 (WEA 2) 18:54	06:35 20:30	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:34 16:37
24	08:20 17:18	07:31 18:10	09:18 (WEA 2) 18:55	06:33 20:31	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:35 16:37
25	08:19 17:20	07:30 18:12	09:18 (WEA 2) 18:56	06:31 20:32	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:36 16:37
26	08:18 17:21	07:28 18:13	09:18 (WEA 2) 18:57	06:29 20:33	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:37 16:37
27	08:17 17:23	07:26 18:15	09:18 (WEA 2) 18:58	06:27 20:34	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:38 16:37
28	08:16 17:25	07:24 18:17	09:18 (WEA 2) 18:59	06:25 20:35	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:39 16:37
29	08:14 17:26	07:23 18:17	09:18 (WEA 2) 19:00	06:23 20:36	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:40 16:37
30	08:13 17:28	07:22 18:17	09:18 (WEA 2) 19:01	06:21 20:37	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:41 16:37
31	08:12 17:29	07:21 18:17	09:18 (WEA 2) 19:02	06:19 20:38	08:26 (WEA 1) 21:03	07:01 21:41	06:03 21:45	05:31 21:08	06:18 20:07	07:47 19:03	07:47 17:05	08:42 16:37
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	516	255
astr. max. mögl. Beschattung	357	465	183							502	0,15	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,54	0,56	0,57							0,57	0,54	
Gesamte Reduktion	0,07	0,12	0,18							0,15	0,07	
Met. wahrsch. Beschattung	26	57	34							74	38	

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-50 - 103, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung  
Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:59 (WEA 2) 18:18	07:22 18:18	08:08 (WEA 1) 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:07 21:19	06:51 20:22	07:35 19:18	08:11 16:40
2	08:33 16:48	08:09 17:33	08:59 (WEA 2) 18:20	07:20 18:20	08:09 (WEA 1) 20:07	06:15 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:12 16:40
3	08:33 16:49	08:08 17:35	09:00 (WEA 2) 18:21	07:18 18:21	08:09 (WEA 1) 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:13 16:39
4	08:33 16:50	08:06 17:36	09:01 (WEA 2) 18:23	07:16 18:23	08:10 (WEA 1) 20:12	06:11 20:57	05:34 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:14 16:39
5	08:33 16:51	08:05 17:38	09:02 (WEA 2) 18:25	07:13 18:25	08:12 (WEA 1) 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:16 16:39
6	08:33 16:52	08:03 17:40	09:03 (WEA 2) 18:26	07:11 18:26	08:12 (WEA 1) 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:58 20:12	07:43 19:07	08:17 16:38
7	08:33 16:54	08:02 17:41	09:05 (WEA 2) 18:29	07:09 18:29	08:15 (WEA 1) 20:16	06:06 21:02	05:32 21:43	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	08:18 16:38
8	08:33 16:55	08:00 17:43	09:09 (WEA 2) 18:30	07:07 18:30	08:26 (WEA 1) 20:18	06:05 21:03	05:31 21:45	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:19 16:38
9	08:33 16:56	07:57 17:45	09:15 (WEA 2) 18:31	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:20 16:37
10	08:31 16:57	07:57 17:46	09:15 (WEA 2) 18:33	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:59	08:21 16:37
11	08:31 16:59	07:55 17:48	09:15 (WEA 2) 18:34	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	08:22 16:37
12	08:30 17:00	07:53 17:50	09:15 (WEA 2) 18:36	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:23 16:37
13	08:30 17:01	07:52 17:52	09:15 (WEA 2) 18:37	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:24 16:37
14	08:29 17:03	07:50 17:53	09:15 (WEA 2) 18:39	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	08:25 16:37
15	08:28 17:04	07:48 17:55	09:15 (WEA 2) 18:41	06:53 18:41	06:47 20:29	05:54 21:13	05:29 21:45	05:45 21:39	06:26 20:56	07:12 19:52	07:57 18:48	08:26 16:37
16	08:28 17:06	07:46 17:57	09:15 (WEA 2) 18:42	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	08:27 16:37
17	08:27 17:07	07:45 17:58	09:15 (WEA 2) 18:44	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	08:28 16:38
18	08:26 17:09	07:43 18:00	09:15 (WEA 2) 18:45	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	08:29 16:38
19	08:25 17:10	07:41 18:02	09:15 (WEA 2) 18:47	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	08:30 16:38
20	08:24 17:12	07:39 18:03	09:15 (WEA 2) 18:48	06:42 18:48	06:37 20:36	05:47 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	08:31 16:39
21	08:23 17:13	07:37 18:05	09:15 (WEA 2) 18:50	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	08:32 16:39
22	08:22 17:15	07:35 18:07	09:15 (WEA 2) 18:52	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	08:33 16:39
23	08:21 17:16	07:33 18:08	09:15 (WEA 2) 18:53	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	08:34 16:40
24	08:20 17:18	07:31 18:10	09:15 (WEA 2) 18:55	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:30	06:39 20:38	07:25 19:33	08:11 18:31	08:35 16:41
25	08:19 17:20	07:30 18:12	09:15 (WEA 2) 18:56	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	05:57 21:29	06:41 20:36	07:26 19:30	08:13 18:29	08:36 16:41
26	08:18 17:21	07:28 18:13	09:15 (WEA 2) 18:58	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:59 21:27	06:42 20:34	07:28 19:28	08:14 18:27	08:37 16:42
27	08:17 17:23	07:26 18:15	09:15 (WEA 2) 18:59	06:27 18:59	06:24 20:47	05:40 21:29	05:31 21:48	06:00 21:26	06:44 20:32	07:29 19:26	08:16 18:25	08:38 16:43
28	08:16 17:25	07:24 18:17	09:15 (WEA 2) 19:01	06:25 19:01	06:22 20:50	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	08:17 18:23	08:39 16:43
29	08:14 17:26	07:23 18:17	09:15 (WEA 2) 19:02	06:23 19:02	06:20 20:51	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 19:22	08:19 18:22	08:40 16:44
30	08:13 17:28	07:22 18:17	09:15 (WEA 2) 19:03	06:21 19:03	06:18 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	08:21 18:20	08:41 16:45
31	08:12 17:29	07:21 18:18	09:15 (WEA 2) 19:04	06:20 19:04	06:17 20:52	05:36 21:33	05:34 21:49	06:05 21:21	06:50 20:24	07:22 19:18	08:22 18:19	08:42 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max.mögl. Beschattung	335	464	154							472	485	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,54	0,56	0,57							0,57	0,54	
Gesamte Reduktion	0,07	0,12	0,18							0,15	0,07	
Met. wahrsch. Beschattung	24	57	28							69	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)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-51 - 120, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:54 (WEA 2) 18:18	07:22 18:18	08:02 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:32 (WEA 2) 16:40
2	08:33 16:48	08:09 17:33	08:54 (WEA 2) 18:20	07:20 18:20	08:02 (WEA 1) 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:30 (WEA 2) 16:40
3	08:33 16:49	08:08 17:35	08:55 (WEA 2) 18:21	07:18 18:21	08:02 (WEA 1) 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:29 (WEA 2) 16:39
4	08:33 16:50	08:06 17:36	08:55 (WEA 2) 18:23	07:16 18:23	08:03 (WEA 1) 20:12	06:11 20:57	05:36 21:37	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:12	08:27 (WEA 2) 16:39
5	08:33 16:51	08:05 17:38	08:56 (WEA 2) 18:25	07:13 18:25	08:03 (WEA 1) 20:13	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:09	07:41 19:09	07:31 17:10	08:26 (WEA 2) 16:39
6	08:33 16:52	08:03 17:40	08:56 (WEA 2) 18:26	07:11 18:26	08:03 (WEA 1) 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:26 (WEA 2) 16:38
7	08:33 16:54	08:02 17:41	08:57 (WEA 2) 18:28	07:09 18:28	08:04 (WEA 1) 20:16	06:06 21:02	05:32 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:25 (WEA 2) 16:38
8	08:32 16:55	08:00 17:43	08:59 (WEA 2) 18:30	07:07 18:30	08:06 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:39 (WEA 1) 16:38
9	08:32 16:56	08:01 17:45	09:01 (WEA 2) 18:31	07:05 18:31	08:08 (WEA 1) 20:19	06:03 21:05	05:31 21:41	06:18 21:14	07:03 20:05	07:47 19:01	07:37 17:04	08:40 (WEA 1) 16:37
10	08:31 16:57	07:57 17:46	09:03 (WEA 2) 18:33	07:03 18:33	08:12 (WEA 1) 20:21	06:01 21:06	05:31 21:42	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:37 (WEA 1) 16:37
11	08:31 16:59	07:55 17:48	09:05 (WEA 2) 18:34	07:01 18:34	08:18 (WEA 1) 20:22	06:00 21:08	05:30 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:42 (WEA 1) 16:37
12	08:30 17:00	07:53 17:50	09:06 (WEA 2) 18:36	06:59 18:36	08:20 (WEA 1) 20:24	05:58 21:09	05:30 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:44 (WEA 1) 16:37
13	08:30 17:01	07:52 17:52	09:07 (WEA 2) 18:37	06:57 18:37	08:21 (WEA 1) 20:25	05:57 21:11	05:30 21:44	06:23 21:01	07:09 19:57	07:54 18:52	07:44 17:01	08:45 (WEA 1) 16:37
14	08:29 17:03	07:50 17:53	09:08 (WEA 2) 18:38	06:55 18:39	08:22 (WEA 1) 20:27	05:55 21:12	05:30 21:45	06:25 21:08	07:10 19:54	07:55 18:50	07:45 17:05	08:46 (WEA 1) 16:37
15	08:28 17:04	07:48 17:55	09:09 (WEA 2) 18:39	06:53 18:41	08:23 (WEA 1) 20:29	05:54 21:13	05:30 21:45	06:26 21:09	07:12 19:52	07:57 18:48	07:47 17:06	08:47 (WEA 1) 16:37
16	08:28 17:06	07:46 17:57	09:10 (WEA 2) 18:40	06:50 18:42	08:24 (WEA 1) 20:30	05:53 21:15	05:30 21:46	06:28 21:13	07:13 19:50	07:58 18:46	07:48 17:04	08:48 (WEA 1) 16:37
17	08:27 17:07	07:45 17:58	09:11 (WEA 2) 18:41	06:48 18:44	08:25 (WEA 1) 20:32	05:51 21:16	05:30 21:46	06:29 21:05	07:15 19:48	08:00 18:44	07:50 17:03	08:49 (WEA 1) 16:38
18	08:26 17:09	07:43 18:00	09:12 (WEA 2) 18:42	06:46 18:45	08:26 (WEA 1) 20:33	05:50 21:17	05:30 21:46	06:31 21:07	07:16 19:46	08:01 18:42	07:51 17:02	08:50 (WEA 1) 16:38
19	08:25 17:10	07:41 18:02	09:13 (WEA 2) 18:43	06:44 18:47	08:27 (WEA 1) 20:34	05:49 21:19	05:30 21:47	06:32 21:06	07:17 19:44	08:03 18:40	07:53 17:01	08:51 (WEA 1) 16:38
20	08:24 17:12	07:39 18:03	09:14 (WEA 2) 18:44	06:42 18:48	08:28 (WEA 1) 20:36	05:47 21:20	05:30 21:47	06:34 21:05	07:19 19:41	08:05 18:38	07:55 17:00	08:52 (WEA 1) 16:39
21	08:23 17:13	07:37 18:05	09:15 (WEA 2) 18:45	06:40 18:50	08:29 (WEA 1) 20:38	05:46 21:21	05:30 21:47	06:35 21:04	07:20 19:39	08:06 18:36	07:56 17:01	08:53 (WEA 1) 16:39
22	08:22 17:15	07:35 18:07	09:16 (WEA 2) 18:46	06:38 18:52	08:30 (WEA 1) 20:39	05:45 21:23	05:30 21:48	06:37 21:02	07:22 19:37	08:08 18:35	07:58 17:03	08:54 (WEA 1) 16:39
23	08:21 17:16	07:33 18:08	09:17 (WEA 2) 18:47	06:35 18:53	08:31 (WEA 1) 20:41	05:44 21:24	05:30 21:48	06:38 21:01	07:23 19:35	08:09 18:33	07:59 17:04	08:55 (WEA 1) 16:39
24	08:20 17:18	07:31 18:10	09:18 (WEA 2) 18:48	06:33 18:55	08:32 (WEA 1) 20:42	05:43 21:25	05:30 21:49	06:39 21:00	07:25 19:31	08:11 18:31	08:01 17:05	08:56 (WEA 1) 16:40
25	08:19 17:20	07:30 18:12	09:19 (WEA 2) 18:49	06:31 18:56	08:33 (WEA 1) 20:44	05:42 21:26	05:30 21:50	06:41 21:01	07:26 19:30	08:13 18:36	08:02 17:06	08:57 (WEA 1) 16:41
26	08:18 17:21	07:28 18:13	09:20 (WEA 2) 18:50	06:29 18:58	08:34 (WEA 1) 20:46	05:41 21:27	05:30 21:51	06:42 21:02	07:28 19:28	08:14 18:37	08:04 17:07	08:58 (WEA 1) 16:42
27	08:17 17:23	07:26 18:15	09:21 (WEA 2) 18:51	06:27 18:59	08:35 (WEA 1) 20:48	05:40 21:29	05:30 21:52	06:44 21:03	07:29 19:26	08:16 18:39	08:05 17:08	08:59 (WEA 1) 16:43
28	08:16 17:25	07:24 18:17	09:22 (WEA 2) 18:52	06:25 19:01	08:36 (WEA 1) 20:50	05:39 21:30	05:32 21:53	06:45 21:04	07:31 19:24	08:17 18:41	08:06 17:09	09:00 (WEA 1) 16:44
29	08:14 17:26	07:23 18:19	09:23 (WEA 2) 18:53	06:23 19:02	08:37 (WEA 1) 20:51	05:38 21:31	05:30 21:54	06:47 21:05	07:32 19:20	08:19 18:42	08:08 17:10	09:01 (WEA 1) 16:45
30	08:13 17:28	07:22 18:20	09:24 (WEA 2) 18:54	06:21 19:04	08:38 (WEA 1) 20:52	05:37 21:32	05:30 21:55	06:48 21:06	07:34 19:21	08:21 18:43	08:09 17:11	09:02 (WEA 1) 16:46
31	08:12 17:29	07:21 18:21	09:25 (WEA 2) 18:55	06:20 19:05	08:39 (WEA 1) 20:53	05:36 21:33	05:30 21:56	06:49 21:07	07:35 19:22	08:22 18:44	08:10 17:12	09:03 (WEA 1) 16:47
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	260	440	232							474	470	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,54	0,56	0,57							0,57	0,54	
Gesamte Reduktion	0,07	0,12	0,18							0,15	0,08	
Met. wahrsch. Beschattung	19	54	43							70	35	

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

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





## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-52 - 95, Rue Pierre Gansen, 4570 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:54 (WEA 2) 18:18	07:22 20:07	08:03 (WEA 1) 20:53	07:16 21:34	06:16 21:47	05:36 21:19	06:07 20:22	06:51 19:18	07:35 17:16	08:11 16:40
2	08:33 16:48	08:09 17:33	08:53 (WEA 2) 18:20	07:20 20:07	08:03 (WEA 1) 20:54	07:14 21:35	06:15 21:47	05:35 21:18	06:08 20:20	06:53 19:15	07:37 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	08:54 (WEA 2) 18:21	07:18 20:06	08:04 (WEA 1) 20:56	07:12 21:36	06:13 21:47	05:34 21:16	06:09 20:18	06:54 19:13	07:38 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	08:55 (WEA 2) 18:23	07:16 20:05	08:04 (WEA 1) 20:57	07:10 21:37	06:11 21:46	05:34 21:15	06:11 20:16	06:56 19:11	07:40 17:12	08:14 16:39
5	08:33 16:51	08:05 17:41	08:56 (WEA 2) 18:28	07:13 20:02	08:05 (WEA 1) 20:59	07:08 21:40	06:09 21:45	05:36 21:10	06:12 20:09	06:57 19:05	07:41 17:15	08:16 16:39
6	08:33 16:52	08:03 17:40	08:57 (WEA 2) 18:26	07:11 20:00	08:05 (WEA 1) 20:58	07:05 21:11	06:08 21:46	05:32 21:11	06:08 20:12	06:58 19:07	07:43 17:12	08:17 16:38
7	08:33 16:54	08:02 17:41	08:57 (WEA 2) 18:28	07:09 20:00	08:07 (WEA 1) 20:59	07:03 21:42	06:06 21:45	05:32 21:10	06:08 20:09	06:58 19:05	07:44 17:12	08:18 16:39
8	08:32 16:55	08:00 17:45	09:00 (WEA 2) 18:30	07:07 20:03	08:09 (WEA 1) 21:03	07:01 21:41	06:05 21:45	05:31 21:10	06:16 20:07	07:46 19:03	07:46 17:05	08:19 16:38
9	08:32 16:56	08:00 17:45	09:02 (WEA 2) 18:31	07:05 20:03	08:09 (WEA 1) 21:03	07:01 21:41	06:05 21:45	05:31 21:10	06:16 20:07	07:46 19:03	07:46 17:05	08:19 16:38
10	08:31 16:57	07:57 17:46	09:12 (WEA 2) 18:33	07:03 20:00	08:22 (WEA 1) 21:03	07:01 21:41	06:05 21:45	05:31 21:10	06:16 20:07	07:46 19:03	07:46 17:05	08:19 16:38
11	08:31 16:59	07:55 17:48	09:15 (WEA 2) 18:34	07:01 20:00	08:25 (WEA 1) 21:03	07:01 21:41	06:05 21:45	05:31 21:10	06:16 20:07	07:46 19:03	07:46 17:05	08:19 16:38
12	08:30 17:00	07:53 17:50	09:18 (WEA 2) 18:36	06:59 19:59	08:28 (WEA 1) 21:05	07:03 21:43	06:08 21:47	05:31 21:12	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
13	08:30 17:01	07:52 17:52	09:20 (WEA 2) 18:37	06:57 19:59	08:30 (WEA 1) 21:06	07:03 21:44	06:08 21:48	05:31 21:12	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
14	08:29 17:03	07:50 17:53	09:22 (WEA 2) 18:39	06:55 19:59	08:32 (WEA 1) 21:08	07:03 21:46	06:08 21:50	05:31 21:13	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
15	08:28 17:04	07:48 17:55	09:24 (WEA 2) 18:41	06:53 19:59	08:34 (WEA 1) 21:10	07:03 21:48	06:08 21:52	05:31 21:14	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
16	08:28 17:06	07:46 17:57	09:26 (WEA 2) 18:43	06:50 19:59	08:36 (WEA 1) 21:12	07:03 21:50	06:08 21:54	05:31 21:16	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
17	08:27 17:07	07:45 17:58	09:28 (WEA 2) 18:45	06:48 19:59	08:38 (WEA 1) 21:14	07:03 21:52	06:08 21:56	05:31 21:18	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
18	08:26 17:09	07:43 18:00	09:30 (WEA 2) 18:47	06:46 19:59	08:40 (WEA 1) 21:16	07:03 21:54	06:08 21:58	05:31 21:20	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
19	08:25 17:10	08:59 (WEA 2) 18:07	09:32 (WEA 2) 18:49	06:44 19:59	08:42 (WEA 1) 21:18	07:03 21:56	06:08 22:00	05:31 21:22	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
20	08:24 17:12	08:57 (WEA 2) 18:09	09:34 (WEA 2) 18:51	06:42 19:59	08:44 (WEA 1) 21:20	07:03 21:58	06:08 22:02	05:31 21:24	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
21	08:23 17:13	08:56 (WEA 2) 18:11	09:36 (WEA 2) 19:03	06:40 19:59	08:46 (WEA 1) 21:22	07:03 22:00	06:08 22:04	05:31 21:26	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
22	08:22 17:15	08:55 (WEA 2) 18:13	09:38 (WEA 2) 19:05	06:38 19:59	08:48 (WEA 1) 21:24	07:03 22:02	06:08 22:06	05:31 21:28	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
23	08:21 17:16	08:55 (WEA 2) 18:14	09:40 (WEA 2) 19:07	06:36 19:59	08:50 (WEA 1) 21:26	07:03 22:04	06:08 22:08	05:31 21:30	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
24	08:20 17:18	08:54 (WEA 2) 18:16	09:42 (WEA 2) 19:09	06:34 19:59	08:52 (WEA 1) 21:28	07:03 22:06	06:08 22:10	05:31 21:32	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
25	08:19 17:20	08:54 (WEA 2) 18:18	09:44 (WEA 2) 19:11	06:32 19:59	08:54 (WEA 1) 21:30	07:03 22:08	06:08 22:12	05:31 21:34	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
26	08:18 17:21	08:53 (WEA 2) 18:19	09:46 (WEA 2) 19:13	06:30 19:59	08:56 (WEA 1) 21:32	07:03 22:10	06:08 22:14	05:31 21:36	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
27	08:17 17:23	08:53 (WEA 2) 18:21	09:48 (WEA 2) 19:15	06:28 19:59	08:58 (WEA 1) 21:34	07:03 22:12	06:08 22:16	05:31 21:38	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
28	08:16 17:25	08:53 (WEA 2) 18:23	09:50 (WEA 2) 19:17	06:26 19:59	09:00 (WEA 1) 21:36	07:03 22:14	06:08 22:18	05:31 21:40	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
29	08:14 17:26	08:53 (WEA 2) 18:25	09:52 (WEA 2) 19:19	06:24 19:59	09:02 (WEA 1) 21:38	07:03 22:16	06:08 22:20	05:31 21:42	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
30	08:13 17:28	08:53 (WEA 2) 18:27	09:54 (WEA 2) 19:21	06:22 19:59	09:04 (WEA 1) 21:40	07:03 22:18	06:08 22:22	05:31 21:44	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
31	08:12 17:29	08:53 (WEA 2) 18:29	09:56 (WEA 2) 19:23	06:20 19:59	09:06 (WEA 1) 21:42	07:03 22:20	06:08 22:24	05:31 21:46	06:18 20:09	07:47 19:05	07:47 17:07	08:20 16:37
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	255	
astr. max. mögl. Beschattung	263	444	188						456			
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35						0,28		0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93						0,93		0,93	
Reduktion Windrichtung	0,54	0,56	0,57						0,57		0,54	
Gesamte Reduktion	0,07	0,12	0,18						0,15		0,08	
Met. wahrsch. Beschattung	19	55	35						67		34	

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-53 - 114, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:50 (WEA 2) 18:18	07:22 20:07	07:59 (WEA 1) 20:53	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:25 (WEA 2) 16:40
2	08:33 16:48	08:09 17:33	08:49 (WEA 2) 18:20	07:20 20:07	07:58 (WEA 1) 20:54	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:24 (WEA 2) 16:40
3	08:33 16:49	08:08 17:35	08:50 (WEA 2) 18:21	07:18 20:10	07:58 (WEA 1) 20:56	06:13 20:56	05:34 21:36	06:09 21:47	06:54 20:18	07:38 19:13	07:27 17:13	08:23 (WEA 2) 16:39
4	08:33 16:50	08:06 17:36	08:50 (WEA 2) 18:23	07:16 20:12	07:59 (WEA 1) 20:57	06:11 20:57	05:36 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:11	08:21 (WEA 2) 16:39
5	08:33 16:51	08:05 17:43	08:51 (WEA 2) 18:25	07:13 20:28	07:59 (WEA 1) 20:59	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:31 17:10	08:21 (WEA 2) 16:39
6	08:33 16:52	08:03 17:40	08:51 (WEA 2) 18:26	07:11 20:27	07:58 (WEA 1) 20:15	06:08 21:00	05:32 21:46	06:03 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:21 (WEA 2) 16:38
7	08:33 16:54	08:02 17:41	08:52 (WEA 2) 18:28	07:09 20:35	07:59 (WEA 1) 20:35	06:06 21:02	05:32 21:45	06:08 21:10	07:00 20:09	07:44 19:05	07:44 17:05	08:21 (WEA 2) 16:38
8	08:32 16:55	08:00 17:43	08:53 (WEA 2) 18:30	07:07 20:22	08:00 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:46 17:05	08:21 (WEA 2) 16:38
9	08:32 16:56	08:00 17:44	08:54 (WEA 2) 18:31	07:05 20:19	08:02 (WEA 1) 20:19	06:03 21:05	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:20 (WEA 2) 16:37
10	08:31 16:57	07:57 17:46	08:55 (WEA 2) 18:33	07:03 20:14	08:04 (WEA 1) 20:21	06:01 21:06	05:31 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:21 (WEA 2) 16:37
11	08:31 16:59	07:55 17:48	08:58 (WEA 2) 18:34	07:01 20:14	08:08 (WEA 1) 20:22	06:00 21:08	05:30 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:21 (WEA 2) 16:37
12	08:30 17:00	07:53 17:50	08:59 18:36	06:59 20:24	08:04 (WEA 1) 20:24	06:00 21:09	05:30 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:21 (WEA 2) 16:37
13	08:30 17:01	07:52 17:52	08:59 18:37	06:57 20:25	08:04 (WEA 1) 20:25	06:00 21:11	05:30 21:44	06:23 21:01	07:09 19:57	07:54 18:52	07:44 17:01	08:21 (WEA 2) 16:37
14	08:29 17:03	07:50 17:53	08:59 18:39	06:55 20:27	08:04 (WEA 1) 20:27	06:00 21:12	05:30 21:45	06:25 21:01	07:10 19:54	07:55 18:50	07:45 17:00	08:21 (WEA 2) 16:37
15	08:28 17:04	07:48 17:55	08:53 18:41	06:53 20:29	08:04 (WEA 1) 20:29	06:00 21:13	05:30 21:45	06:26 21:01	07:12 19:52	07:57 18:48	07:47 17:00	08:21 (WEA 2) 16:37
16	08:28 17:06	07:46 17:57	08:50 18:42	06:50 20:30	08:04 (WEA 1) 20:30	06:00 21:15	05:30 21:46	06:28 21:01	07:13 19:50	07:58 18:46	07:48 17:00	08:21 (WEA 2) 16:37
17	08:27 17:07	07:45 17:58	08:48 18:44	06:48 20:32	08:04 (WEA 1) 20:32	06:00 21:16	05:30 21:46	06:29 21:01	07:15 19:48	08:00 18:44	07:50 17:00	08:21 (WEA 2) 16:37
18	08:26 17:09	07:43 18:00	08:46 18:45	06:46 20:33	08:04 (WEA 1) 20:33	06:00 21:17	05:30 21:46	06:31 21:01	07:16 19:46	08:01 18:42	07:51 17:00	08:21 (WEA 2) 16:37
19	08:25 17:10	07:41 18:02	08:44 18:47	06:44 20:35	08:04 (WEA 1) 20:35	06:00 21:19	05:30 21:47	06:32 21:01	07:17 19:44	08:03 18:40	07:53 17:00	08:21 (WEA 2) 16:37
20	08:24 17:12	07:39 18:03	08:14 (WEA 1) 18:42	06:42 20:36	08:04 (WEA 1) 20:36	06:00 21:20	05:30 21:47	06:34 21:01	07:19 19:41	08:05 18:38	07:55 17:00	08:21 (WEA 2) 16:37
21	08:23 17:13	07:37 18:05	08:15 (WEA 1) 18:50	06:40 20:38	08:04 (WEA 1) 20:38	06:00 21:21	05:30 21:47	06:35 21:01	07:20 19:39	08:06 18:36	07:56 17:00	08:21 (WEA 2) 16:37
22	08:22 17:15	07:35 18:05 (WEA 2)	08:15 (WEA 1) 18:52	06:38 20:39	08:04 (WEA 1) 20:39	06:00 21:23	05:30 21:48	06:37 21:01	07:22 19:37	08:08 18:35	07:58 17:00	08:21 (WEA 2) 16:37
23	08:21 17:16	07:33 18:07 (WEA 2)	08:15 (WEA 1) 18:53	06:35 20:41	08:04 (WEA 1) 20:41	06:00 21:24	05:30 21:48	06:38 21:01	07:23 19:35	08:09 18:33	07:59 17:00	08:21 (WEA 2) 16:37
24	08:20 17:18	07:31 18:09 (WEA 2)	08:15 (WEA 1) 18:55	06:33 20:42	08:04 (WEA 1) 20:42	06:00 21:25	05:30 21:48	06:39 21:01	07:25 19:33	08:11 18:31	08:01 17:00	08:21 (WEA 2) 16:37
25	08:19 17:20	07:30 18:12 (WEA 2)	08:15 (WEA 1) 18:56	06:31 20:44	08:04 (WEA 1) 20:44	06:00 21:26	05:30 21:48	06:41 21:01	07:26 19:30	08:13 18:31	08:02 17:00	08:21 (WEA 2) 16:37
26	08:18 17:21	07:28 18:13 (WEA 2)	08:15 (WEA 1) 18:58	06:29 20:45	08:04 (WEA 1) 20:45	06:00 21:27	05:30 21:48	06:42 21:01	07:28 19:28	08:14 18:31	08:04 17:00	08:21 (WEA 2) 16:37
27	08:17 17:23	07:26 18:15 (WEA 2)	08:15 (WEA 1) 18:59	06:27 20:47	08:04 (WEA 1) 20:47	06:00 21:29	05:30 21:48	06:44 21:01	07:29 19:26	08:16 18:31	08:05 17:00	08:21 (WEA 2) 16:37
28	08:16 17:25	07:24 18:17 (WEA 2)	08:15 (WEA 1) 19:01	06:25 20:48	08:04 (WEA 1) 20:48	06:00 21:30	05:30 21:48	06:45 21:01	07:31 19:24	08:17 18:31	08:06 17:00	08:21 (WEA 2) 16:37
29	08:14 17:26	07:23 18:14 (WEA 2)	08:15 (WEA 1) 19:02	06:23 20:50	08:04 (WEA 1) 20:50	06:00 21:31	05:30 21:48	06:47 21:01	07:32 19:22	08:19 18:31	08:08 17:00	08:21 (WEA 2) 16:37
30	08:13 17:28	07:22 18:15 (WEA 2)	08:15 (WEA 1) 19:03	06:21 20:51	08:04 (WEA 1) 20:51	06:00 21:32	05:30 21:48	06:48 21:01	07:34 19:20	08:21 (WEA 2) 18:31	08:09 17:00	08:21 (WEA 2) 16:37
31	08:12 17:29	07:21 18:16 (WEA 2)	08:15 (WEA 1) 19:04	06:20 20:52	08:04 (WEA 1) 20:52	06:00 21:33	05:30 21:48	06:50 21:01	07:35 19:19	08:22 (WEA 2) 18:31	08:10 17:00	08:21 (WEA 2) 16:37
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	255	
astr. max. mögl. Beschattung	198	429	258							464		
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28		
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93		
Reduktion Windrichtung	0,55	0,56	0,57							0,57		
Gesamte Reduktion	0,07	0,12	0,18							0,15		
Met. wahrsch. Beschattung	15	53	48							68	33	

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





## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-54 - 108B, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Juli	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:46 (WEA 2) 18:18	07:22 20:07	07:55 (WEA 1) 20:53	07:16 20:53	06:16 20:53	05:36 20:53	06:07 20:53	06:51 20:53	07:35 20:53	08:40 (WEA 1) 20:53
2	08:33 16:48	08:09 17:33	08:45 (WEA 2) 18:20	07:20 20:09	07:54 (WEA 1) 20:54	07:14 20:54	06:15 20:54	05:35 20:54	06:08 20:54	06:53 20:54	07:37 20:54	08:37 (WEA 1) 20:54
3	08:33 16:49	08:08 17:35	08:46 (WEA 2) 18:21	07:18 20:09	07:54 (WEA 1) 20:54	07:12 20:54	06:13 20:54	05:34 20:54	06:09 20:54	06:54 20:54	07:38 20:54	08:34 (WEA 1) 20:54
4	08:33 16:50	08:06 17:36	08:45 (WEA 2) 18:23	07:16 20:09	07:54 (WEA 1) 20:54	07:10 20:54	06:11 20:54	05:34 20:54	06:11 20:54	06:56 20:54	07:40 20:54	08:33 (WEA 1) 20:54
5	08:33 16:51	08:05 17:36	08:46 (WEA 2) 18:25	07:13 20:09	07:54 (WEA 1) 20:54	07:08 20:54	06:09 20:54	05:33 20:54	06:12 20:54	06:57 20:54	07:41 20:54	08:31 (WEA 1) 20:54
6	08:33 16:52	08:03 17:40	08:46 (WEA 2) 18:26	07:11 20:09	07:53 (WEA 1) 20:53	07:05 20:53	06:08 20:53	05:32 20:53	06:13 20:53	06:58 20:53	07:43 20:53	08:31 (WEA 1) 20:53
7	08:33 16:54	08:02 17:41	08:46 (WEA 2) 18:26	07:09 20:09	07:53 (WEA 1) 20:53	07:03 20:53	06:06 20:53	05:32 20:53	06:13 20:53	06:58 20:53	07:44 20:53	08:29 (WEA 1) 20:53
8	08:32 16:55	08:00 17:43	08:47 (WEA 2) 18:30	07:07 20:09	07:54 (WEA 1) 20:54	07:01 20:54	06:05 20:54	05:31 20:54	06:16 20:54	07:01 20:54	07:46 20:54	08:29 (WEA 1) 20:54
9	08:32 16:56	07:58 17:45	08:48 (WEA 2) 18:31	07:05 20:09	07:55 (WEA 1) 20:54	06:59 20:54	06:03 20:54	05:31 20:54	06:18 20:54	07:03 20:54	07:47 20:54	08:28 (WEA 1) 20:54
10	08:31 16:57	07:57 17:46	08:48 (WEA 2) 18:33	07:03 20:09	07:56 (WEA 1) 20:54	06:57 20:54	06:01 20:54	05:31 20:54	06:19 20:54	07:04 20:54	07:49 20:54	08:28 (WEA 1) 20:54
11	08:31 16:59	07:55 17:48	08:49 (WEA 2) 18:34	07:01 20:09	07:57 (WEA 1) 20:54	06:55 20:54	06:00 20:54	05:30 20:54	06:21 20:54	07:06 20:54	07:50 20:54	08:28 (WEA 1) 20:54
12	08:30 17:00	07:53 17:50	08:52 (WEA 2) 18:36	06:59 20:09	08:00 (WEA 1) 20:54	06:53 20:54	05:58 20:54	05:30 20:54	06:22 20:54	07:07 20:54	07:52 20:54	08:28 (WEA 1) 20:54
13	08:30 17:01	07:52 17:52	08:54 (WEA 2) 18:37	06:57 20:09	08:13 (WEA 1) 20:54	06:51 20:54	05:57 20:54	05:30 20:54	06:23 20:54	07:09 20:54	07:54 20:54	08:28 (WEA 1) 20:54
14	08:29 17:03	07:50 17:53	09:04 (WEA 2) 18:37	06:55 20:09	08:25 20:54	06:49 20:54	05:55 20:54	05:30 20:54	06:25 20:54	07:10 20:54	07:55 20:54	08:28 (WEA 1) 20:54
15	08:28 17:04	07:48 17:55	08:53 18:41	06:53 20:09	08:25 20:54	06:47 20:54	05:54 20:54	05:30 20:54	06:26 20:54	07:12 20:54	07:57 20:54	08:29 (WEA 1) 20:54
16	08:28 17:06	07:46 17:57	08:50 18:42	06:50 20:09	08:25 20:54	06:45 20:54	05:53 20:54	05:29 20:54	06:28 20:54	07:13 20:54	07:58 20:54	08:30 (WEA 1) 20:54
17	08:27 17:07	07:45 17:58	08:48 18:44	06:48 20:09	08:25 20:54	06:43 20:54	05:51 20:54	05:29 20:54	06:29 20:54	07:15 20:54	08:00 20:54	08:31 (WEA 1) 20:54
18	08:26 17:09	07:43 18:00	08:46 18:45	06:46 20:09	08:25 20:54	06:41 20:54	05:50 20:54	05:29 20:54	06:31 20:54	07:16 20:54	08:01 20:54	08:33 (WEA 1) 20:54
19	08:25 17:10	07:41 18:02	08:44 18:47	06:44 20:09	08:25 20:54	06:39 20:54	05:49 20:54	05:29 20:54	06:32 20:54	07:17 20:54	08:03 20:54	08:36 (WEA 1) 20:54
20	08:24 17:12	07:39 18:03	08:42 18:48	06:42 20:09	08:25 20:54	06:37 20:54	05:47 20:54	05:30 20:54	06:34 20:54	07:19 20:54	08:05 20:54	08:37 (WEA 1) 20:54
21	08:23 17:13	07:37 18:05	08:40 18:50	06:40 20:09	08:25 20:54	06:36 20:54	05:46 20:54	05:30 20:54	06:35 20:54	07:20 20:54	08:06 20:54	08:38 (WEA 1) 20:54
22	08:22 17:15	07:35 18:07	08:38 18:52	06:38 20:09	08:25 20:54	06:33 20:54	05:45 20:54	05:30 20:54	06:37 20:54	07:22 20:54	08:08 20:54	08:39 (WEA 1) 20:54
23	08:21 17:16	07:33 18:08	08:35 18:53	06:35 20:09	08:25 20:54	06:31 20:54	05:44 20:54	05:30 20:54	06:38 20:54	07:23 20:54	08:09 20:54	08:40 (WEA 1) 20:54
24	08:20 17:18	07:31 18:10	08:31 18:55	06:33 20:09	08:25 20:54	06:29 20:54	05:43 20:54	05:30 20:54	06:39 20:54	07:25 20:54	08:11 20:54	08:41 (WEA 1) 20:54
25	08:19 17:20	07:30 18:12	08:30 18:56	06:31 20:09	08:25 20:54	06:27 20:54	05:42 20:54	05:31 20:54	06:41 20:54	07:26 20:54	08:13 20:54	08:42 (WEA 1) 20:54
26	08:18 17:21	07:28 18:13	08:29 18:58	06:29 20:09	08:25 20:54	06:25 20:54	05:41 20:54	05:31 20:54	06:42 20:54	07:28 20:54	08:14 20:54	08:43 (WEA 1) 20:54
27	08:17 17:23	07:26 18:15	08:27 18:59	06:27 20:09	08:25 20:54	06:24 20:54	05:40 20:54	05:31 20:54	06:44 20:54	07:29 20:54	08:16 20:54	08:44 (WEA 1) 20:54
28	08:16 17:25	07:24 18:17	08:26 19:01	06:25 20:09	08:25 20:54	06:22 20:54	05:39 20:54	05:32 20:54	06:45 20:54	07:31 20:54	08:17 20:54	08:45 (WEA 1) 20:54
29	08:14 17:26	07:22 18:19	08:24 19:04	06:23 20:09	08:25 20:54	06:20 20:54	05:38 20:54	05:32 20:54	06:47 20:54	07:32 20:54	08:19 20:54	08:46 (WEA 1) 20:54
30	08:13 17:28	07:20 18:22	08:22 19:06	06:20 20:09	08:25 20:54	06:18 20:54	05:37 20:54	05:33 20:54	06:48 20:54	07:34 20:54	08:21 20:54	08:47 (WEA 1) 20:54
31	08:12 17:29	07:18 18:23	08:21 19:09	06:18 20:09	08:25 20:54	06:15 20:54	05:34 20:54	05:30 20:54	06:50 20:54	07:36 20:54	08:23 20:54	08:48 (WEA 1) 20:54
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	373	255
astr. max. mögl. Beschattung	129	411	302								485	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35								0,28	
Reduktion Betriebsdauer	0,93	0,93	0,93								0,93	
Reduktion Windrichtung	0,55	0,56	0,57								0,57	
Gesamte Reduktion	0,07	0,12	0,19								0,15	
Met. wahrsch. Beschattung	10	50	56								71	

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)



# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: ZusatzbelastungSchattenrezeptor: N-55 - 108, Rue Pierre Gansen, 4570 Niederkorn  
 Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
 1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
 300 483 640 678 577 410 544 1.204 1.449 999 547 327 8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	08:10	08:44 (WEA 2)	07:22	07:53 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51	07:35
	16:47	17:31	23 09:07 (WEA 2)	18:18	27 08:20 (WEA 1)	20:07	20:53	21:34	21:47	21:19	20:22	19:18
2	08:33	08:09	08:43 (WEA 2)	07:20	07:53 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
	16:48	17:33	25 09:08 (WEA 2)	18:20	27 08:20 (WEA 1)	20:09	20:54	21:35	21:47	21:18	20:20	19:15
3	08:33	08:08	08:44 (WEA 2)	07:18	07:52 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:38
	16:49	17:35	25 09:09 (WEA 2)	18:21	29 08:21 (WEA 1)	20:10	20:56	21:36	21:47	21:16	20:18	19:13
4	08:33	08:06	08:43 (WEA 2)	07:16	07:52 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
	16:50	17:36	25 09:08 (WEA 2)	18:23	29 08:21 (WEA 1)	20:12	20:57	21:37	21:46	21:15	20:16	19:11
5	08:33	08:05	08:44 (WEA 2)	07:13	07:52 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
	16:51	17:38	25 09:09 (WEA 2)	18:25	28 08:20 (WEA 1)	20:13	20:59	21:38	21:46	21:13	20:14	19:09
6	08:33	08:03	08:44 (WEA 2)	07:11	07:51 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:58	07:43
	16:52	17:40	25 09:09 (WEA 2)	18:26	28 08:19 (WEA 1)	20:15	21:00	21:39	21:46	21:11	20:12	19:07
7	08:33	08:02	08:44 (WEA 2)	07:09	07:51 (WEA 1)	07:03	06:06	05:32	05:38	06:15	07:00	07:44
	16:54	17:41	24 09:08 (WEA 2)	18:28	28 08:19 (WEA 1)	20:16	21:02	21:40	21:45	21:10	20:09	19:05
8	08:32	08:00	08:45 (WEA 2)	07:07	07:51 (WEA 1)	07:01	06:05	05:31	05:39	06:16	07:01	07:46
	16:55	17:43	24 09:09 (WEA 2)	18:30	27 08:18 (WEA 1)	20:18	21:03	21:41	21:45	21:08	20:07	19:03
9	08:32	07:58	08:45 (WEA 2)	07:05	07:52 (WEA 1)	06:59	06:03	05:31	05:40	06:18	07:03	07:47
	16:56	17:45	23 09:08 (WEA 2)	18:31	25 08:17 (WEA 1)	20:19	21:05	21:41	21:44	21:06	20:05	19:01
10	08:31	07:57	08:45 (WEA 2)	07:03	07:53 (WEA 1)	06:57	06:01	05:31	05:40	06:19	07:04	07:49
	16:57	17:46	22 09:07 (WEA 2)	18:33	23 08:16 (WEA 1)	20:21	21:06	21:42	21:43	21:05	20:03	18:59
11	08:31	07:55	08:46 (WEA 2)	07:01	07:54 (WEA 1)	06:55	06:00	05:30	05:41	06:21	07:06	07:50
	16:59	17:48	20 09:06 (WEA 2)	18:34	20 08:14 (WEA 1)	20:22	21:08	21:43	21:43	21:03	20:01	18:56
12	08:30	07:53	08:48 (WEA 2)	06:59	07:56 (WEA 1)	06:53	05:58	05:30	05:42	06:22	07:07	07:52
	17:00	17:50	18 09:06 (WEA 2)	18:36	16 08:12 (WEA 1)	20:24	21:09	21:43	21:42	21:01	19:59	18:54
13	08:30	07:52	08:49 (WEA 2)	06:57	07:59 (WEA 1)	06:51	05:57	05:30	05:43	06:23	07:09	07:54
	17:01	17:52	15 09:04 (WEA 2)	18:37	10 08:09 (WEA 1)	20:25	21:11	21:44	21:41	20:59	19:57	18:52
14	08:29	07:50	08:52 (WEA 2)	06:55		06:49	05:55	05:30	05:44	06:25	07:10	07:55
	17:03	17:53	9 09:01 (WEA 2)	18:39		20:27	21:12	21:45	21:40	20:58	19:54	18:50
15	08:28	07:48		06:53		06:47	05:54	05:30	05:45	06:26	07:12	07:57
	17:04	17:55		18:41		20:29	21:13	21:45	21:39	20:56	19:52	18:48
16	08:28	07:46		06:50		06:45	05:53	05:29	05:47	06:28	07:13	07:58
	17:06	17:57		18:42		20:30	21:15	21:46	21:39	20:54	19:50	18:46
17	08:27	07:45		06:48		06:43	05:51	05:29	05:48	06:29	07:15	08:00
	17:07	17:58		18:44		20:32	21:16	21:46	21:38	20:52	19:48	18:44
18	08:26	07:43		06:46		06:41	05:50	05:29	05:49	06:31	07:16	08:01
	17:09	18:00		18:45		20:33	21:17	21:46	21:37	20:50	19:46	18:42
19	08:25	07:41		06:44		06:39	05:49	05:29	05:50	06:32	07:17	08:03
	17:10	18:02		18:47		20:35	21:19	21:47	21:36	20:48	19:44	18:40
20	08:24	07:39		06:42		06:37	05:47	05:30	05:51	06:34	07:19	08:05
	17:12	18:03		18:48		20:36	21:20	21:47	21:35	20:46	19:41	18:38
21	08:23	07:37		06:40		06:35	05:46	05:30	05:52	06:35	07:20	08:06
	17:13	18:05		18:50		20:38	21:21	21:47	21:34	20:44	19:39	18:36
22	08:22	07:35		06:38		06:33	05:45	05:30	05:53	06:37	07:22	08:08
	17:15	18:07		18:52		20:39	21:23	21:48	21:32	20:42	19:37	18:35
23	08:21	07:33		06:35		06:31	05:44	05:30	05:55	06:38	07:23	08:09
	17:16	18:08		18:53		20:41	21:24	21:48	21:31	20:40	19:35	18:33
24	08:20	07:31	08:01 (WEA 1)	06:33		06:29	05:43	05:30	05:56	06:39	07:25	08:11
	17:18	18:10	12 08:13 (WEA 1)	18:55		20:42	21:25	21:48	21:30	20:38	19:33	18:31
25	08:19	07:30	07:58 (WEA 1)	06:31		06:27	05:42	05:31	05:57	06:41	07:26	08:13
	17:20	18:12	18 08:16 (WEA 1)	18:56		20:44	21:26	21:48	21:29	20:36	19:31	17:29
26	08:18	07:28	07:57 (WEA 1)	06:29		06:25	05:41	05:31	05:59	06:42	07:28	08:14
	17:21	8 08:58 (WEA 2)	18:13	20 08:17 (WEA 1)	18:58	20:45	21:28	21:48	21:27	20:34	19:28	17:27
27	08:17	08:48 (WEA 2)	07:26		06:27	06:24	05:40	05:31	06:00	06:44	07:29	08:16
	17:23	13 09:01 (WEA 2)	18:15	23 08:18 (WEA 1)	18:59	20:47	21:29	21:48	21:26	20:32	19:26	17:25
28	08:16	08:47 (WEA 2)	07:24		06:25	06:22	05:39	05:32	06:01	06:45	07:31	08:17
	17:25	16 09:03 (WEA 2)	18:17	25 08:19 (WEA 1)	19:01	20:48	21:30	21:48	21:25	20:30	19:24	17:23
29	08:14	08:46 (WEA 2)		07:23		06:20	05:38	05:32	06:02	06:47	07:32	08:19
	17:26	18 09:04 (WEA 2)		20:02		20:50	21:31	21:48	21:23	20:28	19:22	17:22
30	08:13	08:45 (WEA 2)		07:20		06:18	05:37	05:33	06:04	06:48	07:34	08:20
	17:28	21 09:06 (WEA 2)		20:04		20:51	21:32	21:48	21:22	20:26	19:20	17:20
31	08:12	08:44 (WEA 2)		07:18			05:36		06:05	06:50		07:22
	17:29	22 09:06 (WEA 2)		20:05			21:33		21:21	20:24		17:18
Sonnenscheinstunden	269		283		368		475	486	491	447	379	335
astr. max. mögl. Beschattung	98		401		317		475	486	491	447	379	335
Red. Sonnenscheinwahrsch.	0,15		0,24		0,35		0,42	0,43	0,44	0,45	0,46	0,47
Reduktion Betriebsdauer	0,30		0,93		0,93		0,93	0,93	0,93	0,93	0,93	0,93
Reduktion Windrichtung	0,55		0,56		0,57		0,57	0,57	0,57	0,57	0,57	0,57
Gesamte Reduktion	0,07		0,12		0,19		0,22	0,22	0,22	0,22	0,22	0,22
Met. wahrsch. Beschattung	7		49		59		71	71	71	71	71	71

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) Schattendecke (WEA mit letztem Schatten)





## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-56 - 87, Rue Pierre Gansen, 4570 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:50 (WEA 2) 18:18	07:22 18:18	08:00 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:26 (WEA 2) 16:40
2	08:33 16:48	08:09 17:33	08:50 (WEA 2) 18:20	07:20 18:18	08:00 (WEA 1) 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:25 (WEA 2) 16:40
3	08:33 16:49	08:08 17:35	08:51 (WEA 2) 18:21	07:18 18:21	08:00 (WEA 1) 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:24 (WEA 2) 16:39
4	08:33 16:50	08:06 17:36	08:51 (WEA 2) 18:23	07:16 18:23	08:00 (WEA 1) 20:12	06:11 20:57	05:34 21:37	06:11 21:15	06:56 20:16	07:40 19:11	07:29 17:12	08:22 (WEA 2) 16:39
5	08:33 16:51	08:05 17:38	08:52 (WEA 2) 18:25	07:13 18:25	08:01 (WEA 1) 20:13	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:31 17:10	08:22 (WEA 2) 16:39
6	08:33 16:52	08:03 17:40	08:52 (WEA 2) 18:26	07:11 18:26	08:01 (WEA 1) 20:15	06:08 21:00	05:32 21:11	06:13 21:02	06:58 20:12	07:43 19:07	07:32 17:08	08:21 (WEA 2) 16:38
7	08:33 16:53	08:02 17:41	08:52 (WEA 2) 18:27	07:09 18:27	08:02 (WEA 1) 20:16	06:06 21:02	05:32 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:05	08:21 (WEA 2) 16:38
8	08:32 16:55	08:00 17:43	08:54 (WEA 2) 18:30	07:07 18:30	08:03 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:21 (WEA 2) 16:38
9	08:32 16:56	07:58 17:45	08:55 (WEA 2) 18:31	07:05 18:31	08:06 (WEA 1) 20:19	06:03 21:05	05:31 21:41	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:21 (WEA 2) 16:37
10	08:31 16:57	07:57 17:46	08:57 (WEA 2) 18:33	07:03 18:33	08:19 (WEA 1) 20:21	06:01 21:06	05:31 21:43	06:19 21:05	07:04 20:03	07:49 19:05	07:39 17:02	08:21 (WEA 2) 16:37
11	08:31 16:59	07:55 17:48	09:01 (WEA 2) 18:34	07:01 18:34	06:55 20:22	06:00 21:08	05:41 21:43	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01	08:21 (WEA 2) 16:37
12	08:30 17:00	07:53 17:50	09:05 (WEA 2) 18:36	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:21 (WEA 2) 16:37
13	08:30 17:01	07:52 17:52	09:05 (WEA 2) 18:37	06:57 18:37	06:51 20:25	05:57 21:11	05:30 21:44	06:23 21:09	07:09 19:57	07:54 18:52	07:44 17:02	08:22 (WEA 2) 16:37
14	08:29 17:03	07:50 17:53	09:06 (WEA 2) 18:38	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	06:25 21:08	07:10 19:54	07:55 18:50	07:45 17:03	08:23 (WEA 2) 16:37
15	08:28 17:04	07:48 17:55	09:07 (WEA 2) 18:39	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	06:26 21:39	07:12 19:52	07:57 18:48	07:47 17:04	08:24 (WEA 2) 16:37
16	08:28 17:06	07:46 17:57	09:08 (WEA 2) 18:40	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	06:28 21:39	07:13 19:50	07:58 18:46	07:48 17:01	08:24 (WEA 2) 16:37
17	08:27 17:07	07:45 17:58	09:09 (WEA 2) 18:41	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	06:29 21:38	07:15 19:48	08:00 18:44	07:50 17:03	08:25 (WEA 2) 16:38
18	08:26 17:09	07:43 18:00	09:10 (WEA 2) 18:42	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	06:31 21:37	07:16 19:46	08:01 18:42	07:51 17:04	08:26 (WEA 2) 16:38
19	08:25 17:10	07:41 18:02	09:11 (WEA 2) 18:43	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	06:30 21:35	07:17 19:44	08:03 18:40	07:53 17:05	08:27 (WEA 2) 16:39
20	08:24 17:12	07:39 18:03	09:12 (WEA 2) 18:44	06:42 18:48	06:37 20:36	05:47 21:20	05:30 21:47	06:34 21:35	07:19 19:41	08:05 18:38	07:55 17:06	08:29 (WEA 2) 16:39
21	08:23 17:13	07:37 18:05	09:13 (WEA 2) 18:45	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	06:35 21:34	07:20 19:39	08:06 18:36	07:56 17:07	08:30 (WEA 2) 16:39
22	08:22 17:15	07:35 18:06	09:14 (WEA 2) 18:46	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	06:37 21:32	07:22 19:37	08:08 18:35	07:58 17:08	08:31 (WEA 2) 16:39
23	08:21 17:16	07:33 18:08	09:15 (WEA 2) 18:47	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	06:38 21:31	07:23 19:35	08:09 18:33	07:59 17:09	08:32 (WEA 2) 16:40
24	08:20 17:18	07:31 18:10	09:16 (WEA 2) 18:48	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	06:39 21:30	07:25 19:33	08:11 18:31	08:01 17:10	08:33 (WEA 2) 16:41
25	08:19 17:20	07:30 18:12	09:17 (WEA 2) 18:49	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	06:41 21:29	07:26 19:31	07:13 17:29	07:08 17:11	08:34 (WEA 2) 16:41
26	08:18 17:21	07:28 18:13	09:18 (WEA 2) 18:50	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	06:42 21:27	07:28 19:28	07:14 17:27	07:04 17:14	08:35 (WEA 2) 16:42
27	08:17 17:23	07:26 18:15	09:19 (WEA 2) 18:51	06:27 18:59	06:24 20:47	05:40 21:29	05:31 21:48	06:44 21:26	07:29 19:26	07:16 17:25	07:03 17:15	08:36 (WEA 2) 16:43
28	08:16 17:25	07:24 18:17	09:20 (WEA 2) 18:52	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:45 21:25	07:31 19:24	07:17 17:23	07:01 17:23	08:37 (WEA 2) 16:43
29	08:14 17:26	07:23 18:14	09:21 (WEA 2) 18:53	06:23 19:02	06:20 20:50	05:38 21:31	05:32 21:48	06:47 21:23	07:32 19:22	07:19 17:22	07:00 17:22	08:38 (WEA 2) 16:44
30	08:13 17:28	07:22 18:15	09:22 (WEA 2) 18:54	06:21 19:03	06:18 20:51	05:37 21:32	05:33 21:48	06:48 21:22	07:34 19:20	07:21 17:20	07:09 17:21	08:39 (WEA 2) 16:45
31	08:12 17:29	07:21 18:16	09:23 (WEA 2) 18:55	06:20 19:04	06:17 20:52	05:36 21:33	05:34 21:49	06:50 21:21	07:35 19:21	07:22 17:18	07:10 17:22	08:40 (WEA 2) 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	255	
astr. max. mögl. Beschattung	211	430	213							444	427	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,55	0,56	0,57							0,57	0,55	
Gesamte Reduktion	0,07	0,12	0,18							0,15	0,08	
Met. wahrsch. Beschattung	16	53	39							65	32	

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com  
Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-57 - 77, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung  
Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:46 (WEA 2) 18:18	07:22 20:07	07:56 (WEA 1) 20:53	07:16 20:34	06:16 20:53	05:36 21:19	06:07 21:29	06:51 21:18	07:35 21:18	08:11 21:16
2	08:33 16:48	08:09 17:33	08:45 (WEA 2) 18:20	07:20 20:07	07:56 (WEA 1) 20:53	07:14 20:34	06:15 20:53	05:35 21:19	06:08 21:29	06:53 21:18	07:37 21:18	08:12 21:16
3	08:33 16:49	08:08 17:35	08:46 (WEA 2) 18:21	07:18 20:06	07:56 (WEA 1) 20:56	07:12 20:36	06:13 20:56	05:34 21:26	06:09 21:47	06:54 21:16	07:38 21:13	08:13 21:13
4	08:33 16:50	08:06 17:36	08:46 (WEA 2) 18:23	07:16 20:07	07:56 (WEA 1) 20:57	07:10 20:37	06:11 20:57	05:34 21:26	06:11 21:46	06:56 21:15	07:40 21:11	08:14 21:11
5	08:33 16:51	08:05 17:38	08:46 (WEA 2) 18:25	07:13 20:09	07:56 (WEA 1) 20:59	07:08 20:38	06:09 20:59	05:33 21:26	06:12 21:46	06:57 21:14	07:41 21:09	08:16 21:10
6	08:33 16:52	08:03 17:40	08:46 (WEA 2) 18:26	07:11 20:09	07:56 (WEA 1) 20:57	07:05 20:38	06:08 20:59	05:32 21:26	06:07 21:46	06:58 21:15	07:43 21:11	08:17 21:11
7	08:33 16:54	08:02 17:41	08:47 (WEA 2) 18:28	07:09 20:10	07:56 (WEA 1) 20:57	07:03 20:39	06:06 20:59	05:32 21:26	06:08 21:46	06:58 21:15	07:44 21:11	08:18 21:11
8	08:32 16:55	08:00 17:43	08:48 (WEA 2) 18:30	07:07 20:11	07:57 (WEA 1) 20:59	07:01 20:40	06:05 20:59	05:31 21:26	06:16 21:46	07:01 21:15	07:46 21:11	08:19 21:11
9	08:32 16:56	07:58 17:45	08:49 (WEA 2) 18:31	07:05 20:12	07:59 (WEA 1) 20:59	06:03 20:41	05:31 20:59	05:40 21:26	06:18 21:46	07:03 21:15	07:47 21:11	08:20 21:11
10	08:31 16:57	07:57 17:46	08:49 (WEA 2) 18:33	07:03 20:13	08:00 (WEA 1) 20:57	06:57 20:42	06:01 20:59	05:31 21:26	06:19 21:46	07:04 21:15	07:49 21:11	08:21 21:11
11	08:31 16:59	07:55 17:48	08:51 (WEA 2) 18:34	07:01 20:14	08:04 (WEA 1) 20:55	06:55 20:42	06:00 20:59	05:30 21:26	06:21 21:46	07:06 21:15	07:50 21:11	08:22 21:11
12	08:30 17:00	07:53 17:50	08:54 (WEA 2) 18:36	06:59 20:15	08:05 (WEA 1) 20:57	06:58 20:43	06:03 20:59	05:30 21:26	06:22 21:46	07:07 21:15	07:52 21:11	08:23 21:11
13	08:30 17:01	07:52 17:52	09:05 (WEA 2) 18:37	06:57 20:16	08:11 (WEA 1) 20:57	06:57 20:44	06:03 20:59	05:30 21:26	07:09 21:46	07:09 21:15	07:54 21:11	08:24 21:11
14	08:29 17:03	07:50 17:53	09:06 (WEA 2) 18:39	06:55 20:17	08:12 (WEA 1) 20:57	06:55 20:45	06:04 20:59	05:30 21:26	07:10 21:46	07:10 21:15	07:55 21:11	08:25 21:11
15	08:28 17:04	07:48 17:55	09:08 (WEA 2) 18:41	06:53 20:18	08:14 (WEA 1) 20:57	06:53 20:46	06:05 20:59	05:30 21:26	07:12 21:46	07:12 21:15	07:57 21:11	08:26 21:11
16	08:28 17:06	07:46 17:57	09:10 (WEA 2) 18:42	06:50 20:19	08:16 (WEA 1) 20:57	06:50 20:47	06:06 20:59	05:30 21:26	07:13 21:46	07:13 21:15	07:58 21:11	08:27 21:11
17	08:27 17:07	07:45 17:58	09:12 (WEA 2) 18:44	06:48 20:20	08:18 (WEA 1) 20:57	06:48 20:48	06:07 20:59	05:30 21:26	07:14 21:46	07:14 21:15	07:59 21:11	08:28 21:11
18	08:26 17:09	07:43 18:00	09:14 (WEA 2) 18:46	06:46 20:21	08:20 (WEA 1) 20:57	06:46 20:49	06:08 20:59	05:30 21:26	07:15 21:46	07:15 21:15	08:01 21:11	08:29 21:11
19	08:25 17:10	07:41 18:02	09:16 (WEA 2) 18:47	06:44 20:22	08:22 (WEA 1) 20:57	06:44 20:50	06:09 20:59	05:30 21:26	07:16 21:46	07:16 21:15	08:03 21:11	08:30 21:11
20	08:24 17:12	07:39 18:03	09:18 (WEA 2) 18:48	06:42 20:23	08:24 (WEA 1) 20:57	06:42 20:51	06:10 20:59	05:30 21:26	07:17 21:46	07:17 21:15	08:05 21:11	08:31 21:11
21	08:23 17:13	07:37 18:05	09:20 (WEA 2) 18:50	06:40 20:24	08:26 (WEA 1) 20:57	06:40 20:52	06:11 20:59	05:30 21:26	07:18 21:46	07:18 21:15	08:06 21:11	08:32 21:11
22	08:22 17:15	07:35 18:07	09:22 (WEA 2) 18:52	06:38 20:25	08:28 (WEA 1) 20:57	06:38 20:53	06:12 20:59	05:30 21:26	07:19 21:46	07:19 21:15	08:07 21:11	08:33 21:11
23	08:21 17:16	07:33 18:08	09:24 (WEA 2) 18:53	06:36 20:26	08:30 (WEA 1) 20:57	06:36 20:54	06:13 20:59	05:30 21:26	07:20 21:46	07:20 21:15	08:08 21:11	08:34 21:11
24	08:20 17:18	07:31 18:10	09:26 (WEA 2) 18:55	06:34 20:27	08:32 (WEA 1) 20:57	06:34 20:52	06:14 20:59	05:30 21:26	07:21 21:46	07:21 21:15	08:09 21:11	08:35 21:11
25	08:19 17:20	07:29 18:12	09:28 (WEA 2) 18:56	06:32 20:28	08:34 (WEA 1) 20:57	06:32 20:51	06:15 20:59	05:30 21:26	07:22 21:46	07:22 21:15	08:10 21:11	08:36 21:11
26	08:18 17:21	07:28 18:13	09:30 (WEA 2) 18:58	06:30 20:29	08:36 (WEA 1) 20:57	06:30 20:50	06:16 20:59	05:30 21:26	07:23 21:46	07:23 21:15	08:11 21:11	08:37 21:11
27	08:17 17:23	07:26 18:15	09:32 (WEA 2) 18:59	06:28 20:30	08:38 (WEA 1) 20:57	06:28 20:50	06:17 20:59	05:30 21:26	07:24 21:46	07:24 21:15	08:12 21:11	08:38 21:11
28	08:16 17:25	07:24 18:17	09:34 (WEA 2) 19:01	06:26 20:31	08:40 (WEA 1) 20:57	06:26 20:50	06:18 20:59	05:30 21:26	07:25 21:46	07:25 21:15	08:13 21:11	08:39 21:11
29	08:14 17:26	07:22 18:19	09:36 (WEA 2) 19:03	06:24 20:32	08:42 (WEA 1) 20:57	06:24 20:50	06:20 20:59	05:30 21:26	07:26 21:46	07:26 21:15	08:14 21:11	08:40 21:11
30	08:13 17:28	07:21 18:22	09:38 (WEA 2) 19:05	06:22 20:33	08:44 (WEA 1) 20:57	06:22 20:50	06:21 20:59	05:30 21:26	07:27 21:46	07:27 21:15	08:15 21:11	08:41 21:11
31	08:12 17:29	07:20 18:23	09:40 (WEA 2) 19:07	06:20 20:34	08:46 (WEA 1) 20:57	06:20 20:50	06:22 20:59	05:30 21:26	07:28 21:46	07:28 21:15	08:16 21:11	08:42 21:11
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)
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# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-58 - 98, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mar Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	Marz	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	08:10	08:41 (WEA 2)	07:22	07:50 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51	07:35
2	16:47	17:31	18	08:59 (WEA 2)	18:18	23	08:13 (WEA 1)	20:07	20:53	21:34	21:47	19:18
3	08:33	08:09	08:40 (WEA 2)	07:20	07:49 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
4	16:48	17:33	20	09:00 (WEA 2)	18:20	24	08:13 (WEA 1)	20:09	20:54	21:35	21:47	19:15
5	08:33	08:08	08:40 (WEA 2)	07:18	07:48 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:38
6	16:49	17:35	21	09:01 (WEA 2)	18:21	26	08:14 (WEA 1)	20:10	20:56	21:36	21:47	19:13
7	08:33	08:06	08:39 (WEA 2)	07:16	07:48 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
8	16:50	17:36	22	09:01 (WEA 2)	18:23	26	08:14 (WEA 1)	20:12	20:57	21:37	21:46	19:11
9	08:33	08:05	08:39 (WEA 2)	07:13	07:47 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
10	16:51	17:38	24	09:03 (WEA 2)	18:25	28	08:15 (WEA 1)	20:13	20:59	21:38	21:46	19:09
11	08:33	08:03	08:38 (WEA 2)	07:11	07:46 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:59	07:43
12	16:52	17:40	25	09:03 (WEA 2)	18:26	28	08:14 (WEA 1)	20:15	21:00	21:39	21:46	19:07
13	08:33	08:02	08:38 (WEA 2)	07:09	07:46 (WEA 1)	07:03	06:06	05:32	05:38	06:15	07:00	07:44
14	16:54	17:41	25	09:03 (WEA 2)	18:28	28	08:14 (WEA 1)	20:16	21:02	21:40	21:45	19:05
15	08:32	08:00	08:39 (WEA 2)	07:07	07:46 (WEA 1)	07:01	06:05	05:31	05:39	06:16	07:01	07:46
16	16:55	17:43	24	09:03 (WEA 2)	18:30	27	08:13 (WEA 1)	20:18	21:03	21:41	21:45	19:03
17	08:32	07:58	08:38 (WEA 2)	07:05	07:46 (WEA 1)	06:59	06:03	05:31	05:40	06:18	07:03	07:47
18	16:56	17:45	25	09:03 (WEA 2)	18:31	27	08:13 (WEA 1)	20:19	21:05	21:41	21:44	19:01
19	08:31	07:57	08:38 (WEA 2)	07:03	07:47 (WEA 1)	06:57	06:01	05:31	05:40	06:19	07:04	07:49
20	16:57	17:46	25	09:03 (WEA 2)	18:33	25	08:12 (WEA 1)	20:21	21:06	21:42	21:43	19:01
21	08:31	07:55	08:39 (WEA 2)	07:01	07:47 (WEA 1)	06:55	06:00	05:30	05:41	06:21	07:06	07:50
22	16:59	17:48	23	09:02 (WEA 2)	18:34	24	08:11 (WEA 1)	20:22	21:08	21:43	21:43	18:56
23	08:30	07:53	08:40 (WEA 2)	06:59	07:48 (WEA 1)	06:53	05:58	05:30	05:42	06:22	07:07	07:52
24	17:00	17:50	22	09:02 (WEA 2)	18:36	22	08:10 (WEA 1)	20:24	21:09	21:43	21:42	18:54
25	08:30	07:52	20	09:01 (WEA 2)	18:37	18	08:08 (WEA 1)	20:26	21:11	21:44	21:41	18:52
26	17:01	17:52	20	09:01 (WEA 2)	18:37	18	08:08 (WEA 1)	20:26	21:11	21:44	21:41	18:52
27	08:29	07:50	08:42 (WEA 2)	06:55	07:51 (WEA 1)	06:49	05:55	05:30	05:44	06:25	07:10	07:55
28	17:03	17:53	18	09:00 (WEA 2)	18:39	14	08:05 (WEA 1)	20:27	21:12	21:45	21:40	18:50
29	08:28	07:48	08:43 (WEA 2)	06:50	07:55 (WEA 1)	06:47	05:54	05:30	05:45	06:26	07:12	07:57
30	17:04	17:55	15	08:58 (WEA 2)	18:41	6	08:01 (WEA 1)	20:29	21:13	21:45	21:39	18:48
31	08:28	07:46	08:45 (WEA 2)	06:50	07:58 (WEA 1)	06:45	05:53	05:29	05:47	06:28	07:13	07:58
32	17:06	17:57	10	08:55 (WEA 2)	18:42	20:30	21:15	21:46	21:39	20:54	19:50	18:46
33	08:27	07:45	08:48	06:48	06:43	05:51	05:29	05:48	05:49	06:29	07:15	08:00
34	17:07	17:58	18:44	06:44	20:32	21:16	21:46	21:38	20:52	19:48	18:44	18:44
35	08:26	07:43	06:46	06:41	05:50	05:29	05:49	05:49	06:31	07:16	08:01	18:46
36	17:09	18:00	18:45	20:33	21:17	21:46	21:37	20:50	20:50	19:46	18:42	18:42
37	08:25	07:41	06:44	06:39	05:49	05:29	05:50	06:32	07:17	08:03	08:03	18:46
38	17:10	18:02	18:47	20:35	21:19	21:47	21:36	20:48	19:44	18:40	18:40	18:40
39	08:24	07:39	06:42	06:37	05:47	05:30	05:51	06:34	07:19	08:05	08:05	18:40
40	17:12	18:03	18:48	20:36	21:20	21:47	21:35	20:46	19:41	18:38	18:38	18:38
41	08:23	07:37	06:40	06:35	05:46	05:30	05:52	06:35	07:20	08:06	08:06	18:38
42	17:13	18:05	18:50	20:38	21:21	21:47	21:34	20:44	19:39	18:36	18:36	18:36
43	08:22	07:35	06:38	06:33	05:45	05:30	05:53	06:37	07:22	08:08	08:08	18:36
44	17:15	18:07	18:52	20:39	21:23	21:48	21:32	20:42	19:37	18:35	18:35	18:35
45	08:21	07:33	06:35	06:31	05:44	05:30	05:55	06:38	07:23	08:09	08:09	18:31
46	17:16	18:08	18:53	20:41	21:24	21:48	21:31	20:40	19:35	18:33	18:33	18:33
47	08:20	07:31	06:33	06:29	05:43	05:30	05:56	06:39	07:25	08:11	08:11	18:32
48	17:18	18:10	18:55	20:42	21:25	21:48	21:30	20:38	19:33	18:31	18:31	18:31
49	08:19	07:30	06:31	06:27	05:42	05:31	05:57	06:41	07:26	08:13	08:13	18:31
50	17:20	18:12	18:56	20:44	21:26	21:48	21:29	20:36	19:31	18:29	18:29	18:29
51	08:18	07:28	06:29	06:25	05:41	05:31	05:59	06:42	07:28	08:14	08:14	18:28
52	17:21	18:13	10	08:07 (WEA 1)	18:58	20:45	21:28	21:48	21:27	20:34	19:28	18:27
53	08:17	07:26	07:54 (WEA 1)	06:27	06:24	05:40	05:32	06:00	06:44	07:29	08:14	18:27
54	17:23	18:15	16	08:10 (WEA 1)	18:59	20:47	21:29	21:48	21:26	20:32	19:26	18:25
55	08:16	07:24	07:52 (WEA 1)	06:25	06:22	05:39	05:32	06:01	06:45	07:31	08:16	18:24
56	17:25	18:17	19	08:11 (WEA 1)	19:01	20:48	21:30	21:48	21:25	20:30	19:24	18:23
57	08:14	08:46 (WEA 2)	07:23	06:20	05:38	05:32	06:02	06:47	07:32	08:18	08:18	18:23
58	17:26	6	08:52 (WEA 2)	20:02	20:50	21:31	21:48	21:23	20:28	19:22	18:16	18:21
59	08:13	08:44 (WEA 2)	07:20	06:18	05:37	05:33	06:04	06:48	07:34	08:19	08:19	18:21
60	17:28	12	08:56 (WEA 2)	20:04	20:51	21:32	21:48	21:22	20:26	19:20	18:14	18:19
61	08:12	08:42 (WEA 2)	07:18	06:16	05:36	05:32	06:05	06:50	07:36	08:21	08:21	18:21
62	17:29	15	08:57 (WEA 2)	20:06	21:33	21:31	21:21	20:24	19:18	18:18	18:18	18:18
63	Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275
64	astr. max. mögl. Beschattung	33	382	346	412	475	486	491	447	379	335	275
65	Red. Sonnenscheinwahrsch.	0,15	0,24	0,35	0,42	0,42	0,42	0,42	0,42	0,42	0,42	0,42
66	Reduktion Betriebsdauer	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93
67	Reduktion Windrichtung	0,56	0,56	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57	0,57
68	Gesamte Reduktion	0,08	0,12	0,19	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22
69	Met. wahrsch. Beschattung	2	47	64	64	64	64	64	64	64	64	64

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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# 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-59 - 57, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mar Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar		Februar		März		April		Mai		Juni		Juli		August		September		Oktober		November		Dezember	
1	08:34		08:10	08:41 (WEA 2)	07:22	23	07:51 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51			07:35	08:31 (WEA 1)	07:24	24	08:08 (WEA 2)	07:40			
2	16:47		17:31	18	08:59 (WEA 2)	18	23	08:14 (WEA 1)	20:07	20:53	21:34	21:47	21:07	19:19	20:22	19:18	15	08:46 (WEA 1)	17:16	24	08:32 (WEA 2)	08:11		
3	08:33		08:09	08:39 (WEA 2)	07:20	23	07:50 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53			07:37	08:29 (WEA 1)	07:14	25	08:08 (WEA 2)	07:46			
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-60 - 76, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung  
Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

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18:21 06:11 18:23 06:09 18:25 06:08 18:26 06:06 18:28 06:05 18:33 06:03 18:37 06:01 18:40 05:59 18:37 06:00 18:42 05:58 18:47 05:57 18:40 05:55 18:42 05:53 18:47 05:48 18:44 05:46 18:45 05:44 18:47 05:42 18:48 05:40 18:50 05:38 18:52 05:35 18:53 05:33 18:55 05:31 18:56 05:29 18:58 05:27 18:59 05:25 19:01 05:23 20:02 05:20 19:04 05:18 20:04 05:16 20:06 05:14 20:06 05:13 20:06 05:11 20:06 05:10 20:06 05:09 20:06 05:08 20:06 05:07 20:06 05:06 20:06 05:05 20:06 05:04 20:06 05:03 20:06 05:02 20:06 05:01 20:06 05:00 20:06 04:59 20:06 04:58 20:06 04:57 20:06 04:56 20:06 04:55 20:06 04:54 20:06 04:53 20:06 04:52 20:06 04:51 20:06 04:50 20:06 04:49 20:06 04:48 20:06 04:47 20:06 04:46 20:06 04:45 20:06 04:44 20:06 04:43 20:06 04:42 20:06 04:41 20:06 04:40 20:06 04:39 20:06 04:38 20:06 04:37 20:06 04:36 20:06 04:35 20:06 04:34 20:06 04:33 20:06 04:32 20:06 04:31 20:06 04:30 20:06 04:29 20:06 04:28 20:06 04:27 20:06 04:26 20:06 04:25 20:06 04:24 20:06 04:23 20:06 04:22 20:06 04:21 20:06 04:20 20:06 04:19 20:06 04:18 20:06 04:17 20:06 04:16 20:06 04:15 20:06 04:14 20:06 04:13 20:06 04:12 20:06 04:11 20:06 04:10 20:06 04:09 20:06 04:08 20:06 04:07 20:06 04:06 20:06 04:05 20:06 04:04 20:06 04:03 20:06 04:02 20:06 04:01 20:06 04:00 20:06 03:59 20:06 03:58 20:06 03:57 20:06 03:56 20:06 03:55 20:06 03:54 20:06 03:53 20:06 03:52 20:06 03:51 20:06 03:50 20:06 03:49 20:06 03:48 20:06 03:47 20:06 03:46 20:06 03:45 20:06 03:44 20:06 03:43 20:06 03:42 20:06 03:41 20:06 03:40 20:06 03:39 20:06 03:38 20:06 03:37 20:06 03:36 20:06 03:35 20:06 03:34 20:06 03:33 20:06 03:32 20:06 03:31 20:06 03:30 20:06 03:29 20:06 03:28 20:06 03:27 20:06 03:26 20:06 03:25 20:06 03:24 20:06 03:23 20:06 03:22 20:06 03:21 20:06 03:20 20:06 03:19 20:06 03:18 20:06 03:17 20:06 03:16 20:06 03:15 20:06 03:14 20:06 03:13 20:06 03:12 20:06 03:11 20:06 03:10 20:06 03:09 20:06 03:08 20:06 03:07 20:06 03:06 20:06 03:05 20:06 03:04 20:06 03:03 20:06 03:02 20:06 03:01 20:06 03:00 20:06 02:59 20:06 02:58 20:06 02:57 20:06 02:56 20:06 02:55 20:06 02:54 20:06 02:53 20:06 02:52 20:06 02:51 20:06 02:50 20:06 02:49 20:06 02:48 20:06 02:47 20:06 02:46 20:06 02:45 20:06 02:44 20:06 02:43 20:06 02:42 20:06 02:41 20:06 02:40 20:06 02:39 20:06 02:38 20:06 02:37 20:06 02:36 20:06 02:35 20:06 02:34 20:06 02:33 20:06 02:32 20:06 02:31 20:06 02:30 20:06 02:29 20:06 02:28 20:06 02:27 20:06 02:26 20:06 02:25 20:06 02:24 20:06 02:23 20:06 02:22 20:06 02:21 20:06 02:20 20:06 02:19 20:06 02:18 20:06 02:17 20:06 02:16 20:06 02:15 20:06 02:14 20:06 02:13 20:06 02:12 20:06 02:11 20:06 02:10 20:06 02:09 20:06 02:08 20:06 02:07 20:06 02:06 20:06 02:05 20:06 02:04 20:06 02:03 20:06 02:02 20:06 02:01 20:06 02:00 20:06 01:59 20:06 01:58 20:06 01:57 20:06 01:56 20:06 01:55 20:06 01:54 20:06 01:53 20:06 01:52 20:06 01:51 20:06 01:50 20:06 01:49 20:06 01:48 20:06 01:47 20:06 01:46 20:06 01:45 20:06 01:44 20:06 01:43 20:06 01:42 20:06 01:41 20:06 01:40 20:06 01:39 20:06 01:38 20:06 01:37 20:06 01:36 20:06 01:35 20:06 01:34 20:06 01:33 20:06 01:32 20:06 01:31 20:06 01:30 20:06 01:29 20:06 01:28 20:06 01:27 20:06 01:26 20:06 01:25 20:06 01:24 20:06 01:23 20:06 01:22 20:06 01:21 20:06 01:20 20:06 01:19 20:06 01:18 20:06 01:17 20:06 01:16 20:06 01:15 20:06 01:14 20:06 01:13 20:06 01:12 20:06 01:11 20:06 01:10 20:06 01:09 20:06 01:08 20:06 01:07 20:06 01:06 20:06 01:05 20:06 01:04 20:06 01:03 20:06 01:02 20:06 01:01 20:06 01:00 20:06 12:59 20:06 12:58 20:06 12:57 20:06 12:56 20:06 12:55 20:06 12:54 20:06 12:53 20:06 12:52 20:06 12:51 20:06 12:50 20:06 12:49 20:06 12:48 20:06 12:47 20:06 12:46 20:06 12:45 20:06 12:44 20:06 12:43 20:06 12:42 20:06 12:41 20:06 12:40 20:06 12:39 20:06 12:38 20:06 12:37 20:06 12:36 20:06 12:35 20:06 12:34 20:06 12:33 20:06 12:32 20:06 12:31 20:06 12:30 20:06 12:29 20:06 12:28 20:06 12:27 20:06 12:26 20:06 12:25 20:06 12:24 20:06 12:23 20:06 12:22 20:06 12:21 20:06 12:20 20:06 12:19 20:06 12:18 20:06 12:17 20:06 12:16 20:06 12:15 20:06 12:14 20:06 12:13 20:06 12:12 20:06 12:11 20:06 12:10 20:06 12:09 20:06 12:08 20:06 12:07 20:06 12:06 20:06 12:05 20:06 12:04 20:06 12:03 20:06 12:02 20:06 12:01 20:06 12:00 20:06 11:59 20:06 11:58 20:06 11:57 20:06 11:56 20:06 11:55 20:06 11:54 20:06 11:53 20:06 11:52 20:06 11:51 20:06 11:50 20:06 11:49 20:06 11:48 20:06 11:47 20:06 11:46 20:06 11:45 20:06 11:44 20:06 11:43 20:06 11:42 20:06 11:41 20:06 11:40 20:06 11:39 20:06 11:38 20:06 11:37 20:06 11:36 20:06 11:35 20:06 11:34 20:06 11:33 20:06 11:32 20:06 11:31 20:06 11:30 20:06 11:29 20:06 11:28 20:06 11:27 20:06 11:26 20:06 11:25 20:06 11:24 20:06 11:23 20:06 11:22 20:06 11:21 20:06 11:20 20:06 11:19 20:06 11:18 20:06 11:17 20:06 11:16 20:06 11:15 20:06 11:14 20:06 11:13 20:06 11:12 20:06 11:11 20:06 11:10 20:06 11:09 20:06 11:08 20:06 11:07 20:06 11:06 20:06 11:05 20:06 11:04 20:06 11:03 20:06 11:02 20:06 11:01 20:06 11:00 20:06 10:59 20:06 10:58 20:06 10:57 20:06 10:56 20:06 10:55 20:06 10:54 20:06 10:53 20:06 10:52 20:06 10:51 20:06 10:50 20:06 10:49 20:06 10:48 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Sonnenscheinstunden	269	283	332	355	412	475	486	491	447	379	335	275	255
astr max.mögl Beschuttung	0,24	0,93	0,35	0,93	0,42	0,93	0,58	0,23	19	84	467	144	
Red.Sonnenscheinwahrsh.	0,93	0,28	0,93	0,15	0,93	0,42	0,93	0,58	0,23	19	84	144	
Reduktion Betriebsdauer	0,56	0,19	0,67	0,19	0,51	0,36	0,48	0,26	0,23	0,59	0,58	0,56	
Reduktion Windrichtung	0,12	0,19	0,67	0,19	0,51								







## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-62 - 36, Rue Pierre Gansen, 4570 Niederkorn

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
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Juli	August	September	Oktober	November	Dezember		
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2	08:34 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	05:34 21:18	06:08 21:18	06:53 20:20	07:37 19:15	08:07 (WEA 1) 08:31 (WEA 1)	07:26 17:15	07:56 (WEA 2) 07:58 (WEA 2)	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:17	06:09 21:16	06:54 20:18	07:38 19:13	08:06 (WEA 1) 08:29 (WEA 1)	07:27 17:13		08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	05:36 21:16	06:11 21:15	06:56 20:16	07:40 19:11	08:07 (WEA 1) 08:29 (WEA 1)	07:29 17:12		08:14 16:39
5	08:33 16:51	08:05 17:38	07:14 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:16	06:12 21:13	06:57 20:14	07:41 19:09	08:07 (WEA 1) 08:27 (WEA 1)	07:31 17:10		08:16 16:39
6	08:33 16:52	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	05:37 21:11	06:13 21:02	06:59 20:12	07:43 19:07	08:08 (WEA 1) 08:26 (WEA 1)	07:32 17:08		08:17 16:38
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:10	06:15 21:00	07:00 20:09	07:44 19:05	08:09 (WEA 1) 08:24 (WEA 1)	07:34 17:07		08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:12 (WEA 1) 08:21 (WEA 1)	07:35 17:05		08:19 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:21 (WEA 1) 08:21 (WEA 1)	07:37 17:04		08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:41 21:43	06:19 21:05	07:04 20:03	07:49 18:59	08:21 (WEA 1) 08:21 (WEA 1)	07:39 17:02		08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:03	06:21 21:03	07:06 20:01	07:51 18:56	08:21 (WEA 1) 08:21 (WEA 1)	07:40 17:01		08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:01	06:22 21:01	07:07 19:59	07:52 18:54	08:21 (WEA 1) 08:21 (WEA 1)	07:42 17:00		08:23 16:37
13	08:30 17:01	07:52 17:52	06:57 18:38	06:51 20:26	05:57 21:11	05:30 21:44	05:43 21:01	06:24 20:59	07:09 19:57	07:54 18:52	08:21 (WEA 1) 08:21 (WEA 1)	07:44 16:58		08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:01	06:25 20:58	07:10 19:54	07:55 18:50	08:21 (WEA 1) 08:21 (WEA 1)	07:45 16:57		08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	05:45 21:02	06:26 20:56	07:12 19:52	07:57 18:48	08:21 (WEA 1) 08:21 (WEA 1)	07:47 16:56		08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	05:47 21:03	06:28 20:54	07:13 19:50	07:58 18:46	08:21 (WEA 1) 08:21 (WEA 1)	07:48 16:54		08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:03	06:29 20:52	07:15 19:48	08:00 18:44	08:21 (WEA 1) 08:21 (WEA 1)	07:50 16:53		08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:03	06:31 20:50	07:16 19:46	08:01 18:42	08:54 (WEA 2) 09:03 (WEA 2)	07:51 16:52		08:28 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:03	06:32 20:48	07:17 19:44	08:03 18:40	08:52 (WEA 2) 09:06 (WEA 2)	07:53 16:51		08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	05:51 21:03	06:34 20:46	07:19 19:41	08:05 18:38	08:54 (WEA 2) 09:06 (WEA 2)	07:55 16:50		08:30 16:39
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26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:31 21:48	05:59 21:03	06:42 20:34	07:28 19:28	08:11 18:30	08:54 (WEA 2) 09:09 (WEA 2)	08:04 16:44		08:33 16:42
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28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:03	06:45 20:30	07:31 19:24	08:09 18:31	08:54 (WEA 2) 09:09 (WEA 2)	08:06 16:42		08:33 16:43
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30	08:13 17:28		06:20 20:04	06:18 20:51	05:37 21:32	05:33 21:48	06:04 21:03	06:48 20:26	07:34 19:20	08:07 18:31	08:54 (WEA 2) 09:09 (WEA 2)	08:09 16:41		08:33 16:45
31	08:12 17:30		06:18 20:06	06:16 20:53	05:36 21:33	05:34 21:48	06:05 21:03	06:50 20:24	07:35 19:18	08:08 18:31	08:54 (WEA 2) 09:09 (WEA 2)	08:10 16:40		08:33 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255		
astr. max.mögl. Beschattung		275	291							136	415	13		
Red. Sonnenscheinwahrsch.		0,24	0,35							0,42	0,28	0,15		
Reduktion Betriebsdauer		0,93	0,93							0,93	0,93	0,93		
Reduktion Windrichtung		0,57	0,61							0,58	0,58	0,57		
Gesamte Reduktion		0,12	0,20							0,24	0,15	0,08		
Met. wahrsch. Beschattung		34	57							32	62	1		

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-63 - 17A, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember		
1	08:34 16:47	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	06:07 21:19	06:51 20:22	07:35 19:18	08:13 (WEA 1) 08:36 (WEA 1)	07:24 17:26	07:53 (WEA 2) 08:13 (WEA 2)	08:11 16:40
2	08:34 16:48	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	05:34 21:47	06:08 21:18	06:53 20:20	07:37 19:15	08:12 (WEA 1) 08:36 (WEA 1)	07:26 17:15	07:54 (WEA 2) 08:12 (WEA 2)	08:12 16:40
3	08:33 16:49	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	08:11 (WEA 1) 08:36 (WEA 1)	07:27 17:13	07:55 (WEA 2) 08:11 (WEA 2)	08:13 16:39
4	08:33 16:50	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	05:36 21:46	06:11 21:15	06:56 20:16	07:40 19:11	08:12 (WEA 1) 08:36 (WEA 1)	07:29 17:12	07:57 (WEA 2) 08:12 (WEA 2)	08:14 16:39
5	08:33 16:51	08:05 17:38	07:14 18:25	07:08 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	08:11 (WEA 1) 08:35 (WEA 1)	07:31 17:10	08:00 (WEA 2) 08:06 (WEA 2)	08:16 16:39
6	08:33 16:52	08:03 17:40	07:11 18:26	07:06 20:15	06:08 21:00	05:32 21:39	05:37 21:46	06:13 21:11	06:59 20:12	07:43 19:07	08:11 (WEA 1) 08:35 (WEA 1)	07:32 17:08	08:07 (WEA 2) 08:13 (WEA 2)	08:17 16:38
7	08:33 16:54	08:02 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	05:38 21:45	06:15 21:10	07:00 20:09	07:44 19:05	08:11 (WEA 1) 08:33 (WEA 1)	07:34 17:07	08:18 (WEA 2) 08:24 (WEA 2)	08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:30	07:01 20:18	06:05 21:03	05:31 21:41	05:39 21:45	06:16 21:08	07:01 20:07	07:46 19:03	08:12 (WEA 1) 08:33 (WEA 1)	07:35 17:05	08:19 (WEA 2) 08:25 (WEA 2)	08:19 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	05:40 21:44	06:18 21:06	07:03 20:05	07:47 19:01	08:13 (WEA 1) 08:30 (WEA 1)	07:37 17:04	08:20 (WEA 2) 08:26 (WEA 2)	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	05:40 21:43	06:19 21:05	07:04 20:03	07:49 18:59	08:14 (WEA 1) 08:29 (WEA 1)	07:39 17:02	08:21 (WEA 2) 08:27 (WEA 2)	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	05:41 21:43	06:21 21:03	07:06 20:01	07:51 18:56	08:17 (WEA 1) 08:26 (WEA 1)	07:40 17:01	08:22 (WEA 2) 08:28 (WEA 2)	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	08:18 (WEA 1) 08:33 (WEA 1)	07:42 17:00	08:23 (WEA 2) 08:29 (WEA 2)	08:23 16:37
13	08:30 17:01	07:52 17:52	06:57 18:38	06:51 20:26	05:57 21:11	05:30 21:44	05:43 21:41	06:23 20:59	07:09 19:57	07:54 18:52	08:19 (WEA 1) 08:34 (WEA 1)	07:44 17:05	08:24 (WEA 2) 08:30 (WEA 2)	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:45	05:44 21:40	06:25 20:58	07:10 19:54	07:55 18:50	08:13 (WEA 1) 08:28 (WEA 1)	07:45 17:05	08:25 (WEA 2) 08:31 (WEA 2)	08:25 16:37
15	08:28 17:04	07:48 17:55	06:53 18:41	06:47 20:29	05:54 21:13	05:30 21:45	05:45 21:40	06:26 20:56	07:12 19:52	07:57 18:48	08:14 (WEA 1) 08:29 (WEA 1)	07:47 17:05	08:26 (WEA 2) 08:32 (WEA 2)	08:26 16:37
16	08:28 17:06	07:46 17:57	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:46	05:47 21:39	06:28 20:54	07:13 19:50	07:58 18:46	08:15 (WEA 1) 08:30 (WEA 1)	07:48 17:04	08:27 (WEA 2) 08:33 (WEA 2)	08:27 16:37
17	08:27 17:07	07:45 17:58	06:48 18:44	06:43 20:32	05:51 21:16	05:29 21:46	05:48 21:38	06:29 20:52	07:15 19:48	08:00 18:44	08:16 (WEA 1) 08:31 (WEA 1)	07:50 17:03	08:28 (WEA 2) 08:34 (WEA 2)	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	05:49 21:37	06:31 20:50	07:16 19:46	08:01 18:42	08:17 (WEA 1) 08:32 (WEA 1)	07:51 17:05	08:29 (WEA 2) 08:35 (WEA 2)	08:29 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	05:50 21:36	06:32 20:48	07:17 19:44	08:03 18:40	08:18 (WEA 1) 08:33 (WEA 1)	07:52 17:05	08:30 (WEA 2) 08:36 (WEA 2)	08:30 16:39
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:48 21:20	05:30 21:47	05:51 21:35	06:34 20:46	07:19 19:41	08:05 18:38	08:19 (WEA 1) 08:34 (WEA 1)	07:55 17:05	08:31 (WEA 2) 08:37 (WEA 2)	08:31 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	05:52 21:34	06:35 20:44	07:20 19:39	08:06 18:36	08:20 (WEA 1) 08:35 (WEA 1)	07:56 17:05	08:32 (WEA 2) 08:38 (WEA 2)	08:32 16:39
22	08:22 17:15	07:35 18:07	06:38 18:52	06:33 20:39	05:45 21:23	05:30 21:48	05:53 21:32	06:37 20:42	07:22 19:37	08:08 18:35	08:21 (WEA 1) 08:36 (WEA 1)	07:58 17:05	08:33 (WEA 2) 08:39 (WEA 2)	08:33 16:39
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	05:55 21:31	06:38 20:40	07:23 19:35	08:09 18:33	08:22 (WEA 1) 08:37 (WEA 1)	07:59 17:05	08:34 (WEA 2) 08:40 (WEA 2)	08:34 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	05:56 21:33	06:40 20:38	07:25 19:33	08:11 18:31	08:23 (WEA 1) 08:38 (WEA 1)	08:01 17:05	08:35 (WEA 2) 08:41 (WEA 2)	08:35 16:41
25	08:19 17:20	07:30 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:30 21:48	05:57 21:29	06:41 20:36	07:26 19:31	08:13 17:29	08:24 (WEA 1) 08:39 (WEA 1)	08:02 17:05	08:36 (WEA 2) 08:42 (WEA 2)	08:36 16:41
26	08:18 17:21	07:28 18:13	06:29 18:58	06:25 20:45	05:41 21:28	05:30 21:48	05:59 21:28	06:42 20:34	07:28 19:28	08:14 17:31	08:25 (WEA 1) 08:40 (WEA 1)	08:04 17:05	08:37 (WEA 2) 08:43 (WEA 2)	08:37 16:42
27	08:17 17:23	07:26 18:15	06:27 18:59	06:24 20:47	05:40 21:29	05:30 21:48	06:00 21:26	06:44 20:32	07:29 19:26	08:15 17:33	08:26 (WEA 1) 08:41 (WEA 1)	08:05 17:05	08:38 (WEA 2) 08:44 (WEA 2)	08:38 16:43
28	08:16 17:25	07:24 18:17	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	06:01 21:25	06:45 20:30	07:31 19:24	08:16 17:35	08:27 (WEA 1) 08:42 (WEA 1)	08:06 17:05	08:39 (WEA 2) 08:45 (WEA 2)	08:39 16:43
29	08:14 17:26		07:23 20:02	06:20 20:50	05:38 21:31	05:32 21:48	06:02 21:23	06:47 20:28	07:32 19:22	08:17 17:36	08:28 (WEA 1) 08:43 (WEA 1)	08:08 17:05	08:40 (WEA 2) 08:46 (WEA 2)	08:40 16:44
30	08:13 17:28		07:20 20:04	06:18 20:51	05:37 21:32	05:33 21:48	06:04 21:22	06:48 20:26	07:34 19:20	08:18 17:37	08:29 (WEA 1) 08:44 (WEA 1)	08:09 17:05	08:41 (WEA 2) 08:47 (WEA 2)	08:41 16:45
31	08:12 17:30		07:18 20:06	06:16 20:50	05:36 21:33	05:32 21:49	06:05 21:21	06:50 20:24	07:35 19:21	08:19 17:38	08:30 (WEA 1) 08:45 (WEA 1)	08:10 17:05	08:42 (WEA 2) 08:48 (WEA 2)	08:42 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275		255	
astr. max.mögl. Beschattung		281	298							79	443		70	
Red. Sonnenscheinwahrsch.		0,24	0,35						0,42	0,28	0,15		0,15	
Reduktion Betriebsdauer		0,93	0,93						0,93	0,93	0,93		0,93	
Reduktion Windrichtung		0,57	0,60						0,58	0,58	0,57		0,57	
Gesamte Reduktion		0,12	0,19						0,23	0,15	0,08		0,08	
Met. wahrsch. Beschattung		35	57					18		66	6			

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-64 - 35, Rue Pierre Gansen, 4570 Niederkorn  
Annahmen für Schattenwurfberechnung  
Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34	08:10	07:22		07:16	06:16	05:36	05:34	06:07	06:51	07:35	
2	16:47	17:31	18:18	13	08:01 (WEA 1)	20:07	20:53	21:34	21:47	21:20	22:22	
3	08:34	08:09	07:20		07:46 (WEA 1)	07:14	06:15	05:34	06:08	06:53	07:37	
4	16:48	17:33	18:20	17	08:03 (WEA 1)	20:09	20:54	21:35	21:47	21:18	20:20	
5	08:33	08:08			07:44 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	
6	16:49	17:35	18:21	20	08:04 (WEA 1)	20:10	20:56	21:36	21:47	21:16	20:18	
7	08:33:14	08:06	08:34 (WEA 2)	22	07:43 (WEA 1)	20:17	20:56	21:37	21:46	21:17	20:19	
8	16:50	17:36	18:24 (WEA 2)	18:23	22	08:05 (WEA 1)	20:12	20:57	21:37	21:46	21:15	20:16
9	08:33	08:05	08:33 (WEA 2)	07:14	24	07:42 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57
10	16:51	17:38	17	08:50 (WEA 1)	20:13	20:59	21:38	21:46	21:13	20:14	21:09	25
11	08:33	08:03	08:32 (WEA 2)	07:11	25	07:40 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:59
12	16:52	17:40	18	08:50 (WEA 1)	20:14	21:00	21:38	21:46	21:13	20:15	21:00	25
13	08:33	08:02	08:31 (WEA 2)	07:09	27	07:40 (WEA 1)	07:03	06:06	05:32	05:38	06:15	07:00
14	16:54	17:41	20	08:51 (WEA 1)	20:16	21:02	21:40	21:45	21:10	20:09	21:05	25
15	08:33	08:00	08:31 (WEA 2)	07:07	27	07:40 (WEA 1)	07:01	06:05	05:31	05:39	06:16	07:01
16	16:55	17:43	21	08:52 (WEA 1)	20:18	21:03	21:41	21:45	21:10	20:07	21:03	25
17	08:32	07:58	08:30 (WEA 2)	07:05	27	07:40 (WEA 1)	06:59	06:03	05:31	05:48	06:18	07:03
18	16:56	17:45	23	08:53 (WEA 1)	20:19	21:05	21:41	21:44	21:06	20:05	21:01	24
19	08:31	07:57	08:30 (WEA 2)	07:03	27	07:40 (WEA 1)	06:57	06:01	05:31	05:40	06:19	07:04
20	16:57	17:46	23	08:53 (WEA 1)	20:23	21:08	21:42	21:43	21:04	21:05	20:03	21:09
21	08:31:11	07:55	07:01	08:53 (WEA 1)	20:24	21:09	21:43	21:43	21:03	20:01	20:07	21:08
22	16:59	17:48	24	08:53 (WEA 1)	20:24	21:09	21:43	21:43	21:03	20:01	20:07	21:08
23	08:30	07:53	08:30 (WEA 2)	06:59	24	07:41 (WEA 1)	06:53	05:58	05:30	05:42	06:22	07:01
24	17:00	17:50	23	08:53 (WEA 1)	20:26	21:11	21:44	21:41	21:01	20:59	21:57	18:52
25	08:30	07:52	08:30 (WEA 2)	06:57	22	08:03 (WEA 1)	20:24	21:09	21:43	21:42	21:01	19:59
26	17:01	17:52	23	08:53 (WEA 1)	20:27	21:12	21:44	21:41	21:01	20:59	21:57	18:52
27	08:29	07:50	08:30 (WEA 2)	06:55	20	07:42 (WEA 1)	06:49	05:55	05:30	05:44	06:25	07:01
28	17:03	17:53	22	08:52 (WEA 1)	20:28	21:13	21:45	21:40	21:00	20:58	21:50	18:55
29	08:28	07:48	08:31 (WEA 2)	06:53		07:44 (WEA 1)	06:47	05:54	05:30	05:45	06:26	07:12
30	17:04	17:55	20	08:51 (WEA 1)	20:29	21:13	21:45	21:40	21:00	20:56	21:52	18:57
31	08:28	07:46	08:31 (WEA 2)	06:50	13	07:45 (WEA 1)	06:48	05:53	05:34	05:46	06:28	07:09
1	17:06	17:57	19	08:50 (WEA 1)	20:30	21:15	21:46	21:39	21:04	20:54	21:50	18:46
2	08:27	07:45	18	08:33 (WEA 2)	06:48	06:43	05:51	05:29	05:48	06:29	07:15	18:00
3	17:07	17:58	17	08:50 (WEA 1)	20:31	21:16	21:46	21:38	21:02	20:52	21:48	18:02
4	08:26	07:43	18	08:33 (WEA 2)	06:46	06:41	05:49	05:27	05:49	06:31	07:17	18:01
5	17:09	18:00	13	08:48 (WEA 1)	20:32	21:17	21:46	21:37	21:00	20:50	21:46	18:02
6	08:25	07:41	18	08:38 (WEA 2)	06:44	06:39	05:49	05:29	05:50	06:32	07:17	18:03
7	17:10	18:02	7	08:45 (WEA 1)	20:33	21:18	21:47	21:36	21:08	21:48	19:44	18:04
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10	08:23	07:37		06:42	20	07:39	05:49	05:32	05:53	06:36	07:21	18:07
11	17:13	18:05		06:40	20	07:40	05:50	05:33	05:54	06:37	07:22	18:08
12	08:22	07:35		06:38	20	07:41	05:51	05:34	05:55	06:38	07:23	18:09
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14	08:21	07:33		06:36	20	07:43	05:53	05:36	05:57	06:40	07:25	18:11
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16	08:20	07:31		06:33	20	07:45	05:55	05:38	05:59	06:42	07:27	18:13
17	17:18	18:10		06:33	20	07:46	05:56	05:39	06:00	06:43	07:28	18:14
18	08:19	07:30		06:31	20	07:47	05:57	05:40	06:01	06:44	07:29	18:15
19	17:20	18:12		06:30	20	07:48	05:58	05:41	06:02	06:45	07:30	18:16
20	08:18	07:28		06:29	20	07:49	05:59	05:42	06:03	06:46	07:31	18:17
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22	08:17	07:26		06:27	20	07:51	06:01	05:44	06:05	06:48	07:33	18:19
23	17:23	18:15		06:26	20	07:52	06:02	05:45	06:06	06:49	07:34	18:20
24	08:16	07:24	7	07:51 (WEA 1)	20:25	21:06	21:48	21:29	20:36	21:31	21:22	20:27
25	17:25	18:17	7	07:58 (WEA 1)	20:26	21:07	21:49	21:30	20:37	21:32	21:23	20:28
26	08:14			07:23	20	07:50	21:48	21:29	20:38	21:33	21:24	20:29
27	17:26			07:22	20	07:51	21:49	21:30	20:39	21:34	21:25	20:30
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30	08:12			07:17	20	07:54	21:52	21:33	20:42	21:37	21:28	20:33
31	17:29			07:16	20	07:55	21:53	21:34	20:43	21:38	21:29	20:34
32	08:11			07:15	20	07:56	21:54	21:35	20:44	21:39	21:30	20:35
33	17:30			07:14	20	07:57	21:55	21:36	20:45	21:40	21:31	20:36
34				07:13	20	07:58	21:56	21:37	20:46	21:41	21:32	20:37
35				07:12	20	07:59	21:57	21:38	20:47	21:42	21:33	20:38
36				07:11	20	08:00	21:58	21:39	20:48	21:43	21:34	20:39
37				07:10	20	08:01	21:59	21:40	20:49	21:44	21:35	20:40
38				07:09	20	08:02	22:00	21:41	20:50	21:45	21:36	20:41
39				07:08	20	08:03	22:01	21:42	20:51	21:46	21:37	20:42
40				07:07	20	08:04	22:02	21:43	20:52	21:47	21:38	20:43
41				07:06	20	08:05	22:03	21:44	20:53	21:48	21:39	20:44
42				07:05	20	08:06	22:04	21:45	20:54	21:49	21:40	20:45
43				07:04	20	08:07	22:05	21:46	20:55	21:50	21:41	20:46
44				07:03	20	08:08	22:06	21:47	20:56	21:51	21:42	20:47
45				07:02	20	08:09	22:07	21:48	20:57	21:52	21:43	20:48
46				07:01	20	08:10	22:08	21:49	20:58	21:53	21:44	20:49
47				07:00	20	08:11	22:09	21:50	20:59	21:54	21:45	20:50
48				06:59	20	08:12	22:10	21:51	21:00	21:55	21:46	20:51
49				06:58	20	08:13	22:11	21:52	21:01	21:56	21:47	20:52
50				06:57	20	08:14	22:12	21:53	21:02	21:57	21:48	20:53
51				06:56	20	08:15	22:13	21:54	21:03	21:58	21:49	20:54
52				06:55	20	08:16	22:14	21:55	21:04	21:59	21:50	20:55
53				06:54	20	08:17	22:15	21:56	21:05	22:00	21:51	20:56
54				06:53	20	08:18	22:16	21:57	21:06	22:01	21:52	20:57
55				06:52	20	08:19	22:17	21:58	21:07	22:02	21:53	20:58
56				06:51	20	08:20	22:18	21:59	21:08	22:03	21:54	20:59
57				06:50	20	08:21	22:19	22:00	21:09	22:04	21:55	21:00
58				06:49	20	08:22	22:20	22:01	21:10	22:05	21:56	21:01
59				06:48	20	08:23	22:21	22:02	21:11	22:06	21:57	21:02
60				06:47	20	08:24	22:22	22:03	21:12	22:07	21:58	21:03
61				06:46	20	08:25	22:23	22:04	21:13	22:08	21:59	21:04
62				06:45	20	08:26	22:24	22:05	21:14	22:09	22:00	21:05
63				06:44	20	08:27	22:25	22:06	21:15	22:10	22:01	21:06
64				06:43	20	08:28	22:26	22:07	21:16	22:11	22:02	21:07
65				06:42	20	08:29	22:27	22:08	21:17	22:12	22:03	21:08
66				06:41	20	08:30	22:28	22:09	21:18	22:13	22:04	21:09
67				06:40	20	08:31	22:29	22:10	21:19	22:14	22:05	21:10
68				06:39	20	08:32	22:30	22:11	21:20	22:15	22:06	21:11
69				06:38	20	08:33	22:31	22:12	21:21	22:16	22:07	21:12
70				06:37	20	08:34	22:32	22:13	21:22	22:17	22:08	21:13
71				06:36	20	08:35	22:					

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

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

astr. max. mögl. Beschattung 321 323 412 475 486 491 447 379 335 275 143 255

Red. Sonnenscheinwahrsch. 0,24 0,35 0,35 0,42 0,42 0,42 0,42 0,42 0,42 0,42 0,42 0,42

Reduktion Betriebsdauer 0,93 0,93 0,93 0,93 0,93 0,93 0,93 0,93 0,93 0,93 0,93 0,93

Reduktion Windrichtung 0,56 0,58 0,58 0,58 0,58 0,58 0,58 0,58 0,58 0,58 0,58 0,58

Gesamte Reduktion 0,12 0,19 0,19 0,23 0,23 0,23 0,23 0,23 0,23 0,23 0,23 0,23

Met. wahrsch. Beschattung 40 61 61 11 11 11 11 11 11 11 11 11



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-65 - 18, Rue des Celtes, 4526 Niederkorn

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anbieter:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-66 - 10, Rue des Celtes, 4526 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:39 (WEA 2) 18:18	07:22 20:07	07:50 (WEA 1) 20:53	07:16 20:07	06:16 20:53	05:36 21:19	06:07 21:19	06:51 20:22	07:35 19:18	08:11 17:16
2	08:34 16:48	08:09 17:33	08:37 (WEA 2) 18:20	07:20 20:07	07:50 (WEA 1) 20:53	07:14 20:07	06:15 20:53	05:35 21:19	06:08 21:19	06:53 20:20	07:37 19:15	08:12 17:15
3	08:33 16:49	08:08 17:35	08:37 (WEA 2) 18:21	07:18 20:06	07:49 (WEA 1) 20:10	07:12 20:06	06:13 20:56	05:34 21:16	06:09 21:16	06:54 20:18	07:38 19:13	08:13 17:13
4	08:33 16:50	08:06 17:36	08:37 (WEA 2) 18:23	07:16 20:05	07:49 (WEA 1) 20:12	07:10 20:05	06:11 20:57	05:36 21:19	06:11 21:19	06:56 20:16	07:40 19:11	08:14 17:12
5	08:33 16:51	08:05 17:38	08:37 (WEA 2) 18:25	07:14 20:06	07:49 (WEA 1) 20:13	07:08 20:09	06:09 20:59	05:35 21:13	06:09 21:13	06:54 20:14	07:38 19:09	08:13 17:10
6	08:33 16:52	08:03 17:40	08:36 (WEA 2) 18:26	07:11 20:06	07:49 (WEA 1) 20:15	07:05 20:08	06:08 21:00	05:32 21:11	06:08 21:11	06:59 20:12	07:43 19:07	08:17 17:08
7	08:33 16:54	08:02 17:41	08:36 (WEA 2) 18:28	07:09 20:06	07:49 (WEA 1) 20:16	07:03 20:12	06:06 21:02	05:32 21:10	06:08 21:10	06:59 20:09	07:44 19:05	08:18 17:05
8	08:32 16:55	08:00 17:43	08:37 (WEA 2) 18:30	07:07 20:05	07:50 (WEA 1) 20:18	07:01 20:13	06:05 21:03	05:31 21:11	06:08 21:11	06:59 20:07	07:46 19:03	08:19 17:05
9	08:32 16:56	07:58 17:45	08:37 (WEA 2) 18:31	07:05 20:05	07:51 (WEA 1) 20:19	06:59 20:05	06:03 21:05	05:31 21:11	06:08 21:11	06:59 20:05	07:47 19:01	08:20 17:04
10	08:31 16:57	07:57 17:46	08:37 (WEA 2) 18:33	07:03 20:05	07:52 (WEA 1) 20:21	06:57 20:06	06:01 21:06	05:31 21:11	06:08 21:11	06:59 20:05	07:49 19:01	08:21 17:02
11	08:31 16:59	07:55 17:48	08:38 (WEA 2) 18:34	07:01 20:06	07:55 (WEA 1) 20:22	06:55 20:08	06:00 21:08	05:30 21:11	06:08 21:11	06:59 20:05	07:51 19:01	08:22 17:01
12	08:30 17:00	07:53 17:50	08:39 (WEA 2) 18:36	06:59 20:06	08:05 (WEA 1) 20:24	06:53 20:09	05:58 21:05	05:30 21:11	06:08 21:11	06:59 20:05	07:52 19:01	08:23 17:00
13	08:30 17:01	07:52 17:52	08:40 (WEA 2) 18:37	06:57 20:06	08:08 (WEA 1) 20:26	06:51 20:11	05:57 21:06	05:30 21:11	06:08 21:11	06:59 20:05	07:54 19:01	08:24 17:01
14	08:29 17:03	07:50 17:53	08:42 (WEA 2) 18:39	06:55 20:06	08:11 (WEA 1) 20:27	06:49 20:12	05:55 21:08	05:30 21:11	06:08 21:11	06:59 20:05	07:55 19:01	08:25 17:01
15	08:28 17:04	07:48 17:55	08:45 (WEA 2) 18:41	06:53 20:06	08:12 (WEA 1) 20:29	06:47 20:13	05:54 21:08	05:30 21:11	06:08 21:11	06:59 20:05	07:57 19:01	08:26 17:01
16	08:28 17:06	07:46 17:57	08:51 (WEA 2) 18:42	06:50 20:06	08:13 (WEA 1) 20:30	06:45 20:15	05:53 21:08	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:27 17:01
17	08:27 17:07	07:45 17:58	08:52 (WEA 2) 18:44	06:48 20:06	08:14 (WEA 1) 20:32	06:43 20:16	05:51 21:08	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:28 17:01
18	08:26 17:09	07:43 18:00	08:53 (WEA 2) 18:45	06:46 20:06	08:15 (WEA 1) 20:33	06:41 20:17	05:50 21:08	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:29 17:01
19	08:25 17:10	07:41 18:02	08:54 (WEA 2) 18:47	06:44 20:06	08:16 (WEA 1) 20:34	06:39 20:19	05:49 21:09	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:30 17:01
20	08:24 17:12	07:39 18:03	08:55 (WEA 2) 18:48	06:42 20:06	08:17 (WEA 1) 20:35	06:37 20:20	05:47 21:09	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:31 17:01
21	08:23 17:13	07:37 18:05	08:56 (WEA 2) 18:50	06:40 20:06	08:18 (WEA 1) 20:36	06:35 20:21	05:46 21:09	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:32 17:01
22	08:22 17:15	07:35 18:07	08:57 (WEA 2) 18:52	06:38 20:06	08:19 (WEA 1) 20:37	06:33 20:22	05:45 21:10	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:33 17:01
23	08:21 17:16	07:33 18:08	08:58 (WEA 2) 18:53	06:35 20:06	08:20 (WEA 1) 20:38	06:31 20:23	05:44 21:11	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:34 17:01
24	08:20 17:18	07:31 18:10	08:59 (WEA 2) 18:55	06:33 20:06	08:21 (WEA 1) 20:39	06:29 20:24	05:43 21:12	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:35 17:01
25	08:19 17:20	07:30 18:12	09:00 (WEA 2) 18:56	06:31 20:06	08:22 (WEA 1) 20:40	06:27 20:26	05:42 21:13	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:36 17:01
26	08:18 17:21	07:28 18:13	09:01 (WEA 2) 18:58	06:29 20:06	08:23 (WEA 1) 20:41	06:25 20:27	05:41 21:14	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:37 17:01
27	08:17 17:23	07:26 18:15	09:02 (WEA 2) 18:59	06:27 20:06	08:24 (WEA 1) 20:42	06:24 20:28	05:40 21:15	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:38 17:01
28	08:16 17:25	07:24 18:17	09:03 (WEA 2) 19:01	06:25 20:06	08:25 (WEA 1) 20:43	06:22 20:29	05:39 21:16	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:39 17:01
29	08:14 17:26	07:23 18:16	09:04 (WEA 2) 19:02	06:23 20:06	08:26 (WEA 1) 20:44	06:20 20:30	05:38 21:17	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:40 17:01
30	08:13 17:28	07:22 18:18	09:05 (WEA 2) 19:03	06:21 20:06	08:27 (WEA 1) 20:45	06:18 20:31	05:37 21:18	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:41 17:01
31	08:12 17:30	07:21 18:19	09:06 (WEA 2) 19:04	06:20 20:06	08:28 (WEA 1) 20:46	06:17 20:32	05:36 21:19	05:29 21:11	06:08 21:11	06:59 20:05	07:58 19:01	08:42 17:01
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung	37	378	241							420		
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28		0,15
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93		0,93
Reduktion Windrichtung	0,56	0,56	0,57							0,57		0,56
Gesamte Reduktion	0,08	0,12	0,19							0,15		0,08
Met. wahrsch. Beschattung	3	47	45							62		19

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang	Zeitpunkt (SS:MM) Schattenende	(WEA mit erstem Schatten)	(WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-67 - 10, Rue des Lignes, 4609 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:45 (WEA 2) 18:18	07:22 18:18	07:58 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:20 (WEA 2) 16:40
2	08:34 16:48	08:09 17:33	08:44 (WEA 2) 18:20	07:20 18:20	07:58 (WEA 1) 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:18 (WEA 2) 16:40
3	08:33 16:49	08:08 17:35	08:45 (WEA 2) 18:21	07:18 18:21	07:59 (WEA 1) 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:19 (WEA 2) 16:39
4	08:33 16:50	08:06 17:36	08:45 (WEA 2) 18:23	07:16 18:23	07:59 (WEA 1) 20:12	06:11 20:57	05:36 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:12	08:16 (WEA 2) 16:39
5	08:33 16:51	08:05 17:37	08:46 (WEA 2) 18:25	07:13 18:25	08:00 (WEA 1) 20:13	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:09	07:41 19:09	07:31 17:10	08:16 (WEA 2) 16:39
6	08:33 16:52	08:03 17:40	08:46 (WEA 2) 18:26	07:11 18:26	08:00 (WEA 1) 20:15	06:08 21:00	05:32 21:11	06:03 21:11	06:59 20:12	07:43 19:07	07:32 17:08	08:16 (WEA 2) 16:38
7	08:33 16:54	08:02 17:41	08:46 (WEA 2) 18:28	07:09 18:28	08:02 (WEA 1) 20:16	06:06 21:02	05:32 21:45	06:05 21:10	07:00 20:09	07:44 19:05	07:34 17:05	08:16 (WEA 2) 16:38
8	08:32 16:55	08:00 17:43	08:48 (WEA 2) 18:30	07:07 18:30	08:05 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:15 (WEA 2) 16:38
9	08:32 16:56	07:58 17:45	08:49 (WEA 2) 18:31	07:05 18:31	08:14 (WEA 1) 20:18	06:03 21:05	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:15 (WEA 2) 16:37
10	08:31 16:57	07:57 17:46	08:50 (WEA 2) 18:33	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:16 (WEA 2) 16:37
11	08:31 16:59	07:55 17:48	08:53 (WEA 2) 18:34	07:01 18:34	06:55 20:22	06:00 21:08	05:41 21:43	06:21 21:03	07:06 20:01	07:51 18:56	07:40 17:01	08:16 (WEA 2) 16:37
12	08:30 17:00	07:53 17:50	08:54 (WEA 2) 18:36	07:00 18:36	06:53 20:24	05:58 21:09	05:42 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:16 (WEA 2) 16:37
13	08:30 17:01	07:52 17:52	08:55 (WEA 2) 18:37	06:59 18:37	06:51 20:26	05:57 21:11	05:43 21:41	06:23 21:09	07:09 19:57	07:54 18:52	07:44 17:01	08:17 (WEA 2) 16:37
14	08:29 17:03	07:50 17:53	08:56 (WEA 2) 18:39	06:55 18:39	06:49 20:27	05:55 21:12	05:44 21:45	06:25 20:58	07:10 19:54	07:55 18:50	07:45 17:02	08:18 (WEA 2) 16:37
15	08:28 17:04	07:48 17:55	08:57 (WEA 2) 18:41	06:53 18:41	06:47 20:29	05:54 21:13	05:45 21:45	06:26 20:56	07:12 19:52	07:57 18:48	07:47 17:05	08:19 (WEA 2) 16:37
16	08:28 17:06	07:46 17:57	08:58 (WEA 2) 18:42	06:50 18:42	06:45 20:30	05:53 21:15	05:47 21:46	06:28 20:54	07:13 19:50	07:58 18:46	07:48 17:04	08:20 (WEA 2) 16:37
17	08:27 17:07	07:45 17:58	08:59 (WEA 2) 18:44	06:48 18:44	06:43 20:32	05:51 21:16	05:48 21:46	06:29 20:52	07:15 19:48	08:00 18:44	07:50 17:05	08:22 (WEA 2) 16:38
18	08:26 17:09	07:43 18:00	09:00 (WEA 2) 18:46	06:46 18:45	06:41 20:33	05:50 21:17	05:49 21:46	06:31 20:50	07:16 19:46	08:01 18:42	07:51 17:06	08:24 (WEA 2) 16:38
19	08:25 17:10	07:41 18:02	09:01 (WEA 2) 18:47	06:44 18:47	06:39 20:35	05:49 21:19	05:50 21:47	06:32 20:48	07:17 19:44	08:03 18:40	07:53 17:05	08:25 (WEA 2) 16:38
20	08:24 17:12	07:39 18:03	09:02 (WEA 2) 18:48	06:42 18:48	06:37 20:36	05:47 21:20	05:51 21:47	06:34 20:46	07:19 19:41	08:05 18:38	07:55 17:06	08:26 (WEA 2) 16:39
21	08:23 17:13	07:37 18:05	09:03 (WEA 2) 18:50	06:40 18:50	06:35 20:38	05:46 21:21	05:52 21:47	06:35 20:44	07:20 19:39	08:06 18:36	07:56 17:07	08:27 (WEA 2) 16:39
22	08:22 17:15	07:35 18:07	09:04 (WEA 2) 18:52	06:38 18:52	06:33 20:39	05:45 21:23	05:53 21:48	06:37 20:42	07:22 19:37	08:08 18:35	07:58 17:08	08:28 (WEA 2) 16:39
23	08:21 17:16	07:33 18:08	09:05 (WEA 2) 18:53	06:35 18:53	06:31 20:41	05:44 21:24	05:55 21:48	06:38 20:40	07:23 19:35	08:09 18:33	07:59 17:09	08:29 (WEA 2) 16:40
24	08:20 17:18	07:31 18:10	09:06 (WEA 2) 18:55	06:33 18:55	06:29 20:42	05:43 21:25	05:56 21:48	06:39 20:38	07:25 19:33	08:11 18:31	08:01 17:10	08:30 (WEA 2) 16:41
25	08:19 17:20	07:30 18:12	09:07 (WEA 2) 18:56	06:31 18:56	06:27 20:44	05:42 21:26	05:57 21:48	06:41 20:36	07:26 19:31	07:13 18:29	07:08 17:12	08:31 (WEA 2) 16:41
26	08:18 17:21	07:28 18:13	09:08 (WEA 2) 18:58	06:29 18:58	06:25 20:45	05:41 21:28	05:59 21:48	06:42 20:34	07:28 19:28	07:14 18:27	07:04 17:13	08:32 (WEA 2) 16:42
27	08:17 17:23	07:26 18:15	09:09 (WEA 2) 18:59	06:27 18:59	06:24 20:47	05:40 21:29	05:52 21:48	06:44 20:32	07:29 19:26	07:16 18:25	07:07 17:14	08:33 (WEA 2) 16:43
28	08:16 17:25	07:24 18:17	09:10 (WEA 2) 19:01	06:25 19:01	06:22 20:48	05:39 21:30	05:53 21:48	06:45 20:30	07:31 19:24	07:17 18:23	07:08 17:15	08:34 (WEA 2) 16:43
29	08:14 17:26	07:22 18:19	09:11 (WEA 2) 19:02	06:23 19:02	06:20 20:50	05:38 21:31	05:52 21:48	06:47 20:28	07:32 19:22	07:19 18:22	07:09 17:16	08:35 (WEA 2) 16:44
30	08:13 17:28	07:20 18:22	09:12 (WEA 2) 19:03	06:21 19:03	06:18 20:51	05:37 21:32	05:53 21:48	06:48 20:26	07:34 19:20	07:21 18:20	07:10 17:17	08:36 (WEA 2) 16:45
31	08:12 17:29	07:18 18:23	09:13 (WEA 2) 19:04	06:20 19:04	06:17 20:52	05:36 21:33	05:50 21:49	06:50 20:24	07:35 19:21	07:22 18:22	07:11 17:18	08:37 (WEA 2) 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	255	
astr. max. mögl. Beschattung	146	418	164							378	358	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,55	0,56	0,57							0,57	0,55	
Gesamte Reduktion	0,07	0,12	0,19							0,15	0,08	
Met. wahrsch. Beschattung	11	52	30							56	27	

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-68 - 7, Rue des Trévires, 4680 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1   08:34		08:10	08:40 (WEA 2)	07:22	07:55 (WEA 1)	07:16	06:16	05:36	05:34	06:07	06:51	07:35
16:47		17:31	21 09:01 (WEA 2)	18:18	24 08:19 (WEA 1)	20:07	20:53	21:34	21:19	20:22	17:16	17:18
2   08:34		08:09	08:39 (WEA 2)	07:20	07:55 (WEA 1)	07:14	06:15	05:35	05:34	06:08	06:53	07:37
16:48		17:33	22 09:01 (WEA 2)	18:20	24 08:19 (WEA 1)	20:09	20:54	21:35	21:19	20:20	17:15	17:15
3   08:33		08:08	08:40 (WEA 2)	07:18	07:55 (WEA 1)	07:12	06:13	05:34	05:35	06:09	06:54	07:38
16:49		17:35	22 09:02 (WEA 2)	18:21	23 08:18 (WEA 1)	20:10	20:56	21:36	21:19	20:18	17:13	17:13
4   08:33		08:06	08:39 (WEA 2)	07:16	07:56 (WEA 1)	07:10	06:11	05:34	05:36	06:11	06:56	07:40
16:50		17:36	23 09:02 (WEA 2)	18:23	22 08:18 (WEA 1)	20:12	20:57	21:37	21:19	20:16	17:12	17:12
5   08:33		08:05	08:40 (WEA 2)	07:14	07:57 (WEA 1)	07:08	06:09	05:33	05:36	06:12	06:57	07:41
16:51		17:38	22 09:02 (WEA 2)	18:25	19 08:16 (WEA 1)	20:13	20:59	21:38	21:19	20:14	17:10	17:10
6   08:33		08:03	08:40 (WEA 2)	07:11	07:57 (WEA 1)	07:05	06:08	05:32	05:37	06:13	06:59	07:43
16:52		17:40	22 09:02 (WEA 2)	18:26	17 08:14 (WEA 1)	20:15	21:00	21:39	21:19	20:12	17:08	17:08
7   08:33		08:02	08:40 (WEA 2)	07:09	07:59 (WEA 1)	07:03	06:06	05:32	05:38	06:15	07:00	07:44
16:54		17:41	21 09:01 (WEA 2)	18:28	13 08:12 (WEA 1)	20:16	21:02	21:40	21:19	20:09	19:05	19:05
8   08:32		08:00	08:41 (WEA 2)	07:07	08:03 (WEA 1)	07:01	06:05	05:31	05:39	06:16	07:01	07:46
16:55		17:43	20 09:01 (WEA 2)	18:30	4 08:07 (WEA 1)	20:18	21:03	21:41	21:19	20:08	19:03	19:03
9   08:32		07:58	08:42 (WEA 2)	07:05	06:59	06:03	05:31	05:40	06:18	07:03	07:47	08:30 (WEA 1)
16:56		17:45	18 09:00 (WEA 2)	18:31	20:19	21:05	21:41	21:44	21:06	20:05	19:01	19:01
10   08:31		07:57	08:43 (WEA 2)	07:03	06:57	06:01	05:31	05:40	06:19	07:04	07:49	08:30 (WEA 1)
16:57		17:46	16 08:59 (WEA 2)	18:33	20:21	21:06	21:42	21:43	21:05	20:03	18:59	18:59
11   08:31		07:55	08:44 (WEA 2)	07:01	06:55	06:00	05:30	05:41	06:21	07:06	07:51	08:29 (WEA 1)
16:59		17:48	13 08:57 (WEA 2)	18:34	20:22	21:08	21:43	21:43	21:03	20:01	18:56	18:56
12   08:30		07:53	08:48 (WEA 2)	06:59	06:53	05:58	05:30	05:42	06:22	07:07	07:52	08:28 (WEA 1)
17:00		17:50	8 08:56 (WEA 2)	18:36	20:24	21:09	21:43	21:42	21:01	19:59	18:54	18:54
13   08:30		07:52	06:57	06:59	06:51	05:57	05:30	05:43	06:23	07:09	07:54	08:28 (WEA 1)
17:01		17:52	18:37	18:37	20:26	21:11	21:44	21:41	20:59	19:57	18:52	18:52
14   08:29		07:50	06:55	06:55	06:49	05:55	05:30	05:44	06:25	07:10	07:55	08:27 (WEA 1)
17:03		17:53	18:39	18:39	20:27	21:12	21:45	21:40	20:58	19:54	18:50	18:50
15   08:28		07:48	06:53	06:53	06:47	05:54	05:30	05:45	06:26	07:12	07:57	08:27 (WEA 1)
17:04		17:55	18:41	18:41	20:29	21:13	21:45	21:40	20:56	19:52	18:48	18:48
16   08:28		07:46	06:50	06:50	06:45	05:53	05:29	05:47	06:28	07:13	07:58	08:28 (WEA 1)
17:06		17:57	18:42	18:42	20:30	21:15	21:46	21:39	20:54	19:50	18:46	18:46
17   08:27		07:45	06:48	06:48	06:43	05:51	05:29	05:48	06:29	07:15	08:00	08:28 (WEA 1)
17:07		17:58	18:44	18:44	20:32	21:16	21:46	21:38	20:52	19:48	18:44	18:44
18   08:26		07:43	06:46	06:46	06:41	05:50	05:29	05:49	06:31	07:16	08:01	08:29 (WEA 1)
17:09		18:00	18:45	18:45	20:33	21:17	21:46	21:37	20:50	19:46	18:42	18:42
19   08:25		07:41	06:44	06:44	06:39	05:49	05:29	05:50	06:32	07:17	08:03	08:30 (WEA 1)
17:10		18:02	18:47	18:47	20:35	21:19	21:47	21:36	20:48	19:44	18:40	18:40
20   08:24		07:39	08:05 (WEA 1)	06:42	06:37	05:47	05:30	05:51	06:34	07:19	08:05	08:30 (WEA 1)
17:12		18:03	6 08:11 (WEA 1)	18:48	20:36	21:20	21:47	21:35	20:46	19:41	18:38	18:38
21   08:23		07:37	08:02 (WEA 1)	06:40	06:35	05:46	05:30	05:52	06:35	07:20	08:06	08:33 (WEA 1)
17:13		18:05	13 08:15 (WEA 1)	18:50	20:38	21:21	21:47	21:34	20:44	19:39	18:36	18:36
22   08:22		07:35	08:00 (WEA 1)	06:38	06:33	05:45	05:30	05:53	06:37	07:22	08:08	08:33 (WEA 1)
17:15		18:07	16 08:16 (WEA 1)	18:52	20:39	21:23	21:48	21:32	20:42	19:37	18:35	18:35
23   08:21		07:33	07:58 (WEA 1)	06:35	06:31	05:44	05:30	05:55	06:38	07:23	08:09	08:33 (WEA 1)
17:16		18:08	20 08:18 (WEA 1)	18:53	20:41	21:24	21:48	21:31	20:40	19:35	18:33	18:33
24   08:20		07:31	07:57 (WEA 1)	06:33	06:29	05:43	05:30	05:56	06:39	07:25	08:11	08:33 (WEA 1)
17:18		18:10	22 08:19 (WEA 1)	18:55	20:42	21:25	21:48	21:30	20:38	19:33	18:31	18:31
25   08:19		07:30	07:56 (WEA 1)	06:31	06:27	05:42	05:31	05:57	06:41	07:26	07:13	07:13
17:20		18:12	23 08:19 (WEA 1)	18:56	20:44	21:26	21:48	21:29	20:36	19:31	17:29	17:29
26   08:18		08:45 (WEA 2)	07:28	07:55 (WEA 1)	06:25	05:41	05:31	05:59	06:42	07:28	07:14	07:14
17:21		8 08:53 (WEA 2)	18:13	08:20 (WEA 1)	20:45	21:28	21:48	21:28	20:34	19:28	17:27	17:27
27   08:17		07:28	08:43 (WEA 2)	07:26	06:24	05:40	05:32	06:00	06:44	07:29	07:16	07:16
17:23		12 08:55 (WEA 2)	18:15	08:20 (WEA 1)	20:47	21:29	21:48	21:26	20:32	19:26	17:25	17:25
28   08:16		08:42 (WEA 2)	07:24	07:55 (WEA 1)	06:25	06:22	05:39	05:32	06:01	06:45	07:31	07:17
17:25		15 08:57 (WEA 2)	18:17	08:20 (WEA 1)	20:48	21:30	21:48	21:25	20:30	19:24	17:23	17:23
29   08:14		08:41 (WEA 2)		07:23	06:20	05:38	05:32	06:02	06:47	07:32	07:19	07:19
17:26		17 08:58 (WEA 2)		20:02	20:50	21:31	21:48	21:23	20:28	19:22	17:22	17:22
30   08:13		08:41 (WEA 2)		07:20	06:18	05:37	05:33	06:04	06:48	07:34	07:21	07:21
17:28		19 09:00 (WEA 2)		20:04	20:51	21:32	21:48	21:22	20:26	19:20	17:20	17:20
31   08:12		08:40 (WEA 2)		07:18		05:36		06:05	06:50		07:22	07:22
17:30		20 09:00 (WEA 2)		20:06		21:33		21:21	20:24		17:18	17:18
Sonnenscheinstunden	269		283		368		412	475	486	491	447	379
astr. max. mögl. Beschattung	91		403		146						346	298
Red. Sonnenscheinwahrsch.	0,15		0,24		0,35						0,28	0,15
Reduktion Betriebsdauer	0,93		0,93		0,93						0,93	0,93
Reduktion Windrichtung	0,56		0,56		0,57						0,57	0,56
Gesamte Reduktion	0,07		0,12		0,19						0,15	0,08
Met. wahrsch. Beschattung	7		50		27						51	23

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-69 - 19, Rue des Lignes, 4609 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:44 (WEA 2) 18:18	07:22 18:25	07:59 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:21 (WEA 2) 16:40
2	08:34 16:48	08:09 17:33	08:44 (WEA 2) 18:20	07:20 18:23	08:00 (WEA 1) 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:19 (WEA 2) 16:40
3	08:33 16:49	08:08 17:35	08:45 (WEA 2) 18:21	07:18 18:22	08:00 (WEA 1) 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:18 (WEA 2) 16:39
4	08:33 16:50	08:06 17:36	08:45 (WEA 2) 18:23	07:16 18:23	08:01 (WEA 1) 20:12	06:11 20:57	05:36 21:37	06:11 21:16	06:56 20:16	07:40 19:11	07:29 17:12	08:16 (WEA 2) 16:39
5	08:33 16:51	08:05 17:38	08:46 (WEA 2) 18:25	07:14 18:25	08:03 (WEA 1) 20:13	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:31 17:10	08:16 (WEA 2) 16:39
6	08:33 16:52	08:03 17:40	08:46 (WEA 2) 18:26	07:11 18:26	08:04 (WEA 1) 20:15	06:08 21:00	05:32 21:11	06:13 21:11	06:59 20:12	07:43 19:07	07:32 17:08	08:16 (WEA 2) 16:38
7	08:33 16:54	08:02 17:41	08:47 (WEA 2) 18:28	07:09 18:28	08:09 (WEA 1) 20:16	06:06 21:02	05:32 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:05	08:15 (WEA 2) 16:38
8	08:33 16:55	08:00 17:43	08:48 (WEA 2) 18:30	07:07 18:30	08:11 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:39 (WEA 1) 16:38
9	08:32 16:56	08:00 17:43	08:49 (WEA 2) 18:30	07:05 18:30	08:11 (WEA 1) 20:19	06:03 21:05	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:36 (WEA 1) 16:37
10	08:31 16:57	08:00 17:46	08:51 (WEA 2) 18:33	07:03 18:33	08:11 (WEA 1) 20:21	06:01 21:06	05:31 21:43	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:36 (WEA 1) 16:37
11	08:31 16:59	08:00 17:55	08:52 (WEA 2) 18:34	07:01 18:34	08:11 (WEA 1) 20:22	06:00 21:08	05:31 21:43	06:19 21:03	07:05 20:01	07:51 18:56	07:40 17:01	08:37 (WEA 1) 16:37
12	08:30 17:00	08:00 17:50	08:53 (WEA 2) 18:36	06:59 18:36	08:11 (WEA 1) 20:24	05:58 21:09	05:30 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:38 (WEA 1) 16:37
13	08:30 17:01	08:00 17:52	08:54 (WEA 2) 18:37	06:59 18:37	08:11 (WEA 1) 20:26	05:57 21:11	05:30 21:44	06:23 21:05	07:09 19:57	07:54 18:52	07:44 17:01	08:39 (WEA 1) 16:37
14	08:29 17:03	08:00 17:53	08:55 (WEA 2) 18:39	06:59 18:39	08:11 (WEA 1) 20:27	05:55 21:12	05:30 21:45	06:25 21:08	07:10 19:54	07:55 18:50	07:45 17:01	08:40 (WEA 1) 16:37
15	08:28 17:04	08:00 17:55	08:56 (WEA 2) 18:41	06:59 18:41	08:11 (WEA 1) 20:29	05:54 21:13	05:30 21:45	06:26 21:10	07:12 19:52	07:57 18:48	07:47 17:01	08:41 (WEA 1) 16:37
16	08:28 17:06	08:00 17:57	08:57 (WEA 2) 18:42	06:59 18:42	08:11 (WEA 1) 20:30	05:53 21:15	05:30 21:46	06:28 21:10	07:13 19:50	07:58 18:46	07:48 17:01	08:42 (WEA 1) 16:37
17	08:27 17:07	08:00 17:58	08:58 (WEA 2) 18:44	06:59 18:44	08:11 (WEA 1) 20:32	05:51 21:16	05:30 21:46	06:29 21:10	07:14 19:48	07:59 18:44	07:49 17:01	08:43 (WEA 1) 16:38
18	08:26 17:09	08:00 18:00	08:59 (WEA 2) 18:45	06:59 18:45	08:11 (WEA 1) 20:33	05:50 21:17	05:30 21:47	06:31 21:10	07:16 19:46	08:01 18:42	07:51 17:01	08:44 (WEA 1) 16:38
19	08:25 17:10	08:00 18:02	09:00 (WEA 2) 18:47	06:59 18:47	08:11 (WEA 1) 20:35	05:49 21:19	05:30 21:47	06:32 21:10	07:17 19:44	08:03 18:40	07:53 17:01	08:45 (WEA 1) 16:38
20	08:24 17:12	08:00 18:03	09:01 (WEA 2) 18:48	06:59 18:48	08:11 (WEA 1) 20:36	05:47 21:20	05:30 21:47	06:34 21:10	07:19 19:41	08:05 18:38	07:55 17:01	08:46 (WEA 1) 16:39
21	08:23 17:13	08:00 18:05	09:02 (WEA 2) 18:50	06:59 18:50	08:11 (WEA 1) 20:38	05:46 21:21	05:30 21:47	06:35 21:10	07:20 19:39	08:06 18:36	07:56 17:01	08:47 (WEA 1) 16:39
22	08:22 17:15	08:00 18:07	09:03 (WEA 2) 18:52	06:59 18:52	08:11 (WEA 1) 20:40	05:45 21:23	05:30 21:48	06:37 21:10	07:22 19:37	08:08 18:35	07:58 17:01	08:48 (WEA 1) 16:40
23	08:21 17:16	08:00 18:08	09:04 (WEA 2) 18:53	06:59 18:53	08:11 (WEA 1) 20:41	05:44 21:24	05:30 21:48	06:38 21:10	07:23 19:35	08:09 18:33	07:59 17:01	08:49 (WEA 1) 16:40
24	08:20 17:18	08:00 18:10	09:05 (WEA 2) 18:55	06:59 18:55	08:11 (WEA 1) 20:42	05:43 21:25	05:30 21:49	06:39 21:10	07:24 19:36	08:10 18:34	08:01 17:01	08:50 (WEA 1) 16:41
25	08:19 17:20	08:00 18:12	09:06 (WEA 2) 18:56	06:59 18:56	08:11 (WEA 1) 20:44	05:42 21:26	05:30 21:50	06:41 21:10	07:26 19:37	08:11 18:35	08:02 17:01	08:51 (WEA 1) 16:41
26	08:18 17:21	08:00 18:13	09:07 (WEA 2) 18:57	06:59 18:57	08:11 (WEA 1) 20:45	05:41 21:27	05:30 21:51	06:42 21:10	07:28 19:38	08:12 18:36	08:04 17:01	08:52 (WEA 1) 16:42
27	08:17 17:23	08:00 18:15	09:08 (WEA 2) 18:58	06:59 18:58	08:11 (WEA 1) 20:46	05:40 21:28	05:30 21:52	06:44 21:10	07:29 19:39	08:13 18:37	08:05 17:01	08:53 (WEA 1) 16:43
28	08:16 17:25	08:00 18:17	09:09 (WEA 2) 18:59	06:59 18:59	08:11 (WEA 1) 20:48	05:39 21:30	05:30 21:53	06:45 21:10	07:31 19:40	08:14 18:38	08:06 17:01	08:54 (WEA 1) 16:43
29	08:14 17:26	08:00 18:18	09:10 (WEA 2) 19:01	06:59 19:01	08:11 (WEA 1) 20:50	05:38 21:31	05:30 21:54	06:47 21:10	07:32 19:41	08:15 18:39	08:08 17:01	08:55 (WEA 1) 16:44
30	08:13 17:28	08:00 18:19	09:11 (WEA 2) 19:02	06:59 19:02	08:11 (WEA 1) 20:51	05:37 21:32	05:30 21:55	06:48 21:10	07:34 19:42	08:16 18:40	08:09 17:01	08:56 (WEA 1) 16:45
31	08:12 17:29	08:00 18:20	09:12 (WEA 2) 19:03	06:59 19:03	08:11 (WEA 1) 20:52	05:36 21:33	05:30 21:56	06:49 21:10	07:35 19:43	08:17 18:41	08:10 17:01	08:57 (WEA 1) 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	255	
astr. max. mögl. Beschattung	157	415	121							351	347	
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28	0,15	
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93	0,93	
Reduktion Windrichtung	0,55	0,56	0,57							0,57	0,55	
Gesamte Reduktion	0,07	0,12	0,19							0,15	0,08	
Met. wahrsch. Beschattung	12	51	22							52	27	

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-70 - 32, Rue des Lignes, 4609 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:51 (WEA 2) 18:18	07:22 19	08:09 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	08:11 16:40
2	08:34 16:48	08:09 17:33	08:51 (WEA 2) 18:20	07:20 16	08:10 (WEA 1) 20:07	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	08:52 (WEA 2) 18:21	07:18 10	08:13 (WEA 1) 20:10	06:13 20:56	05:34 21:36	06:09 21:47	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	08:53 (WEA 2) 18:23	07:16 18	08:23 (WEA 1) 20:10	06:11 20:57	05:34 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:12	08:14 16:39
5	08:33 16:51	08:05 17:36	08:55 (WEA 2) 18:23	07:14 16	08:26 (WEA 1) 20:13	06:09 20:59	05:33 21:46	06:12 21:13	06:57 20:14	07:41 19:09	07:31 17:10	08:16 16:39
6	08:33 16:52	08:03 17:40	08:56 (WEA 2) 18:26	07:11 13	08:29 (WEA 1) 20:15	06:08 21:00	05:32 21:39	06:13 21:11	06:59 20:12	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	08:58 (WEA 2) 18:28	07:09 8	08:31 (WEA 1) 20:16	06:06 21:02	05:32 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	09:06 (WEA 2) 18:39	07:07 18	08:32 (WEA 1) 20:17	06:05 21:03	05:31 21:46	06:16 21:11	07:01 20:12	07:46 19:07	07:35 17:08	08:19 16:38
9	08:32 16:56	07:57 17:45	09:07 18:40	07:03 18	08:33 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:11	07:01 20:12	07:46 19:07	07:35 17:08	08:19 16:38
10	08:31 16:57	07:57 17:46	09:07 18:41	07:03 18	08:33 (WEA 1) 20:18	06:05 21:03	05:31 21:45	06:16 21:11	07:01 20:12	07:46 19:07	07:35 17:08	08:19 16:38
11	08:31 16:59	07:55 17:48	09:07 18:43	07:01 18	08:34 (WEA 1) 20:19	06:00 21:05	05:41 21:44	06:21 21:06	07:06 20:05	07:51 19:01	07:40 17:04	08:22 16:37
12	08:30 17:00	07:53 17:50	09:07 18:46	06:59 18	08:35 (WEA 1) 20:20	05:58 21:06	05:40 21:43	06:22 21:05	07:07 20:03	07:52 19:03	07:42 17:05	08:23 16:37
13	08:30 17:01	07:52 17:52	09:07 18:47	06:57 18	08:36 (WEA 1) 20:21	05:57 21:07	05:43 21:43	06:23 21:05	07:09 20:03	07:54 19:03	07:44 17:02	08:24 16:37
14	08:29 17:03	07:50 17:53	09:07 18:48	06:55 18	08:37 (WEA 1) 20:22	05:55 21:08	05:44 21:43	06:25 21:03	07:10 20:01	07:55 19:03	07:45 17:01	08:25 16:37
15	08:28 17:04	07:48 17:55	09:07 18:49	06:53 18	08:38 (WEA 1) 20:23	05:53 21:09	05:45 21:43	06:26 21:03	07:12 20:01	07:57 19:03	07:47 17:01	08:26 16:37
16	08:28 17:06	07:46 17:57	09:07 18:50	06:50 18	08:39 (WEA 1) 20:24	05:53 21:10	05:45 21:44	06:26 21:04	07:13 20:02	07:58 19:04	07:48 17:02	08:27 16:37
17	08:27 17:07	07:45 17:58	09:07 18:51	06:48 18	08:40 (WEA 1) 20:25	05:51 21:11	05:48 21:44	06:29 21:05	07:15 20:03	08:00 19:05	07:50 17:01	08:28 16:37
18	08:26 17:09	07:43 18:00	09:07 18:52	06:46 21	08:41 (WEA 1) 20:26	05:50 21:12	05:49 21:45	06:31 21:06	07:16 20:04	08:01 19:06	07:51 17:02	08:29 16:37
19	08:25 17:10	07:41 18:02	09:07 18:53	06:44 21	08:42 (WEA 1) 20:27	05:49 21:13	05:50 21:46	06:32 21:07	07:17 20:05	08:03 19:07	07:53 17:03	08:30 16:37
20	08:24 17:12	07:39 18:03	09:07 18:54	06:42 24	08:43 (WEA 1) 20:28	05:47 21:14	05:51 21:47	06:34 21:08	07:19 20:06	08:05 19:08	07:55 17:04	08:31 16:37
21	08:23 17:13	07:37 18:05	09:07 18:55	06:40 25	08:44 (WEA 1) 20:29	05:46 21:15	05:52 21:48	06:35 21:10	07:20 20:07	08:06 19:09	07:56 17:05	08:32 16:37
22	08:22 17:15	07:35 18:07	09:07 18:56	06:38 26	08:45 (WEA 1) 20:30	05:45 21:16	05:53 21:49	06:37 21:11	07:22 20:08	08:08 19:10	07:58 17:06	08:33 16:37
23	08:21 17:16	07:33 18:08	09:07 18:57	06:35 26	08:46 (WEA 1) 20:31	05:44 21:17	05:55 21:50	06:38 21:12	07:23 20:09	08:09 19:11	07:59 17:07	08:34 16:37
24	08:20 17:18	07:31 18:10	09:07 18:58	06:33 26	08:47 (WEA 1) 20:32	05:43 21:18	05:56 21:51	06:39 21:13	07:25 20:10	08:11 19:12	08:01 17:08	08:35 16:37
25	08:19 17:20	07:30 18:12	09:07 18:59	06:31 26	08:48 (WEA 1) 20:33	05:42 21:19	05:57 21:52	06:41 21:14	07:26 20:11	08:13 19:13	08:02 17:09	08:36 16:37
26	08:18 17:21	07:28 18:13	09:07 19:00	06:29 25	08:49 (WEA 1) 20:34	05:41 21:20	05:59 21:53	06:42 21:15	07:28 20:12	08:14 19:14	08:04 17:10	08:37 16:37
27	08:17 17:23	07:26 18:15	09:07 19:01	06:27 23	08:50 (WEA 1) 20:35	05:40 21:21	06:00 21:54	06:44 21:16	07:29 20:13	08:16 19:15	08:05 17:11	08:38 16:37
28	08:16 17:25	07:24 18:17	09:07 19:02	06:25 21	08:51 (WEA 1) 20:36	05:39 21:22	06:01 21:55	06:45 21:17	07:31 20:14	08:17 19:16	08:06 17:12	08:39 16:37
29	08:14 17:26	07:23 18:18	09:07 19:03	06:23 23	08:52 (WEA 1) 20:37	05:38 21:23	06:02 21:56	06:47 21:18	07:32 20:15	08:18 19:17	08:08 17:13	08:40 16:37
30	08:13 17:28	07:20 18:19	09:07 19:04	06:21 23	08:53 (WEA 1) 20:38	05:37 21:24	06:03 21:57	06:48 21:19	07:34 20:16	08:19 19:18	08:09 17:14	08:41 16:37
31	08:12 17:29	07:18 18:20	09:07 19:05	06:19 23	08:54 (WEA 1) 20:39	05:36 21:25	06:04 21:58	06:49 21:20	07:35 20:17	08:20 19:19	08:10 17:15	08:42 16:37
Sonnenscheinstunden	269	283	368	412	475	486	491	379	335	275	379	255
astr. max. mögl. Beschattung	257	428	45							364		
Red. Sonnenscheinwahrsch.	0,15	0,24	0,35							0,28		
Reduktion Betriebsdauer	0,93	0,93	0,93							0,93		
Reduktion Windrichtung	0,55	0,57	0,57							0,55		
Gesamte Reduktion	0,07	0,12	0,18							0,15		
Met. wahrsch. Beschattung	19	53	8							54	29	

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxemburg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-71 - 39, Rue des Lignes, 4609 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:34 16:47	08:10 17:31	08:51 (WEA 2) 19:12 (WEA 2)	07:22 18:18	08:11 (WEA 1) 20:07	06:16 20:53	05:36 21:34	06:07 21:47	06:51 20:22	07:35 19:18	07:24 17:16	08:11 16:40
2	08:34 16:48	08:09 17:33	08:51 (WEA 2) 19:12 (WEA 2)	07:20 18:18	08:14 (WEA 1) 20:07	06:15 20:53	05:34 21:35	06:08 21:47	06:53 20:20	07:37 19:15	07:26 17:15	08:12 16:40
3	08:33 16:49	08:08 17:35	08:52 (WEA 2) 19:11 (WEA 2)	07:18 18:21	08:23 (WEA 1) 20:09	06:13 20:56	05:34 21:36	06:09 21:47	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	08:53 (WEA 2) 19:10 (WEA 2)	07:16 18:23	08:23 (WEA 1) 20:09	06:11 20:57	05:36 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:12	08:14 16:39
5	08:33 16:51	08:05 17:37	08:54 (WEA 2) 19:09 (WEA 2)	07:14 18:25	08:24 (WEA 1) 20:10	06:09 20:58	05:35 21:38	06:12 21:46	06:57 20:14	07:41 19:09	07:31 17:10	08:16 16:39
6	08:33 16:52	08:03 17:40	08:57 (WEA 2) 19:07 (WEA 2)	07:11 18:26	08:25 (WEA 1) 20:11	06:08 21:00	05:32 21:39	06:13 21:46	06:59 20:12	07:43 19:07	07:32 17:08	08:17 16:38
7	08:33 16:54	08:02 17:41	08:58 (WEA 2) 19:06 (WEA 2)	07:09 18:28	08:26 (WEA 1) 20:12	06:06 21:02	05:32 21:45	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	08:59 (WEA 2) 19:05 (WEA 2)	07:07 18:30	08:27 (WEA 1) 20:13	06:05 21:03	05:31 21:45	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:38
9	08:32 16:56	08:00 17:45	09:00 (WEA 2) 19:04 (WEA 2)	07:05 18:31	08:28 (WEA 1) 20:14	06:03 21:05	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:01	07:37 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	09:01 (WEA 2) 19:03 (WEA 2)	07:03 18:33	08:29 (WEA 1) 20:15	06:01 21:06	05:31 21:42	06:19 21:05	07:04 20:03	07:49 18:59	07:39 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	09:02 (WEA 2) 19:04 (WEA 2)	07:01 18:34	08:30 (WEA 1) 20:16	06:00 21:08	05:41 21:43	06:21 21:03	07:06 20:01	07:51 18:56	07:40 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	09:03 (WEA 2) 19:05 (WEA 2)	06:59 18:36	08:31 (WEA 1) 20:17	05:58 21:09	05:40 21:42	06:22 21:01	07:07 19:59	07:52 18:54	07:42 17:00	08:23 16:37
13	08:30 17:01	07:52 17:52	09:04 (WEA 2) 19:06 (WEA 2)	06:57 18:37	08:32 (WEA 1) 20:18	05:57 21:11	05:43 21:44	06:23 21:05	07:09 19:57	07:54 18:52	07:44 17:01	08:24 16:37
14	08:29 17:03	07:50 17:53	09:05 (WEA 2) 19:07 (WEA 2)	06:55 18:39	08:33 (WEA 1) 20:19	05:55 21:12	05:44 21:45	06:25 21:06	07:10 19:54	07:55 18:50	07:45 17:01	08:25 16:37
15	08:28 17:04	07:48 17:55	09:06 (WEA 2) 19:08 (WEA 2)	06:53 18:41	08:34 (WEA 1) 20:20	05:54 21:13	05:45 21:46	06:26 21:07	07:12 19:52	07:57 18:48	07:47 17:02	08:26 16:37
16	08:28 17:06	07:46 17:57	09:07 (WEA 2) 19:09 (WEA 2)	06:50 18:42	08:35 (WEA 1) 20:21	05:53 21:14	05:47 21:47	06:28 21:08	07:13 19:53	07:58 18:44	07:48 17:03	08:27 16:37
17	08:27 17:07	07:45 17:58	09:08 (WEA 2) 19:10 (WEA 2)	06:48 18:44	08:36 (WEA 1) 20:22	05:51 21:16	05:48 21:48	06:29 21:09	07:15 19:48	08:00 18:44	07:50 17:04	08:28 16:38
18	08:26 17:09	07:43 18:00	09:09 (WEA 2) 19:11 (WEA 2)	06:46 18:45	08:37 (WEA 1) 20:23	05:50 21:17	05:49 21:49	06:31 21:10	07:16 19:46	08:01 18:42	07:51 17:05	08:29 16:38
19	08:25 17:10	07:41 18:02	09:10 (WEA 2) 19:12 (WEA 2)	06:44 18:47	08:38 (WEA 1) 20:24	05:49 21:19	05:50 21:50	06:32 21:11	07:17 19:44	08:03 18:40	07:53 17:06	08:30 16:38
20	08:24 17:12	07:39 18:03	09:11 (WEA 2) 19:13 (WEA 2)	06:42 18:48	08:39 (WEA 1) 20:25	05:47 21:20	05:51 21:51	06:34 21:12	07:19 19:44	08:05 18:40	07:55 17:07	08:31 16:39
21	08:23 17:13	07:37 18:05	09:12 (WEA 2) 19:14 (WEA 2)	06:40 18:50	08:40 (WEA 1) 20:26	05:46 21:21	05:52 21:52	06:35 21:13	07:20 19:45	08:06 18:42	07:56 17:08	08:32 16:39
22	08:22 17:15	07:35 18:07	09:13 (WEA 2) 19:15 (WEA 2)	06:38 18:52	08:41 (WEA 1) 20:27	05:45 21:22	05:53 21:53	06:37 21:14	07:22 19:46	08:08 18:44	07:58 17:09	08:33 16:40
23	08:21 17:16	07:33 18:08	09:14 (WEA 2) 19:16 (WEA 2)	06:35 18:53	08:42 (WEA 1) 20:28	05:44 21:23	05:55 21:54	06:38 21:15	07:23 19:47	08:09 18:46	07:59 17:10	08:34 16:40
24	08:20 17:18	07:31 18:10	09:15 (WEA 2) 19:17 (WEA 2)	06:33 18:55	08:43 (WEA 1) 20:29	05:43 21:24	05:56 21:55	06:39 21:16	07:25 19:48	08:11 18:48	08:01 17:11	08:35 16:40
25	08:19 17:20	07:30 18:12	09:16 (WEA 2) 19:18 (WEA 2)	06:31 18:56	08:44 (WEA 1) 20:30	05:42 21:25	05:57 21:56	06:41 21:17	07:26 19:49	07:13 18:49	08:02 17:12	08:36 16:41
26	08:18 17:21	07:28 18:13	09:17 (WEA 2) 19:19 (WEA 2)	06:29 18:58	08:45 (WEA 1) 20:31	05:41 21:26	05:59 21:57	06:42 21:18	07:28 19:50	07:14 18:50	08:04 17:13	08:37 16:42
27	08:17 17:23	07:26 18:15	09:18 (WEA 2) 19:20 (WEA 2)	06:27 18:59	08:46 (WEA 1) 20:32	05:40 21:27	06:00 21:58	06:44 21:19	07:29 19:51	07:16 18:52	08:05 17:14	08:38 16:43
28	08:16 17:25	07:24 18:17	09:19 (WEA 2) 19:21 (WEA 2)	06:25 19:01	08:47 (WEA 1) 20:33	05:39 21:28	06:01 21:59	06:45 21:20	07:31 19:52	07:17 18:54	08:06 17:15	08:39 16:43
29	08:14 17:26	07:23 18:22	09:20 (WEA 2) 19:22 (WEA 2)	07:23 20:02	08:48 (WEA 1) 20:34	05:38 21:29	06:02 21:59	06:47 21:21	07:32 19:53	07:19 18:55	08:08 17:16	08:40 16:44
30	08:13 17:28	07:20 18:24	09:21 (WEA 2) 19:23 (WEA 2)	07:20 20:04	08:49 (WEA 1) 20:35	05:37 21:30	06:04 21:59	06:48 21:22	07:34 19:54	07:21 18:56	08:09 17:17	08:41 16:45
31	08:12 17:29	07:18 18:26	09:22 (WEA 2) 19:24 (WEA 2)	07:18 20:06	08:50 (WEA 1) 20:36	05:36 21:31	06:05 21:59	06:50 21:23	07:22 19:55	07:22 18:57	08:10 17:18	08:42 16:46
Sonnenscheinstunden	269	283	418	368	412	475	486	491	379	335	275	255
astr. max. mögl. Beschattung	255	418	418	24						345		
Red. Sonnenscheinwahrsch.	0,15	0,24	0,24	0,35						0,28		0,15
Reduktion Betriebsdauer	0,93	0,93	0,93	0,93						0,93		0,93
Reduktion Windrichtung	0,55	0,57	0,57	0,57						0,57		0,55
Gesamte Reduktion	0,07	0,12	0,12	0,18						0,15		0,08
Met. wahrsch. Beschattung	19	52		4						51		28

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: N-72 - Z.I. Hahneboesch, 4562 Niederkorn

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Annahmen für Schattenwurfberechnung

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:34 16:47	09:06 (WEA 2) 17:31	08:10 17:31	07:22 18:18	07:16 20:07	06:16 20:53	05:36 21:34	06:07 21:19	06:51 20:22	07:35 19:18	07:24 17:16	07:59 (WEA 1) 16:40
2	08:34 16:48	09:06 (WEA 2) 17:33	08:09 17:33	07:20 18:20	07:14 20:09	06:15 20:54	05:35 21:35	06:08 21:18	06:53 20:20	07:37 19:15	07:26 17:15	08:00 (WEA 1) 16:40
3	08:33 16:49	09:06 (WEA 2) 17:35	08:08 17:35	07:18 18:21	07:12 20:10	06:13 20:56	05:34 21:36	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13	08:01 (WEA 1) 16:39
4	08:33 16:50	09:06 (WEA 2) 17:36	08:06 17:36	07:16 18:23	07:10 20:12	06:11 20:57	05:34 21:37	06:11 21:46	06:56 20:16	07:40 19:11	07:29 17:12	08:01 (WEA 1) 16:39
5	08:33 16:51	09:06 (WEA 2) 17:37	08:07 17:37	07:13 18:25	07:08 20:13	06:09 20:59	05:33 21:38	06:12 21:46	06:57 20:14	07:41 19:09	07:31 17:10	08:02 (WEA 1) 16:39
6	08:33 16:52	09:06 (WEA 2) 17:38	08:08 17:38	07:13 18:26	07:05 20:15	06:08 20:56	05:32 21:39	06:13 21:11	06:58 20:12	07:43 19:07	07:32 17:08	08:04 (WEA 1) 16:38
7	08:33 16:53	09:06 (WEA 2) 17:39	08:09 17:39	07:11 18:26	07:03 20:16	06:06 20:57	05:32 21:40	06:15 21:45	07:00 20:09	07:44 19:05	07:34 17:07	08:06 (WEA 1) 16:38
8	08:33 16:54	09:06 (WEA 2) 17:40	08:10 17:40	07:09 18:26	07:03 20:16	06:06 20:57	05:32 21:40	06:15 21:45	07:00 20:09	07:44 19:05	07:34 17:07	08:06 (WEA 1) 16:38
9	08:33 16:55	09:06 (WEA 2) 17:41	08:11 17:41	07:09 18:27	07:03 20:17	06:06 20:58	05:32 21:41	06:15 21:46	07:00 20:10	07:44 19:06	07:34 17:08	08:06 (WEA 1) 16:38
10	08:33 16:56	09:06 (WEA 2) 17:42	08:12 17:42	07:09 18:28	07:03 20:18	06:06 20:59	05:32 21:42	06:15 21:47	07:00 20:11	07:44 19:07	07:34 17:09	08:06 (WEA 1) 16:38
11	08:33 16:57	09:06 (WEA 2) 17:43	08:13 17:43	07:09 18:29	07:03 20:19	06:06 20:59	05:32 21:43	06:15 21:48	07:00 20:12	07:44 19:08	07:34 17:10	08:06 (WEA 1) 16:38
12	08:33 16:58	09:06 (WEA 2) 17:44	08:14 17:44	07:09 18:30	07:03 20:20	06:06 21:00	05:32 21:44	06:15 21:49	07:00 20:13	07:44 19:09	07:34 17:11	08:06 (WEA 1) 16:38
13	08:33 16:59	09:06 (WEA 2) 17:45	08:15 17:45	07:09 18:31	07:03 20:21	06:06 21:01	05:32 21:45	06:15 21:50	07:00 20:14	07:44 19:10	07:34 17:12	08:06 (WEA 1) 16:38
14	08:33 17:00	09:06 (WEA 2) 17:46	08:16 17:46	07:09 18:32	07:03 20:22	06:06 21:02	05:32 21:46	06:15 21:51	07:00 20:15	07:44 19:11	07:34 17:13	08:06 (WEA 1) 16:38
15	08:33 17:01	09:06 (WEA 2) 17:47	08:17 17:47	07:09 18:33	07:03 20:23	06:06 21:03	05:32 21:47	06:15 21:52	07:00 20:16	07:44 19:12	07:34 17:14	08:06 (WEA 1) 16:38
16	08:33 17:02	09:06 (WEA 2) 17:48	08:18 17:48	07:09 18:34	07:03 20:24	06:06 21:04	05:32 21:48	06:15 21:53	07:00 20:17	07:44 19:13	07:34 17:15	08:06 (WEA 1) 16:38
17	08:33 17:03	09:06 (WEA 2) 17:49	08:19 17:49	07:09 18:35	07:03 20:25	06:06 21:05	05:32 21:49	06:15 21:54	07:00 20:18	07:44 19:14	07:34 17:16	08:06 (WEA 1) 16:38
18	08:33 17:04	09:06 (WEA 2) 17:50	08:20 17:50	07:09 18:36	07:03 20:26	06:06 21:06	05:32 21:50	06:15 21:55	07:00 20:19	07:44 19:15	07:34 17:17	08:06 (WEA 1) 16:38
19	08:33 17:05	09:06 (WEA 2) 17:51	08:21 17:51	07:09 18:37	07:03 20:27	06:06 21:07	05:32 21:51	06:15 21:56	07:00 20:20	07:44 19:16	07:34 17:18	08:06 (WEA 1) 16:38
20	08:33 17:06	09:06 (WEA 2) 17:52	08:22 17:52	07:09 18:38	07:03 20:28	06:06 21:08	05:32 21:52	06:15 21:57	07:00 20:21	07:44 19:17	07:34 17:19	08:06 (WEA 1) 16:38
21	08:33 17:07	09:06 (WEA 2) 17:53	08:23 17:53	07:09 18:39	07:03 20:29	06:06 21:09	05:32 21:53	06:15 21:58	07:00 20:22	07:44 19:18	07:34 17:20	08:06 (WEA 1) 16:38
22	08:33 17:08	09:06 (WEA 2) 17:54	08:24 17:54	07:09 18:40	07:03 20:30	06:06 21:10	05:32 21:54	06:15 21:59	07:00 20:23	07:44 19:19	07:34 17:21	08:06 (WEA 1) 16:38
23	08:33 17:09	09:06 (WEA 2) 17:55	08:25 17:55	07:09 18:41	07:03 20:31	06:06 21:11	05:32 21:55	06:15 21:59	07:00 20:24	07:44 19:20	07:34 17:22	08:06 (WEA 1) 16:38
24	08:33 17:10	09:06 (WEA 2) 17:56	08:26 17:56	07:09 18:42	07:03 20:32	06:06 21:12	05:32 21:56	06:15 21:59	07:00 20:25	07:44 19:21	07:34 17:23	08:06 (WEA 1) 16:38
25	08:33 17:11	09:06 (WEA 2) 17:57	08:27 17:57	07:09 18:43	07:03 20:33	06:06 21:13	05:32 21:57	06:15 21:59	07:00 20:26	07:44 19:22	07:34 17:24	08:06 (WEA 1) 16:38
26	08:33 17:12	09:06 (WEA 2) 17:58	08:28 17:58	07:09 18:44	07:03 20:34	06:06 21:14	05:32 21:58	06:15 21:59	07:00 20:27	07:44 19:23	07:34 17:25	08:06 (WEA 1) 16:38
27	08:33 17:13	09:06 (WEA 2) 17:59	08:29 17:59	07:09 18:45	07:03 20:35	06:06 21:15	05:32 21:59	06:15 21:59	07:00 20:28	07:44 19:24	07:34 17:26	08:06 (WEA 1) 16:38
28	08:33 17:14	09:06 (WEA 2) 18:00	08:30 18:00	07:09 18:46	07:03 20:36	06:06 21:16	05:32 22:00	06:15 22:00	07:00 20:29	07:44 19:25	07:34 17:27	08:06 (WEA 1) 16:38
29	08:33 17:15	09:06 (WEA 2) 18:01	08:31 18:01	07:09 18:47	07:03 20:37	06:06 21:17	05:32 22:01	06:15 22:01	07:00 20:30	07:44 19:26	07:34 17:28	08:06 (WEA 1) 16:38
30	08:33 17:16	09:06 (WEA 2) 18:02	08:32 18:02	07:09 18:48	07:03 20:38	06:06 21:18	05:32 22:02	06:15 22:02	07:00 20:31	07:44 19:27	07:34 17:29	08:06 (WEA 1) 16:38
31	08:33 17:17	09:06 (WEA 2) 18:03	08:33 18:03	07:09 18:49	07:03 20:39	06:06 21:19	05:32 22:03	06:15 22:03	07:00 20:32	07:44 19:28	07:34 17:30	08:06 (WEA 1) 16:38
Summe	269	283	420	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	542	420	366									366
Red. Sonnenscheinwahrsch.	0,15	0,24	0,13									0,13
Reduktion Betriebsdauer	0,93	0,93	0,93									0,93
Reduktion Windrichtung	0,53	0,56	0,53									0,53
Gesamte Reduktion	0,07	0,12	0,06									0,06
Met. wahrsch. Beschattung	38	52	22									22

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:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-01 - 39, Rue Ermesinde, 4992 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33 16:47 18	15:28 (WEA 1) 15:46 (WEA 1) 17:31	08:10 17:31 18:18	07:21 18:18 20:07	07:16 20:07 20:53	06:16 20:53 21:34	05:35 21:34 21:47	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16	07:24 17:16 16:40	08:10 16:40 16:12
2	08:33 16:48 17	15:29 (WEA 1) 15:46 (WEA 1) 17:33	08:09 17:33 18:20	07:19 18:20 20:08	07:14 20:08 20:54	06:14 20:54 21:35	05:35 21:35 21:47	06:08 21:18 20:20	06:53 20:20 19:15	07:37 19:15 17:15	07:26 17:15 16:40	08:12 16:40 16:13
3	08:33 16:49 16	15:30 (WEA 1) 15:46 (WEA 1) 17:34	08:07 17:34 18:21	07:17 18:21 20:10	07:12 20:10 20:56	06:13 20:56 21:36	05:35 21:36 21:47	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13	07:27 17:13 16:39	08:13 16:39 15:23 (WEA 1)
4	08:33 16:50 14	15:31 (WEA 1) 15:46 (WEA 1) 17:36	08:06 17:36 18:23	07:15 18:23 20:12	07:10 20:12 20:57	06:11 20:57 21:37	05:35 21:37 21:46	06:11 21:14 20:16	06:55 20:16 19:11	07:40 19:11 17:11	07:29 17:11 16:39	08:14 16:39 15:25 (WEA 1)
5	08:33 16:51 13	15:32 (WEA 1) 15:46 (WEA 1) 17:38	08:05 17:38 18:25	07:13 18:25 20:13	07:07 20:13 20:59	06:09 20:59 21:38	05:36 21:38 21:46	06:12 21:13 20:14	06:57 20:14 19:09	07:41 19:09 17:10	07:30 17:10 16:38	08:16 16:38 15:28 (WEA 1)
6	08:33 16:52 11	15:34 (WEA 1) 15:46 (WEA 1) 17:39	08:03 17:39 18:26	07:11 18:26 20:15	07:05 20:15 21:00	06:08 21:00 21:39	05:37 21:39 21:45	06:13 21:11 20:12	06:58 20:12 19:07	07:43 19:07 17:08	07:32 17:08 16:38	08:17 16:38 15:31 (WEA 1)
7	08:32 16:54 8	15:35 (WEA 1) 15:46 (WEA 1) 17:41	08:01 17:41 18:28	07:09 18:28 20:16	07:03 20:16 21:02	06:06 21:02 21:40	05:38 21:40 21:45	06:15 21:10 20:09	07:00 20:09 19:05	07:44 19:05 17:07	07:34 17:07 16:38	08:18 16:38 15:32 (WEA 1)
8	08:32 16:55 3	15:39 (WEA 1) 15:46 (WEA 1) 17:43	08:00 17:43 18:29	07:07 18:29 20:18	07:01 20:18 21:03	06:04 21:03 21:41	05:39 21:41 21:44	06:16 21:08 21:08	07:01 20:07 19:03	07:46 19:03 17:05	07:35 17:05 16:37	08:19 16:37 15:33 (WEA 1)
9	08:32 16:56 10	15:42 (WEA 1) 15:46 (WEA 1) 17:45	08:00 17:45 18:31	07:07 18:31 20:19	07:01 20:19 21:05	06:04 21:05 21:41	05:39 21:41 21:44	06:18 21:06 21:06	07:03 20:05 19:00	07:47 19:00 17:04	07:37 17:04 16:37	08:20 16:37 15:34 (WEA 1)
10	08:31 16:57 11	15:46 (WEA 1) 15:46 (WEA 1) 17:46	08:03 17:46 18:33	07:09 18:33 20:21	07:03 20:21 21:06	06:06 21:06 21:42	05:39 21:42 21:43	06:19 21:05 21:05	07:04 20:03 18:58	07:49 18:58 17:02	07:39 17:02 16:37	08:21 16:37 15:35 (WEA 1)
11	08:31 16:59 12	15:48 (WEA 1) 15:46 (WEA 1) 17:48	08:01 17:48 18:34	07:09 18:34 20:22	07:03 20:22 21:08	06:06 21:08 21:43	05:39 21:43 21:43	06:20 21:03 21:03	07:06 20:01 18:56	07:50 18:56 17:01	07:40 17:01 16:37	08:22 16:37 15:36 (WEA 1)
12	08:30 17:00 13	15:53 (WEA 1) 15:46 (WEA 1) 17:50	08:06 17:50 18:36	07:13 18:36 20:24	07:07 20:24 21:09	06:09 21:09 21:43	05:39 21:43 21:42	06:22 21:01 21:01	07:07 19:59 18:54	07:52 18:54 16:59	07:42 16:59 16:37	08:23 16:37 15:37 (WEA 1)
13	08:30 17:01 14	15:54 (WEA 1) 15:46 (WEA 1) 17:51	08:06 17:51 18:37	07:13 18:37 20:25	07:07 20:25 21:10	06:09 21:10 21:44	05:39 21:44 21:41	06:23 21:01 21:01	07:09 19:56 18:52	07:53 18:52 16:58	07:43 16:58 16:37	08:24 16:37 15:37 (WEA 1)
14	08:29 17:03 15	15:55 (WEA 1) 15:46 (WEA 1) 17:53	08:05 17:53 18:39	07:14 18:39 20:27	07:08 20:27 21:12	06:09 21:12 21:45	05:39 21:45 21:40	06:25 21:07 21:07	07:10 19:54 18:50	07:55 18:50 16:57	07:45 16:57 16:37	08:25 16:37 15:38 (WEA 1)
15	08:28 17:04 16	15:56 (WEA 1) 15:46 (WEA 1) 17:54	08:04 17:54 18:41	07:15 18:41 20:28	07:09 20:28 21:13	06:09 21:13 21:45	05:39 21:45 21:39	06:26 21:07 21:07	07:12 19:52 18:48	07:57 18:48 16:55	07:47 16:55 16:37	08:26 16:37 15:39 (WEA 1)
16	08:28 17:06 17	15:57 (WEA 1) 15:46 (WEA 1) 17:56	08:04 17:56 18:42	07:15 18:42 20:30	07:09 20:30 21:15	06:09 21:15 21:46	05:39 21:46 21:39	06:28 21:04 21:04	07:13 19:50 18:46	07:58 18:46 16:54	07:48 16:54 16:37	08:27 16:37 15:40 (WEA 1)
17	08:27 17:07 18	15:58 (WEA 1) 15:46 (WEA 1) 17:57	08:03 17:57 18:44	07:16 18:44 20:32	07:10 20:32 21:16	06:09 21:16 21:46	05:39 21:46 21:38	06:29 21:05 21:05	07:14 19:48 18:44	08:00 18:44 16:53	07:50 16:53 16:37	08:28 16:37 15:40 (WEA 1)
18	08:26 17:09 19	15:59 (WEA 1) 15:46 (WEA 1) 17:58	08:02 17:58 18:45	07:17 18:45 20:33	07:11 20:33 21:17	06:09 21:17 21:46	05:39 21:46 21:37	06:30 21:05 21:05	07:16 19:46 18:42	08:01 18:42 16:52	07:51 16:52 16:38	08:28 16:38 15:41 (WEA 1)
19	08:25 17:10 20	16:00 (WEA 1) 15:46 (WEA 1) 17:59	08:01 17:59 18:46	07:18 18:46 20:34	07:12 20:34 21:18	06:09 21:18 21:46	05:39 21:46 21:36	06:31 21:05 21:05	07:17 19:43 18:40	08:03 18:40 16:51	07:53 16:51 16:38	08:29 16:38 15:41 (WEA 1)
20	08:24 17:12 21	16:01 (WEA 1) 15:46 (WEA 1) 18:00	08:00 18:00 18:47	07:19 18:47 20:35	07:13 20:35 21:19	06:09 21:19 21:47	05:39 21:47 21:36	06:34 21:05 21:05	07:19 19:43 18:40	08:04 18:40 16:51	07:55 16:51 16:38	08:30 16:38 15:41 (WEA 1)
21	08:23 17:13 22	16:02 (WEA 1) 15:46 (WEA 1) 18:01	08:00 18:01 18:48	07:20 18:48 20:36	07:14 20:36 21:20	06:09 21:20 21:47	05:39 21:47 21:35	06:35 21:05 21:05	07:20 19:41 18:38	08:06 18:38 16:50	07:56 16:50 16:38	08:30 16:38 15:41 (WEA 1)
22	08:22 17:15 23	16:03 (WEA 1) 15:46 (WEA 1) 18:02	08:00 18:02 18:49	07:21 18:49 20:37	07:15 20:37 21:21	06:09 21:21 21:47	05:39 21:47 21:33	06:36 21:05 21:05	07:22 19:39 18:36	08:08 18:36 16:48	07:58 16:48 16:39	08:31 16:39 15:42 (WEA 1)
23	08:21 17:16 24	16:04 (WEA 1) 15:46 (WEA 1) 18:03	08:00 18:03 18:50	07:22 18:50 20:38	07:16 20:38 21:21	06:09 21:21 21:47	05:39 21:47 21:32	06:38 21:05 21:05	07:23 19:37 18:34	08:09 18:34 16:47	07:59 16:47 16:39	08:31 16:39 15:42 (WEA 1)
24	08:20 17:18 25	16:05 (WEA 1) 15:46 (WEA 1) 18:04	08:00 18:04 18:51	07:23 18:51 20:39	07:17 20:39 21:23	06:09 21:23 21:47	05:39 21:47 21:32	06:39 21:05 21:05	07:25 19:35 18:33	08:11 18:33 16:46	08:01 16:46 16:40	08:32 16:40 15:43 (WEA 1)
25	08:19 17:19 26	16:06 (WEA 1) 15:46 (WEA 1) 18:05	08:00 18:05 18:52	07:24 18:52 20:40	07:18 20:40 21:24	06:09 21:24 21:47	05:39 21:47 21:30	06:41 21:05 21:05	07:26 19:33 18:31	07:12 18:31 16:46	08:02 16:46 16:40	08:32 16:40 15:43 (WEA 1)
26	08:18 17:21 27	16:07 (WEA 1) 15:46 (WEA 1) 18:06	08:00 18:06 18:53	07:25 18:53 20:41	07:19 20:41 21:25	06:09 21:25 21:47	05:39 21:47 21:30	06:42 21:05 21:05	07:28 19:28 18:27	07:14 18:27 16:44	08:04 16:44 16:42	08:32 16:42 15:44 (WEA 1)
27	08:17 17:23 28	16:08 (WEA 1) 15:46 (WEA 1) 18:07	08:00 18:07 18:54	07:26 18:54 20:42	07:20 20:42 21:26	06:09 21:26 21:47	05:39 21:47 21:30	06:44 21:05 21:05	07:29 19:26 18:26	07:16 18:26 16:43	08:05 16:43 16:42	08:33 16:42 15:45 (WEA 1)
28	08:16 17:24 29	16:09 (WEA 1) 15:46 (WEA 1) 18:08	08:00 18:08 18:55	07:27 18:55 20:43	07:21 20:43 21:27	06:09 21:27 21:47	05:39 21:47 21:30	06:45 21:05 21:05	07:31 19:24 18:24	07:17 18:24 16:42	08:06 16:42 16:42	08:33 16:42 15:45 (WEA 1)
29	08:14 17:26 30	16:10 (WEA 1) 15:46 (WEA 1) 18:09	08:00 18:09 18:56	07:28 18:56 20:44	07:22 20:44 21:28	06:09 21:28 21:47	05:39 21:47 21:30	06:47 21:05 21:05	07:32 19:22 18:22	07:19 18:22 16:42	08:08 16:42 16:44	08:33 16:44 15:45 (WEA 1)
30	08:13 17:28 31	16:11 (WEA 1) 15:46 (WEA 1) 18:10	08:00 18:10 18:57	07:29 18:57 20:45	07:23 20:45 21:29	06:09 21:29 21:47	05:39 21:47 21:30	06:48 21:05 21:05	07:34 19:20 18:20	07:21 18:20 16:41	08:09 16:41 16:45	08:33 16:45 15:45 (WEA 1)
31	08:12 17:29	16:12 (WEA 1) 15:46 (WEA 1) 18:11	08:00 18:11 18:58	07:30 18:58 20:46	07:24 20:46 21:30	06:09 21:30 21:47	05:39 21:47 21:30	06:50 21:05 21:05	07:22 17:18	07:22 17:18	08:33 16:46	08:33 16:46
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr. max. mögl. Beschattung												495
Red. Sonnenscheinwahrsch.												0,13
Reduktion Betriebsdauer												0,93
Reduktion Windrichtung												0,74
Gesamte Reduktion												0,10
Met. wahrsch. Beschattung												42

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-02 - 37, Rue Ermesinde, 4992 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 21	15:35 (WEA 1) 15:56 (WEA 1) 17:31	08:10 07:21 18:18	07:16 20:07 17:31	06:16 20:53 21:34	05:35 21:34 21:47	05:33 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16	07:24 17:16 16:40	08:10 16:40 10
2	08:33 16:48 21	15:36 (WEA 1) 15:57 (WEA 1) 17:33	08:09 07:19 18:20	07:14 20:08 17:33	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 19:15	06:53 19:15 17:15	07:37 17:15 16:40	07:25 16:40 12	08:12 15:38 (WEA 1) 15:26 (WEA 1)
3	08:33 16:49 21	15:36 (WEA 1) 15:57 (WEA 1) 17:34	08:07 07:17 18:21	07:12 20:10 17:34	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 19:13	06:54 19:13 17:13	07:38 17:13 16:40	07:27 16:40 14	08:13 15:26 (WEA 1) 15:40 (WEA 1)
4	08:33 16:50 20	15:36 (WEA 1) 15:56 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 17:36	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:13	06:11 20:16 19:11	06:55 19:11 17:11	07:40 17:11 16:40	07:29 16:40 16	08:14 15:25 (WEA 1) 15:41 (WEA 1)
5	08:33 16:51 19	15:38 (WEA 1) 15:57 (WEA 1) 17:38	08:05 07:13 18:25	07:07 20:13 17:38	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 19:09	06:57 19:09 17:10	07:41 17:10 16:40	07:30 16:40 17	08:16 15:24 (WEA 1) 15:41 (WEA 1)
6	08:33 16:52 18	15:39 (WEA 1) 15:57 (WEA 1) 17:39	08:03 07:11 18:26	07:05 20:15 17:39	06:08 21:00 21:39	05:32 21:39 21:45	05:37 21:45 21:11	06:13 20:11 19:07	06:58 19:07 17:08	07:43 17:08 16:40	07:32 16:40 18	08:17 15:25 (WEA 1) 15:43 (WEA 1)
7	08:33 16:54 17	15:39 (WEA 1) 15:56 (WEA 1) 17:41	08:01 07:09 18:28	07:03 20:16 17:41	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 20:09 19:05	07:00 19:05 17:07	07:44 17:07 16:40	07:34 16:40 19	08:18 15:25 (WEA 1) 15:44 (WEA 1)
8	08:32 16:55 16	15:41 (WEA 1) 15:57 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 17:43	06:04 21:03 21:41	05:31 21:41 21:44	05:39 21:44 21:08	06:16 20:07 19:03	07:01 19:03 17:05	07:46 17:05 16:40	07:35 16:40 20	08:19 15:25 (WEA 1) 15:44 (WEA 1)
9	08:32 16:56 15	15:41 (WEA 1) 15:56 (WEA 1) 17:45	07:58 07:05 18:31	07:05 20:19 17:45	06:03 21:05 21:41	05:31 21:41 21:44	05:39 21:44 21:06	06:18 20:05 19:00	07:03 19:00 17:04	07:47 17:04 16:40	07:37 16:40 21	08:20 15:25 (WEA 1) 15:45 (WEA 1)
10	08:31 16:57 13	15:43 (WEA 1) 15:56 (WEA 1) 17:46	07:57 07:03 18:33	07:03 20:21 17:46	06:01 21:06 21:42	05:30 21:42 21:43	05:40 21:43 21:05	06:19 20:03 19:04	07:04 19:04 17:02	07:49 17:02 16:40	07:39 16:40 22	08:21 15:25 (WEA 1) 15:46 (WEA 1)
11	08:31 16:59 10	15:45 (WEA 1) 15:55 (WEA 1) 17:48	07:55 07:01 18:34	07:01 20:22 17:48	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:20 20:01 19:01	07:06 19:01 17:01	07:50 17:01 16:40	07:40 16:40 23	08:22 15:25 (WEA 1) 15:46 (WEA 1)
12	08:30 17:00 6	15:47 (WEA 1) 15:53 (WEA 1) 17:50	07:53 06:59 18:36	07:03 20:24 17:50	06:00 21:09 21:43	05:30 21:43 21:42	05:42 21:42 21:01	06:22 19:59 18:54	07:07 18:54 16:59	07:52 16:59 16:40	07:42 16:40 24	08:23 15:25 (WEA 1) 15:47 (WEA 1)
13	08:30 17:01 5	15:47 (WEA 1) 15:53 (WEA 1) 17:51	07:53 06:57 18:37	07:03 20:25 17:51	06:00 21:10 21:44	05:30 21:44 21:41	05:42 21:41 20:59	06:23 19:56 18:52	07:09 18:52 16:58	07:53 16:58 16:40	07:43 16:40 25	08:24 15:25 (WEA 1) 15:48 (WEA 1)
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15	08:28 17:04 3	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:51 06:52 18:41	07:01 20:28 17:51	06:00 21:13 21:45	05:29 21:45 21:39	05:45 21:39 20:56	06:26 19:52 18:48	07:11 18:48 16:55	07:57 16:55 16:40	07:47 16:40 27	08:26 15:26 (WEA 1) 15:49 (WEA 1)
16	08:28 17:06 2	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:51 06:50 18:42	07:01 20:30 17:51	06:00 21:15 21:46	05:29 21:46 21:39	05:46 21:39 20:54	06:28 19:50 18:46	07:13 18:46 16:54	07:58 16:54 16:40	07:48 16:40 28	08:27 15:27 (WEA 1) 15:50 (WEA 1)
17	08:27 17:07 1	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:50 06:48 18:44	07:00 20:32 17:51	06:00 21:16 21:46	05:29 21:46 21:38	05:47 21:38 20:52	06:29 19:48 18:44	07:14 18:44 16:53	08:00 16:53 16:40	07:50 16:40 29	08:28 15:26 (WEA 1) 15:49 (WEA 1)
18	08:26 17:09 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:49 06:46 18:45	06:59 20:33 17:51	06:00 21:17 21:46	05:29 21:46 21:37	05:49 21:37 20:50	06:31 19:46 18:42	07:16 18:42 16:52	08:01 16:52 16:40	07:51 16:40 30	08:29 15:27 (WEA 1) 15:50 (WEA 1)
19	08:25 17:10 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:48 06:44 18:47	06:58 20:35 17:51	06:00 21:19 21:47	05:29 21:47 21:36	05:50 21:36 20:48	06:32 19:43 18:40	07:17 18:40 16:51	08:03 16:51 16:40	07:53 16:40 31	08:30 15:28 (WEA 1) 15:51 (WEA 1)
20	08:24 17:12 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:47 06:42 18:48	06:57 20:36 17:51	06:00 21:20 21:47	05:29 21:47 21:35	05:51 21:35 20:46	06:34 19:41 18:38	07:19 18:38 16:50	08:04 16:50 16:40	07:54 16:40 32	08:31 15:29 (WEA 1) 15:52 (WEA 1)
21	08:23 17:13 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:46 06:40 18:50	06:56 20:38 17:51	06:00 21:21 21:47	05:29 21:47 21:33	05:52 21:33 20:44	06:35 19:39 18:36	07:20 18:36 16:48	08:06 16:48 16:40	07:56 16:40 33	08:32 15:30 (WEA 1) 15:53 (WEA 1)
22	08:22 17:15 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:45 06:37 18:51	06:55 20:39 17:51	06:00 21:22 21:47	05:29 21:47 21:33	05:53 21:33 20:44	06:36 19:39 18:36	07:22 18:36 16:48	08:08 16:48 16:40	07:58 16:40 34	08:33 15:31 (WEA 1) 15:54 (WEA 1)
23	08:21 17:16 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:44 06:35 18:53	06:54 20:41 17:51	06:00 21:23 21:47	05:29 21:47 21:33	05:54 21:33 20:44	06:38 19:39 18:36	07:23 18:36 16:48	08:09 16:48 16:40	07:59 16:40 35	08:34 15:32 (WEA 1) 15:55 (WEA 1)
24	08:20 17:18 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:43 06:33 18:53	06:53 20:41 17:51	06:00 21:24 21:47	05:29 21:47 21:33	05:55 21:33 20:44	06:39 19:39 18:36	07:25 18:36 16:48	08:11 16:48 16:40	08:01 16:40 36	08:35 15:33 (WEA 1) 15:56 (WEA 1)
25	08:19 17:19 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:42 06:31 18:55	06:52 20:42 17:51	06:00 21:25 21:47	05:29 21:47 21:33	05:56 21:33 20:44	06:41 19:39 18:36	07:26 18:36 16:48	08:12 16:48 16:40	08:02 16:40 37	08:36 15:34 (WEA 1) 15:57 (WEA 1)
26	08:18 17:21 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:41 06:29 18:58	06:51 20:45 17:51	06:00 21:26 21:47	05:29 21:47 21:33	05:57 21:33 20:44	06:42 19:39 18:36	07:27 18:36 16:48	08:13 16:48 16:40	08:03 16:40 38	08:37 15:35 (WEA 1) 15:58 (WEA 1)
27	08:17 17:23 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:40 06:27 18:59	06:50 20:47 17:51	06:00 21:27 21:47	05:29 21:47 21:33	05:58 21:33 20:44	06:44 19:39 18:36	07:28 18:36 16:48	08:14 16:48 16:40	08:04 16:40 39	08:38 15:36 (WEA 1) 15:59 (WEA 1)
28	08:16 17:24 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:39 06:25 19:01	06:49 20:48 17:51	06:00 21:28 21:47	05:29 21:47 21:33	05:59 21:33 20:44	06:45 19:39 18:36	07:29 18:36 16:48	08:15 16:48 16:40	08:05 16:40 40	08:39 15:37 (WEA 1) 16:00 (WEA 1)
29	08:14 17:26 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:38 06:24 19:02	06:48 20:49 17:51	06:00 21:29 21:47	05:29 21:47 21:33	06:00 21:33 20:44	06:46 19:39 18:36	07:30 18:36 16:48	08:16 16:48 16:40	08:06 16:40 41	08:40 15:38 (WEA 1) 16:01 (WEA 1)
30	08:13 17:28 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:37 06:23 19:03	06:47 20:50 17:51	06:00 21:30 21:47	05:29 21:47 21:33	06:01 21:33 20:44	06:47 19:39 18:36	07:31 18:36 16:48	08:17 16:48 16:40	08:07 16:40 42	08:41 15:39 (WEA 1) 16:02 (WEA 1)
31	08:12 17:29 0	15:48 (WEA 1) 15:56 (WEA 1) 17:51	07:36 06:22 19:04	06:46 20:51 17:51	06:00 21:31 21:47	05:29 21:47 21:33	06:02 21:33 20:44	06:48 19:39 18:36	07:32 18:36 16:48	08:18 16:48 16:40	08:08 16:40 43	08:42 15:40 (WEA 1) 16:03 (WEA 1)
Sonnenscheinstunden	269		283	368	412	475	486	491	447	379	335	275
astr. max. mögl. Beschattung	197											
Red. Sonnenscheinwahrsch.	0,15											
Reduktion Betriebsdauer	0,93											
Reduktion Windrichtung	0,74											
Gesamte Reduktion	0,10											
Met. wahrsch. Beschattung	20											

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-03 - 79, Rue d'Esch, 4985 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 24	15:45 (WEA 1) 16:09 (WEA 1) 17:31	08:10 07:21 18:18	07:16 20:07 17:31	06:16 20:53 21:34	05:35 21:34 21:47	05:33 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16		08:10 16:40 22
2	08:33 16:48 24	15:45 (WEA 1) 16:09 (WEA 1) 17:33	08:09 07:19 18:20	07:14 20:08 17:33	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 20:20 19:15	06:53 19:15 17:15	07:37 17:15 17:15		08:12 16:40 22
3	08:33 16:49 24	15:46 (WEA 1) 16:10 (WEA 1) 17:34	08:07 07:17 18:21	07:12 20:10 17:34	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 20:18 19:13	06:54 19:13 17:13	07:38 17:13 17:13		08:13 16:39 23
4	08:33 16:50 24	15:46 (WEA 1) 16:10 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 17:36	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:14	06:11 20:16 19:11	06:55 19:11 17:11	07:40 17:11 17:11		08:14 16:39 24
5	08:33 16:51 23	15:47 (WEA 1) 16:10 (WEA 1) 17:38	08:05 07:13 18:25	07:07 20:13 17:38	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 19:09	06:57 19:09 17:10	07:41 17:10 17:10		08:16 16:38 24
6	08:33 16:52 24	15:47 (WEA 1) 16:11 (WEA 1) 17:39	08:03 07:11 18:26	07:05 20:15 17:39	06:08 21:00 21:39	05:32 21:39 21:45	05:37 21:45 21:11	06:13 20:11 19:07	06:58 19:07 17:08	07:43 17:08 17:08		08:17 16:38 23
7	08:32 16:54 24	15:47 (WEA 1) 16:11 (WEA 1) 17:41	08:01 07:09 18:28	07:03 20:16 17:41	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:10 20:09	06:15 20:09 19:05	07:00 19:05 17:07	07:44 17:07 17:07		08:18 16:38 24
8	08:32 16:55 24	15:48 (WEA 1) 16:12 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 17:43	06:04 21:03 21:41	05:31 21:41 21:44	05:39 21:08 20:07	06:16 20:07 19:03	07:01 19:03 17:05	07:46 17:05 17:05		08:19 16:37 24
9	08:32 16:56 24	15:48 (WEA 1) 16:12 (WEA 1) 17:45	07:58 07:05 18:31	07:01 20:19 17:45	06:03 21:05 21:41	05:31 21:41 21:44	05:39 21:06 20:05	06:18 20:05 19:00	07:03 19:00 17:04	07:47 17:04 17:04		08:20 16:37 24
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11	08:31 16:59 22	15:50 (WEA 1) 16:12 (WEA 1) 17:48	07:55 07:01 18:34	07:01 20:22 17:48	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:03 20:01	06:20 20:01 18:56	07:06 18:56 17:01	07:50 17:01 17:01		08:22 16:37 24
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13	08:30 17:01 21	15:52 (WEA 1) 16:13 (WEA 1) 17:51	07:52 06:57 18:37	07:02 20:25 17:51	06:00 21:10 21:44	05:30 21:44 21:41	05:43 20:59 19:56	06:23 19:56 18:52	07:09 18:52 16:58	07:53 16:58 16:58		08:24 16:37 24
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24	08:20 17:18	16:07 (WEA 1) 18:10 17:33	07:31 06:33 18:55	06:33 20:42 17:59	05:30 21:25 21:48	05:30 21:48 21:30	05:56 20:38 19:33	06:39 20:38 18:31	07:25 18:31 16:46	08:11 16:46 16:46		08:35 16:37 23
25	08:19 17:19	16:07 (WEA 1) 18:11 17:33	07:29 06:31 18:56	06:31 20:44 17:59	05:30 21:26 21:48	05:31 21:48 21:29	05:57 20:36 19:30	06:41 20:36 18:30	07:26 18:30 16:45	08:12 16:45 16:45		08:36 16:37 24
26	08:18 17:21	16:07 (WEA 1) 18:13 17:33	07:27 06:29 18:58	06:29 20:45 17:59	05:31 21:28 21:48	05:31 21:48 21:27	05:58 20:34 19:28	06:42 20:34 18:28	07:28 18:28 16:44	08:14 16:44 16:44		08:37 16:37 23
27	08:17 17:23	16:07 (WEA 1) 18:15 17:33	07:25 06:27 18:59	06:27 20:47 17:59	05:31 21:29 21:48	05:31 21:48 21:26	06:00 20:32 19:26	06:44 20:32 18:26	07:29 18:26 16:43	08:15 16:43 16:43		08:38 16:37 23
28	08:16 17:24	16:07 (WEA 1) 18:16 17:33	07:23 06:25 19:01	06:25 20:48 17:59	05:31 21:30 21:48	05:32 21:48 21:25	06:01 20:30 19:24	06:45 20:30 18:24	07:31 18:24 16:42	08:16 16:42 16:42		08:39 16:37 24
29	08:14 17:26	16:07 (WEA 1) 18:17 17:33	07:22 06:20 19:02	06:20 20:50 17:59	05:32 21:31 21:48	05:32 21:48 21:23	06:02 20:28 19:22	06:47 20:28 18:22	07:32 18:22 16:42	08:17 16:42 16:42		08:40 16:37 24
30	08:13 17:28	16:07 (WEA 1) 18:18 17:33	07:20 06:18 19:04	06:18 20:51 17:59	05:33 21:32 21:47	05:33 21:47 21:22	06:04 20:26 19:20	06:48 20:26 18:20	07:34 18:20 16:41	08:19 16:41 16:41		08:41 16:37 23
31	08:12 17:29	16:07 (WEA 1) 18:19 17:33	07:18 06:16 19:05	06:16 20:52 17:59	05:34 21:33 21:48	05:34 21:48 21:21	06:05 20:24 19:24	06:50 20:24 18:20	07:35 18:20 17:18	08:20 16:41 16:41		08:42 16:37 24
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	406											726
Red.Sonnenscheinwahrsch.	0,15											0,13
Reduktion Betriebsdauer	0,93											0,93
Reduktion Windrichtung	0,74											0,74
Gesamte Reduktion	0,10											0,09
Met.wahrsch.Beschattung	40									15		62

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-04 - 89, Rue d'Esch, 4985 Sanem

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47 20	15:55 (WEA 1) 16:15 (WEA 1) 17:31	08:10 07:21 18:18	07:16 20:07 20:53	06:16 20:53 21:34	05:35 21:34 21:47	05:33 21:47 21:19	06:06 21:19 20:22	06:51 20:22 19:17	07:35 19:17 17:16		08:10 16:40 23
2	08:33 16:48 21	15:55 (WEA 1) 16:16 (WEA 1) 17:33	08:09 07:19 18:20	07:14 20:08 20:54	06:14 20:54 21:35	05:35 21:35 21:47	05:34 21:47 21:18	06:08 21:18 20:20	06:53 20:20 19:15	07:25 19:15 17:15		08:12 16:40 23
3	08:33 16:49 21	15:56 (WEA 1) 16:17 (WEA 1) 17:34	08:07 07:17 18:21	07:12 20:07 20:56	06:13 20:56 21:36	05:34 21:36 21:47	05:35 21:47 21:16	06:09 21:16 20:18	06:54 20:18 19:13	07:38 19:13 17:13		08:13 16:41 23
4	08:33 16:50 22	15:55 (WEA 1) 16:17 (WEA 1) 17:36	08:06 07:15 18:23	07:10 20:12 20:57	06:11 20:57 21:37	05:33 21:37 21:46	05:35 21:46 21:13	06:11 20:14 20:16	06:55 20:16 19:11	07:40 19:11 17:11		08:14 16:39 23
5	08:33 16:51 22	15:56 (WEA 1) 16:18 (WEA 1) 17:38	08:05 07:13 18:25	07:07 20:13 20:59	06:09 20:59 21:38	05:33 21:38 21:46	05:36 21:46 21:13	06:12 20:14 20:16	06:57 20:16 19:09	07:41 19:09 17:10		08:16 16:38 23
6	08:33 16:52 23	15:56 (WEA 1) 16:19 (WEA 1) 17:39	08:03 07:11 18:26	07:05 20:15 21:00	06:08 21:00 21:39	05:32 21:39 21:45	05:37 21:45 21:11	06:13 20:11 20:11	06:58 20:11 19:07	07:43 19:07 17:08		08:17 16:38 22
7	08:32 16:54 23	15:56 (WEA 1) 16:19 (WEA 1) 17:41	08:01 07:09 18:28	07:03 20:16 21:02	06:06 21:02 21:40	05:32 21:40 21:45	05:38 21:45 21:10	06:15 20:09 20:09	07:00 19:05 17:07	07:44 19:05 17:07		08:18 16:38 22
8	08:32 16:55 23	15:57 (WEA 1) 16:20 (WEA 1) 17:43	08:00 07:07 18:29	07:01 20:18 21:03	06:04 21:03 21:41	05:31 21:41 21:44	05:39 21:44 21:08	06:16 20:07 20:07	07:01 19:03 17:05	07:46 19:03 17:05		08:19 16:37 22
9	08:32 16:56 23	15:57 (WEA 1) 16:20 (WEA 1) 17:45	07:58 07:05 18:31	06:59 20:19 21:05	06:03 21:05 21:41	05:31 21:41 21:44	05:39 21:44 21:06	06:18 20:05 20:05	07:03 19:00 17:04	07:47 19:00 17:04		08:20 16:37 21
10	08:31 16:57 23	15:58 (WEA 1) 16:21 (WEA 1) 17:46	07:57 07:03 18:33	06:57 20:21 21:06	06:01 21:06 21:42	05:30 21:42 21:43	05:40 21:43 21:05	06:19 20:03 20:03	07:04 18:58 17:02	07:49 18:58 17:02		08:21 16:37 21
11	08:31 16:59 23	15:58 (WEA 1) 16:21 (WEA 1) 17:48	07:55 07:01 18:34	06:55 20:22 21:08	06:00 21:08 21:43	05:30 21:43 21:43	05:41 21:43 21:03	06:20 20:01 20:01	07:06 18:56 17:01	07:50 18:56 17:01		08:22 16:37 20
12	08:30 17:00 23	15:58 (WEA 1) 16:21 (WEA 1) 17:50	07:53 06:59 18:36	06:53 20:24 21:09	05:58 21:09 21:43	05:30 21:43 21:42	05:42 21:42 21:01	06:22 19:59 19:59	07:07 18:54 16:59	07:52 18:54 16:59		08:23 16:37 19
13	08:30 17:01 23	15:59 (WEA 1) 16:22 (WEA 1) 17:51	07:52 06:57 18:37	06:51 20:25 21:10	05:57 21:10 21:44	05:30 21:44 21:41	05:43 21:41 20:59	06:23 19:56 19:56	07:09 18:52 16:58	07:53 18:52 16:58		08:24 16:37 19
14	08:29 17:02 24	15:59 (WEA 1) 16:23 (WEA 1) 17:53	07:50 06:55 18:39	06:49 20:27 21:12	05:55 21:12 21:45	05:29 21:45 21:40	05:44 20:57 19:54	06:25 18:50 16:57	07:10 18:50 16:57	07:55 18:50 16:57		08:25 16:37 18
15	08:28 17:04 24	15:59 (WEA 1) 16:23 (WEA 1) 17:55	07:48 06:52 18:41	06:47 20:28 21:13	05:54 21:13 21:45	05:29 21:45 21:39	05:45 20:56 19:52	06:26 19:52 18:48	07:11 18:48 16:55	07:57 18:48 16:55		08:26 16:37 17
16	08:28 17:06 24	15:59 (WEA 1) 16:23 (WEA 1) 17:56	07:46 06:50 18:42	06:45 20:30 21:15	05:53 21:15 21:46	05:29 21:46 21:38	05:46 20:54 19:50	06:28 19:50 18:46	07:13 18:46 16:54	07:58 18:46 16:54		08:27 16:37 16
17	08:27 17:07 23	16:00 (WEA 1) 16:23 (WEA 1) 17:58	07:44 06:48 18:44	06:43 20:32 21:16	05:51 21:16 21:46	05:29 21:46 21:38	05:47 20:52 19:48	06:29 19:48 18:44	07:14 18:44 16:53	08:00 18:44 16:53		08:28 16:37 15
18	08:26 17:09 22	16:01 (WEA 1) 16:23 (WEA 1) 18:00	07:43 06:46 18:45	06:41 20:33 21:17	05:50 21:17 21:46	05:29 21:46 21:37	05:49 20:50 19:46	06:31 19:46 18:42	07:16 18:42 16:52	08:01 18:42 16:52	9	08:29 16:37 15
19	08:25 17:10 22	16:01 (WEA 1) 16:23 (WEA 1) 18:01	07:41 06:44 18:47	06:39 20:35 21:19	05:49 21:19 21:47	05:29 21:47 21:36	05:50 20:48 19:43	06:32 19:43 18:40	07:17 18:40 16:51	08:03 18:40 16:51	13	08:29 16:37 15
20	08:24 17:12 21	16:02 (WEA 1) 16:23 (WEA 1) 18:03	07:39 06:42 18:48	06:37 20:36 21:20	05:47 21:20 21:47	05:29 21:47 21:35	05:51 20:46 19:41	06:33 19:41 18:38	07:19 18:38 16:50	08:04 18:38 16:50	15	08:30 16:37 15
21	08:23 17:13 19	16:03 (WEA 1) 16:22 (WEA 1) 18:05	07:37 06:40 18:50	06:35 20:38 21:21	05:46 21:21 21:47	05:30 21:47 21:33	05:52 20:44 19:39	06:35 19:39 18:36	07:20 18:36 16:48	08:06 18:36 16:48	18	08:30 16:37 16
22	08:22 17:15 18	16:04 (WEA 1) 16:22 (WEA 1) 18:06	07:35 06:37 18:51	06:33 20:39 21:23	05:45 21:23 21:47	05:30 21:47 21:32	05:53 20:42 19:37	06:36 19:37 18:34	07:22 18:34 16:47	08:08 18:34 16:47	19	08:31 16:37 16
23	08:21 17:16 15	16:04 (WEA 1) 16:21 (WEA 1) 18:08	07:33 06:35 18:53	06:31 20:41 21:24	05:44 21:24 21:48	05:30 21:48 21:31	05:55 20:40 19:35	06:38 19:35 18:32	07:23 18:32 16:46	08:09 18:32 16:46	21	08:31 16:37 16
24	08:20 17:18 13	16:06 (WEA 1) 16:21 (WEA 1) 18:10	07:31 06:33 18:55	06:29 20:42 21:25	05:43 21:25 21:48	05:30 21:48 21:30	05:56 20:38 19:33	06:39 19:33 18:31	07:25 18:31 16:42	08:11 18:31 16:42	22	08:32 16:37 15
25	08:19 17:19 9	16:09 (WEA 1) 16:18 (WEA 1) 18:11	07:29 06:31 18:56	06:31 20:42 21:26	05:42 21:26 21:48	05:31 21:48 21:29	05:57 20:36 19:30	06:41 19:30 18:29	07:26 18:29 16:45	08:12 18:29 16:45	23	08:32 16:37 15
26	08:18 17:21 18	16:10 (WEA 1) 16:19 (WEA 1) 18:13	07:27 06:29 18:58	06:25 20:45 21:28	05:41 21:28 21:48	05:31 21:48 21:27	05:58 20:34 19:28	06:42 19:28 18:27	07:28 18:27 16:44	08:14 18:27 16:44	24	08:33 16:37 15
27	08:17 17:23 18	16:11 (WEA 1) 16:20 (WEA 1) 18:15	07:25 06:27 18:59	06:23 20:47 21:29	05:40 21:29 21:48	05:31 21:48 21:26	06:00 20:32 19:26	06:44 19:26 18:25	07:29 18:25 16:43	08:16 18:25 16:43	25	08:33 16:37 15
28	08:16 17:24 18	16:12 (WEA 1) 16:21 (WEA 1) 18:16	07:23 06:25 19:01	06:22 20:48 21:30	05:39 21:30 21:48	05:32 21:48 21:25	06:01 20:30 19:24	06:45 19:24 18:23	07:31 18:23 16:42	08:17 18:23 16:42	26	08:34 16:37 15
29	08:14 17:26 18	16:13 (WEA 1) 16:22 (WEA 1) 18:17	07:21 06:23 19:03	06:20 20:50 21:31	05:38 21:31 21:48	05:32 21:48 21:23	06:02 20:28 19:22	06:47 19:22 18:22	07:32 18:22 16:42	08:19 18:22 16:42	27	08:34 16:37 15
30	08:13 17:28 18	16:14 (WEA 1) 16:23 (WEA 1) 18:18	07:20 06:24 19:04	06:18 20:51 21:32	05:37 21:32 21:47	05:33 21:47 21:22	06:04 20:26 19:20	06:48 19:20 18:21	07:34 18:21 16:41	08:21 18:21 16:41	28	08:35 16:37 15
31	08:12 17:29 18	16:15 (WEA 1) 16:24 (WEA 1) 18:19	07:18 06:25 19:05	06:16 20:52 21:33	05:36 21:33 21:47	05:34 21:47 21:21	06:05 20:24 19:18	06:50 19:18 18:22	07:22 18:22 16:41	08:22 18:22 16:41	29	08:36 16:37 15
Sonnenscheinstunden	269	283	368	412	475	486	491	447	379	335	275	255
astr.max.mögl.Beschattung	524											574
Red.Sonnenscheinwahrsch.	0,15											0,13
Reduktion Betriebsdauer	0,93											0,93
Reduktion Windrichtung	0,73											0,73
Gesamte Reduktion	0,10											0,09
Met.wahrsch.Beschattung	52											49

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-05 - 10, Um Woeller, 4410 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Juli	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember		
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	05:33 21:47	06:06 21:19	06:51 20:22	07:35 19:17	18:21 (WEA 1)	07:24 17:16	16:29 (WEA 2)	08:10 16:40
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	05:34 21:47	06:08 21:17	06:53 20:20	07:37 19:15	18:20 (WEA 1)	07:25 17:15	16:30 (WEA 2)	08:12 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	05:35 21:47	06:09 21:16	06:54 20:18	07:38 19:13	18:20 (WEA 1)	07:27 17:13	16:31 (WEA 2)	08:13 16:39
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	05:35 21:46	06:11 21:14	06:55 20:16	07:40 19:11	18:19 (WEA 1)	07:29 17:11	16:32 (WEA 2)	08:14 16:39
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	05:36 21:46	06:12 21:13	06:57 20:14	07:41 19:09	18:19 (WEA 1)	07:30 17:10	16:35 (WEA 2)	08:16 16:38
6	08:33 16:52	08:03 17:39	17:05 (WEA 2) 18:26	07:11 20:15	07:05 21:00	06:08 21:39	05:32 21:45	06:13 21:11	06:58 20:11	07:43 19:07	18:20 (WEA 1)	07:32 17:08	16:37 (WEA 2)	08:17 16:38
7	08:32 16:53	08:01 17:40	17:03 (WEA 2) 18:29	07:09 20:16	07:03 21:01	06:06 21:39	05:32 21:45	06:15 21:07	07:00 20:09	07:44 19:05	18:20 (WEA 1)	07:34 17:07	16:38 (WEA 2)	08:18 16:39
8	08:32 16:54	08:00 17:41	17:02 (WEA 2) 18:28	07:07 20:17	07:01 21:02	06:04 21:40	05:31 21:45	06:16 21:10	07:01 20:07	07:46 19:03	18:21 (WEA 1)	07:35 17:05	16:39 (WEA 2)	08:19 16:37
9	08:32 16:55	17:43 17:43	17:16 (WEA 2) 18:29	07:05 20:18	06:59 21:03	06:03 21:40	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:00	18:21 (WEA 1)	07:37 17:04	16:40 (WEA 2)	08:20 16:37
10	08:32 16:56	07:58 17:45	17:01 (WEA 2) 18:31	07:05 20:19	06:59 21:05	06:03 21:41	05:31 21:44	06:18 21:06	07:03 20:05	07:47 19:00	18:21 (WEA 1)	07:37 17:04	16:40 (WEA 2)	08:20 16:37
11	08:31 16:57	07:57 17:46	17:00 (WEA 2) 18:33	07:03 20:21	06:57 21:06	06:01 21:42	05:30 21:43	06:19 21:04	07:04 20:03	07:49 18:58	18:23 (WEA 1)	07:39 17:02	16:41 (WEA 2)	08:21 16:37
12	08:31 16:59	07:55 17:48	16:59 (WEA 2) 18:34	07:01 20:22	06:55 21:08	06:00 21:43	05:30 21:42	06:20 21:03	07:06 20:01	07:50 18:56	18:27 (WEA 1)	07:40 17:01	16:42 (WEA 2)	08:22 16:37
13	08:30 17:00	07:53 17:50	16:59 (WEA 2) 18:36	06:59 20:24	06:53 21:09	05:58 21:43	05:30 21:42	06:22 21:01	07:07 19:59	07:52 18:54	18:29 (WEA 1)	07:42 17:00	16:43 (WEA 2)	08:23 16:37
14	08:30 17:01	07:52 17:51	16:59 (WEA 2) 18:37	06:57 20:25	06:51 21:10	05:57 21:44	05:30 21:41	06:23 20:59	07:09 19:56	07:53 18:52	18:30 (WEA 1)	07:43 17:00	16:44 (WEA 2)	08:24 16:37
15	08:29 17:03	07:50 17:53	16:59 (WEA 2) 18:39	06:55 20:27	06:49 21:12	05:55 21:44	05:29 21:40	06:25 20:57	07:10 19:54	07:55 18:50	18:31 (WEA 1)	07:45 17:00	16:45 (WEA 2)	08:25 16:37
16	08:28 17:04	07:48 17:55	16:59 (WEA 2) 18:40	06:52 20:28	06:47 21:13	05:54 21:45	05:29 21:43	06:26 20:56	07:11 19:52	07:57 18:48	18:32 (WEA 1)	07:47 17:00	16:46 (WEA 2)	08:26 16:37
17	08:28 17:06	07:46 17:56	16:59 (WEA 2) 18:42	06:50 20:30	06:45 21:15	05:53 21:45	05:29 21:43	06:28 20:54	07:13 19:50	07:58 18:46	18:33 (WEA 1)	07:48 17:00	16:47 (WEA 2)	08:27 16:37
18	08:27 17:07	07:44 17:58	16:59 (WEA 2) 18:44	06:48 20:31	06:43 21:16	05:51 21:46	05:29 21:43	06:29 20:52	07:14 19:48	08:00 18:44	18:34 (WEA 1)	07:49 17:00	16:48 (WEA 2)	08:28 16:37
19	08:26 17:09	07:43 18:00	17:01 (WEA 2) 18:45	06:46 20:33	06:41 21:17	05:50 21:46	05:29 21:43	06:31 20:50	07:16 19:46	08:01 18:42	18:35 (WEA 1)	07:51 17:00	16:49 (WEA 2)	08:29 16:38
20	08:25 17:10	07:41 18:01	17:02 (WEA 2) 18:47	06:44 20:35	06:39 21:19	05:49 21:47	05:29 21:46	06:32 20:48	07:17 19:43	08:03 18:40	18:36 (WEA 1)	07:53 17:00	16:50 (WEA 2)	08:30 16:38
21	08:24 17:12	07:39 18:03	17:04 (WEA 2) 18:48	06:42 20:36	06:37 21:20	05:47 21:47	05:29 21:44	06:33 20:46	07:19 19:41	08:04 18:38	18:37 (WEA 1)	07:54 17:00	16:51 (WEA 2)	08:31 16:38
22	08:23 17:13	07:37 18:05	17:06 (WEA 2) 18:50	06:40 20:38	06:35 21:21	05:46 21:47	05:30 21:43	06:35 20:44	07:20 19:39	08:06 18:36	18:38 (WEA 1)	07:56 17:00	16:52 (WEA 2)	08:32 16:39
23	08:22 17:15	07:35 18:06	17:14 (WEA 2) 18:51	06:37 20:39	06:33 21:23	05:45 21:47	05:30 21:42	06:36 20:42	07:22 19:37	08:08 18:34	18:39 (WEA 1)	07:58 17:00	16:53 (WEA 2)	08:33 16:39
24	08:21 17:16	07:33 18:08	17:17 (WEA 2) 18:53	06:35 20:41	06:31 21:24	05:44 21:48	05:30 21:43	06:38 20:40	07:23 19:35	08:09 18:32	18:40 (WEA 1)	07:59 17:00	16:54 (WEA 2)	08:34 16:40
25	08:20 17:18	07:31 18:10	17:18 (WEA 2) 18:55	06:33 20:42	06:29 21:25	05:43 21:48	05:30 21:44	06:39 20:38	07:25 19:33	08:11 18:31	18:41 (WEA 1)	08:01 17:00	16:55 (WEA 2)	08:35 16:40
26	08:19 17:19	07:29 18:11	17:19 (WEA 2) 18:56	06:31 20:44	06:27 21:26	05:42 21:48	05:31 21:47	06:41 20:36	07:26 19:30	07:12 17:29	18:42 (WEA 1)	08:02 17:00	16:56 (WEA 2)	08:36 16:41
27	08:18 17:21	07:27 18:13	17:20 (WEA 2) 18:58	06:29 20:45	06:25 21:27	05:41 21:48	05:31 21:47	06:42 20:34	07:28 19:28	07:14 17:27	18:43 (WEA 1)	08:03 17:00	16:57 (WEA 2)	08:37 16:42
28	08:17 17:23	07:25 18:15	17:21 (WEA 2) 18:59	06:27 20:47	06:23 21:29	05:40 21:48	05:31 21:47	06:44 20:32	07:29 19:26	07:16 17:25	18:44 (WEA 1)	08:05 17:00	16:58 (WEA 2)	08:38 16:43
29	08:16 17:24	07:23 18:16	17:22 (WEA 2) 19:01	06:25 20:48	06:22 21:30	05:39 21:48	05:32 21:45	06:45 20:30	07:31 19:24	07:17 17:23	18:45 (WEA 1)	08:06 17:00	16:59 (WEA 2)	08:39 16:44
30	08:14 17:26		17:23 (WEA 2) 19:02	06:20 20:50	06:16 21:31	05:38 21:48	05:32 21:47	06:47 20:28	07:32 19:22	07:19 17:22	18:46 (WEA 1)	08:08 17:00	17:00 (WEA 2)	08:40 16:45
31	08:13 17:28		17:24 (WEA 2) 19:03	06:18 20:51	06:14 21:32	05:37 21:47	05:33 21:46	06:48 20:26	07:34 19:20	07:21 17:20	18:47 (WEA 1)	08:09 17:00	17:01 (WEA 2)	08:41 16:46
Sonnscheinstunden													269	283
astr. max.mögl. Beschattung													275	266
Red. Sonnscheinwahrsch.													0,24	0,35
Reduktion Betriebsdauer													0,93	0,93
Reduktion Windrichtung													0,74	0,74
Gesamte Reduktion													0,16	0,23
Met. wahrsch. Beschattung													45	60

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-06 - 80, Rue des Champs, 4432 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März		April	Mai		Jun	Jul	August		September		Okt	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18		07:16 20:07	19:08 (WEA 2) 19:35 (WEA 2)	06:16 20:53	19:59 (WEA 1) 20:26 (WEA 1)	05:35 21:34	05:33 21:47	06:06 21:19	20:18 (WEA 1) 20:26 (WEA 1)	06:51 20:22	07:35 19:17	07:24 17:16	08:10 16:40
2	08:33 16:48	08:09 17:32	07:19 18:20		07:14 20:08	19:08 (WEA 2) 19:35 (WEA 2)	06:14 20:54	19:59 (WEA 1) 20:26 (WEA 1)	05:35 21:35	05:34 21:47	06:08 21:17	20:16 (WEA 1) 20:29 (WEA 1)	06:53 20:20	07:37 19:15	07:25 17:15	08:12 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21		07:12 20:10	19:08 (WEA 2) 19:34 (WEA 2)	06:13 20:56	19:59 (WEA 1) 20:26 (WEA 1)	05:34 21:36	05:35 21:47	06:09 21:16	20:14 (WEA 1) 20:31 (WEA 1)	06:54 20:18	07:38 19:13	07:27 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:15 18:23		07:10 20:12	19:09 (WEA 2) 19:33 (WEA 2)	06:11 20:57	19:59 (WEA 1) 20:25 (WEA 1)	05:33 21:37	05:35 21:46	06:11 21:14	20:12 (WEA 1) 20:32 (WEA 1)	06:55 20:16	07:40 19:20	07:29 17:11	08:14 16:39
5	08:33 16:51	08:04 17:38	07:13 18:25		07:07 20:13	19:10 (WEA 2) 19:31 (WEA 2)	06:09 20:59	20:00 (WEA 1) 20:25 (WEA 1)	05:33 21:38	05:36 21:46	06:12 21:13	20:12 (WEA 1) 20:33 (WEA 1)	06:54 20:14	07:41 19:23	07:30 17:10	08:16 16:38
6	08:33 16:52	08:03 17:39	07:11 18:26		07:05 20:15	19:12 (WEA 2) 19:30 (WEA 2)	06:08 21:00	20:00 (WEA 1) 20:24 (WEA 1)	05:32 21:39	05:37 21:45	06:13 21:11	20:11 (WEA 1) 20:34 (WEA 1)	06:58 20:11	07:43 19:26	07:32 17:08	08:17 16:38
7	08:32 16:54	08:01 17:41	07:09 18:28		07:03 20:16	19:14 (WEA 2) 19:27 (WEA 2)	06:06 21:02	20:01 (WEA 1) 20:24 (WEA 1)	05:32 21:40	05:38 21:45	06:15 21:10	20:10 (WEA 1) 20:34 (WEA 1)	07:00 20:09	07:44 19:05	07:34 17:07	08:18 16:38
8	08:32 16:55	08:00 17:42	07:07 18:29		07:01 20:18	19:17 (WEA 2) 19:23 (WEA 2)	06:04 21:03	20:02 (WEA 1) 20:22 (WEA 1)	05:31 21:40	05:39 21:44	06:16 21:08	20:10 (WEA 1) 20:35 (WEA 1)	07:01 20:07	07:46 19:03	07:35 17:05	08:19 16:37
9	08:32 16:56	07:57 17:43	07:03 18:29		06:59 20:19	19:23 (WEA 2) 19:31 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33		06:57 20:21	19:23 (WEA 2) 19:33 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34		06:55 20:22	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36		06:53 20:24	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
13	08:30 17:01	07:52 17:51	06:57 18:37		06:51 20:25	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
14	08:29 17:02	07:50 17:52	06:55 18:38		06:49 20:26	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
15	08:28 17:03	07:48 17:53	06:52 18:39		06:47 20:27	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
16	08:28 17:06	07:46 17:56	06:50 18:42		06:45 20:30	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
17	08:27 17:07	07:44 17:58	06:48 18:44		06:43 20:31	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
18	08:26 17:09	07:43 18:00	06:46 18:45		06:41 20:33	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
19	08:25 17:10	07:41 18:01	06:44 18:47		06:39 20:35	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
20	08:24 17:12	07:39 18:03	06:42 18:48		06:37 20:36	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
21	08:23 17:13	07:37 18:05	06:40 18:50		06:35 20:38	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
22	08:22 17:15	07:35 18:07	06:37 18:51		06:33 20:39	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
23	08:21 17:16	07:33 18:08	06:35 18:53		06:31 20:41	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
24	08:20 17:18	07:31 18:10	06:33 18:55		06:29 20:42	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
25	08:19 17:20	07:29 18:11	06:31 18:56		06:27 20:44	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
26	08:18 17:21	07:27 18:13	06:29 18:58		06:25 20:45	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
27	08:17 17:23	07:25 18:15	06:27 18:59		06:23 20:47	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
28	08:16 17:24	07:23 18:16	06:25 19:01		06:22 20:48	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
29	08:14 17:26	07:22 19:09	06:20 19:37		06:20 20:50	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
30	08:13 17:28	07:20 20:04	06:18 19:37		06:18 20:51	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
31	08:12 17:29	07:18 20:05	06:17 19:37		06:17 20:52	19:23 (WEA 2) 19:34 (WEA 2)	21:03 21:05	20:03 (WEA 1) 20:22 (WEA 1)	05:31 21:41	05:39 21:44	06:18 21:06	20:09 (WEA 1) 20:35 (WEA 1)	07:03 20:05	07:47 19:28	07:37 17:04	08:20 16:37
Sonneneinstrahlung	269	283	368		412	475		486	490	447		379	387	335	275	255
astr. max. mögl. Beschattung			218		320	251				411			387			
Red. Sonneneinstrahlung			0,35		0,46	0,44				0,48			0,42			
Reduktion Betriebsdauer			0,93		0,93	0,93				0,93			0,93			
Reduktion Windrichtung			0,67		0,62	0,57				0,57			0,67			
Gesamte Reduktion			0,22		0,27	0,24				0,26			0,26			
Met. wahrsch. Beschattung			48		85	59				106			102			

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-07 - 75, Rue des Champs, 4432 Soleuvre  
Annahmen für Schattenwurfberechnung  
Sonnencheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember	
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	19:26 (WEA 2) 19:42 (WEA 2)	06:16 20:53	20:15 (WEA 1) 21:34	05:35 21:47	06:06 23	20:24 (WEA 1) 20:22	19:23 (WEA 2) 19:17	07:35 17:16	08:10 16:40
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	19:25 (WEA 2) 19:44 (WEA 2)	06:14 20:54	20:14 (WEA 1) 21:35	05:34 21:47	06:08 24	20:24 (WEA 1) 20:20	19:22 (WEA 2) 19:15	07:37 17:15	08:12 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	19:24 (WEA 2) 19:45 (WEA 2)	06:13 20:56	20:14 (WEA 1) 21:36	05:35 21:47	06:09 25	20:23 (WEA 1) 20:18	19:20 (WEA 2) 19:13	07:38 17:13	08:13 16:39
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	19:23 (WEA 2) 19:47 (WEA 2)	06:11 20:57	20:13 (WEA 1) 21:37	05:35 21:46	06:11 23	20:23 (WEA 1) 20:16	19:20 (WEA 2) 19:11	07:40 17:11	08:14 16:39
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	19:23 (WEA 2) 19:48 (WEA 2)	06:09 20:59	20:13 (WEA 1) 21:38	05:36 21:46	06:12 23	20:23 (WEA 1) 20:14	19:19 (WEA 2) 19:09	07:41 17:10	08:16 16:38
6	08:33 16:52	08:03 17:39	07:11 18:26	07:05 20:15	19:23 (WEA 2) 19:50 (WEA 2)	06:08 21:00	20:12 (WEA 1) 21:39	05:37 21:45	06:13 22	20:22 (WEA 1) 20:11	19:19 (WEA 2) 19:07	07:43 17:08	08:17 16:38
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	19:23 (WEA 2) 19:50 (WEA 2)	06:06 21:02	20:13 (WEA 1) 21:40	05:38 21:45	06:15 20	20:22 (WEA 1) 20:09	19:18 (WEA 2) 19:05	07:44 17:07	08:18 16:38
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	19:23 (WEA 2) 19:49 (WEA 2)	06:04 21:03	20:13 (WEA 1) 21:40	05:39 21:44	06:16 18	20:22 (WEA 1) 20:07	19:17 (WEA 2) 19:03	07:46 17:05	08:19 16:37
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	19:23 (WEA 2) 19:49 (WEA 2)	06:03 21:05	20:13 (WEA 1) 21:41	05:39 21:44	06:18 17	20:22 (WEA 1) 20:05	19:18 (WEA 2) 19:00	07:47 17:04	08:20 16:37
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	19:24 (WEA 2) 19:48 (WEA 2)	06:01 21:06	20:13 (WEA 1) 21:42	05:40 21:43	06:19 15	20:22 (WEA 1) 20:03	19:17 (WEA 2) 18:58	07:49 17:02	08:21 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	19:25 (WEA 2) 19:46 (WEA 2)	06:00 21:08	20:14 (WEA 1) 21:43	05:41 21:42	06:20 13	20:23 (WEA 1) 20:01	19:19 (WEA 2) 18:56	07:50 17:01	08:22 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	19:26 (WEA 2) 19:45 (WEA 2)	05:58 21:09	20:14 (WEA 1) 21:43	05:42 21:42	06:22 11	20:23 (WEA 1) 19:59	19:19 (WEA 2) 18:54	07:52 16:59	08:23 16:37
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	19:27 (WEA 2) 19:43 (WEA 2)	05:57 21:10	20:15 (WEA 1) 21:44	05:43 21:41	06:23 8	20:24 (WEA 1) 19:56	19:20 (WEA 2) 18:52	07:53 16:58	08:24 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	19:30 (WEA 2) 19:40 (WEA 2)	05:55 21:12	20:16 (WEA 1) 21:44	05:44 21:40	06:25 6	20:25 (WEA 1) 19:54	19:21 (WEA 2) 18:50	07:55 16:57	08:25 16:37
15	08:28 17:05	07:48 17:55	06:52 18:41	06:47 20:28	19:48 (WEA 2) 19:55 (WEA 2)	05:54 21:13	20:16 (WEA 1) 21:45	05:45 21:39	06:26 3	20:26 (WEA 1) 19:52	19:23 (WEA 2) 18:48	07:57 16:55	08:26 16:37
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	19:55 (WEA 2) 20:03 (WEA 2)	05:53 21:15	20:17 (WEA 1) 21:45	05:46 21:38	06:28 20	20:27 (WEA 1) 19:50	19:24 (WEA 2) 18:46	07:58 16:54	08:27 16:37
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	20:03 (WEA 2) 20:11 (WEA 2)	05:51 21:16	20:19 (WEA 1) 21:46	05:48 21:37	06:29 20	20:28 (WEA 1) 19:48	19:25 (WEA 2) 18:44	07:59 16:53	08:28 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	20:04 (WEA 2) 20:12 (WEA 2)	05:50 21:17	20:21 (WEA 1) 21:46	05:49 21:37	06:31 20	20:29 (WEA 1) 19:46	19:26 (WEA 2) 18:42	08:01 16:52	08:28 16:38
19	08:25 17:10	07:41 18:01	06:44 18:47	06:39 20:35	20:05 (WEA 2) 20:13 (WEA 2)	05:49 21:19	20:22 (WEA 1) 21:47	05:50 21:35	06:32 20	20:30 (WEA 1) 19:43	19:27 (WEA 2) 18:40	08:03 16:51	08:29 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	20:06 (WEA 2) 20:14 (WEA 2)	05:47 21:20	20:23 (WEA 1) 21:47	05:51 21:34	06:34 20	20:31 (WEA 1) 19:41	19:28 (WEA 2) 18:38	08:04 16:50	08:30 16:38
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	20:07 (WEA 2) 20:15 (WEA 2)	05:46 21:21	20:24 (WEA 1) 21:47	05:52 21:33	06:35 20	20:32 (WEA 1) 19:39	19:29 (WEA 2) 18:36	08:06 16:49	08:30 16:39
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	20:16 (WEA 2) 20:24 (WEA 2)	05:45 21:23	20:25 (WEA 1) 21:47	05:53 21:32	06:36 20	20:33 (WEA 1) 19:37	19:30 (WEA 2) 18:34	08:07 16:47	08:31 16:39
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	20:17 (WEA 2) 20:25 (WEA 2)	05:44 21:24	20:26 (WEA 1) 21:48	05:55 21:31	06:38 20	20:34 (WEA 1) 19:35	19:31 (WEA 2) 18:33	08:09 16:47	08:31 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	20:18 (WEA 2) 20:26 (WEA 2)	05:43 21:25	20:27 (WEA 1) 21:48	05:56 21:30	06:39 20	20:35 (WEA 1) 19:33	19:32 (WEA 2) 18:31	08:11 16:46	08:32 16:40
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	20:19 (WEA 2) 20:27 (WEA 2)	05:42 21:26	20:28 (WEA 1) 21:48	05:57 21:32	06:41 20	20:36 (WEA 1) 19:30	19:33 (WEA 2) 18:29	08:12 16:45	08:32 16:41
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	20:20 (WEA 2) 20:28 (WEA 2)	05:41 21:27	20:29 (WEA 1) 21:48	05:58 21:32	06:42 12	20:37 (WEA 1) 19:28	19:34 (WEA 2) 18:27	08:13 16:44	08:33 16:42
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	20:29 (WEA 2) 20:37 (WEA 2)	05:40 21:29	20:30 (WEA 1) 21:48	05:59 21:36	06:43 20	20:38 (WEA 1) 19:26	19:35 (WEA 2) 18:25	08:14 16:45	08:34 16:42
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	20:30 (WEA 2) 20:38 (WEA 2)	05:39 21:30	20:31 (WEA 1) 21:49	06:00 21:37	06:44 17	20:39 (WEA 1) 19:24	19:36 (WEA 2) 18:23	08:15 16:46	08:35 16:43
29	08:14 17:26	07:22 18:18	06:23 19:03	06:20 20:49	20:39 (WEA 2) 20:47 (WEA 2)	05:38 21:31	20:32 (WEA 1) 21:50	06:01 21:38	06:45 11	20:40 (WEA 1) 19:22	19:37 (WEA 2) 18:22	08:16 16:47	08:36 16:44
30	08:13 17:28	07:20 18:20	06:21 19:04	06:18 20:51	20:48 (WEA 2) 20:56 (WEA 2)	05:37 21:32	20:33 (WEA 1) 21:51	06:02 21:39	06:46 16	20:41 (WEA 1) 19:23	19:38 (WEA 2) 18:23	08:17 16:48	08:37 16:45
31	08:12 17:29	07:18 18:25	06:20 19:08	06:17 20:52	20:57 (WEA 2) 21:05 (WEA 2)	05:36 21:33	20:34 (WEA 1) 21:52	06:03 21:40	06:47 20	20:42 (WEA 1) 19:24	19:39 (WEA 2) 18:24	08:18 16:49	08:38 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255	
astr. max. mögl. Beschattung			31		320	335	112	298	295				
Red. Sonnenscheinwahrsch.			0,35		0,46	0,44	0,48	0,48	0,42				
Reduktion Betriebsdauer			0,93		0,93	0,93	0,93	0,93	0,93				
Reduktion Windrichtung			0,65		0,55	0,57	0,57	0,59	0,65				
Gesamte Reduktion			0,21		0,28	0,24	0,25	0,26	0,26				
Met. wahrsch. Beschattung			7		88	79	28	78	75				

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-08 - 22A, Rue Belle-Vue, 4417 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Juli	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-09 - 9, Rue de Differdange, Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:41 (WEA 2) 21:47	05:33 21:19	20:49 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:35 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:41 (WEA 2) 21:47	05:34 21:17	20:49 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:37 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:42 (WEA 2) 21:47	05:35 21:19	20:49 (WEA 2) 21:19	06:09 20:18	06:54 19:13	07:38 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:11	06:11 20:57	05:33 21:37	20:41 (WEA 2) 21:46	05:35 21:20	20:49 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:40 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:42 (WEA 2) 21:46	05:36 21:21	20:49 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:41 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:42 (WEA 2) 21:45	05:37 21:20	20:49 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:43 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:43 (WEA 2) 21:45	05:38 21:21	20:49 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:44 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:43 (WEA 2) 21:44	05:39 21:22	20:49 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:46 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:44 (WEA 2) 21:44	05:39 21:22	20:49 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:47 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:44 (WEA 2) 21:43	05:40 21:23	20:48 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:49 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:45 (WEA 2) 21:42	05:41 21:23	20:48 (WEA 2) 21:03	06:20 20:01	07:06 18:56	07:50 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:45 (WEA 2) 21:42	05:42 21:23	20:48 (WEA 2) 21:01	06:22 20:09	07:07 19:59	07:52 18:54
13	08:30 17:01	07:51 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:45 (WEA 2) 21:41	05:43 21:22	20:48 (WEA 2) 21:10	06:23 20:59	07:09 19:56	07:53 18:52
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:46 (WEA 2) 21:40	05:44 21:22	20:48 (WEA 2) 21:10	06:25 20:57	07:10 19:54	07:55 18:50
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:46 (WEA 2) 21:39	05:45 21:21	20:48 (WEA 2) 21:09	06:26 20:56	07:11 19:52	07:57 18:48
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:47 (WEA 2) 21:38	05:46 21:20	20:48 (WEA 2) 21:08	06:28 20:54	07:13 19:50	07:58 18:46
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:47 (WEA 2) 21:37	05:48 21:19	20:48 (WEA 2) 21:07	06:29 20:52	07:14 19:48	08:00 18:44
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:47 (WEA 2) 21:36	05:49 21:18	20:48 (WEA 2) 21:06	06:31 20:50	07:16 19:46	08:01 18:42
19	08:25 17:10	07:41 18:01	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:41 (WEA 2) 21:35	05:50 21:16	20:50 (WEA 2) 21:06	06:32 20:48	07:17 19:43	08:03 18:40
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:40 (WEA 2) 21:34	05:51 21:15	20:50 (WEA 2) 21:05	06:34 20:46	07:19 19:41	08:04 18:38
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:40 (WEA 2) 21:33	05:52 21:14	20:50 (WEA 2) 21:04	06:35 20:44	07:20 19:39	08:06 18:36
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:22	05:30 21:47	20:39 (WEA 2) 21:32	05:53 21:13	20:50 (WEA 2) 21:03	06:36 20:42	07:22 19:37	08:08 18:34
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:47	20:39 (WEA 2) 21:31	05:55 21:12	20:50 (WEA 2) 21:02	06:38 20:40	07:23 19:35	08:09 18:33
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:39 (WEA 2) 21:30	05:56 21:09	20:51 (WEA 2) 21:00	06:39 20:38	07:25 19:33	08:11 18:31
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:39 (WEA 2) 21:29	05:57 21:20	20:51 (WEA 2) 21:05	06:41 20:36	07:26 19:30	08:12 18:29
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:39 (WEA 2) 21:27	05:58 21:10	20:53 (WEA 2) 21:05	06:42 20:34	07:28 19:28	08:14 18:27
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:40 (WEA 2) 21:26	06:00 21:06	20:53 (WEA 2) 21:02	06:44 20:32	07:29 19:26	08:15 18:25
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:40 (WEA 2) 21:25	06:01 21:09	20:54 (WEA 2) 21:06	06:45 20:30	07:31 19:24	08:17 18:23
29	08:14 17:26	07:22 19:01	06:22 20:02	06:20 20:50	05:38 21:31	05:32 21:47	20:40 (WEA 2) 21:23	06:02 21:07	20:56 (WEA 2) 21:13	06:47 20:28	07:32 19:22	08:18 18:22
30	08:13 17:28	07:20 19:04	06:18 20:04	06:16 20:51	05:37 21:32	05:33 21:47	20:40 (WEA 2) 21:22	06:04 21:07	20:58 (WEA 2) 21:12	06:48 20:26	07:34 19:20	08:19 18:20
31	08:12 17:29	07:18 20:05	06:18 20:05	06:16 21:33	05:36 21:03	05:36 21:48	20:41 (WEA 2) 21:03	06:05 21:20	20:50 (WEA 2) 20:24	06:50 20:24	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					231	537	472					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					54	129	118					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-10 - 17, Rue de Differdange, Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:39 (WEA 2) 21:47	05:33 21:19	20:48 (WEA 2) 21:07 (WEA 2)	06:06 21:19	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:39 (WEA 2) 21:47	05:34 21:17	20:47 (WEA 2) 21:07 (WEA 2)	06:08 21:17	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:40 (WEA 2) 21:47	05:35 21:18	20:47 (WEA 2) 21:08 (WEA 2)	06:09 21:16	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:11	06:11 20:57	05:33 21:37	20:40 (WEA 2) 21:46	05:35 21:09 (WEA 2)	20:48 (WEA 2) 21:14	06:11 21:14	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:41 (WEA 2) 21:46	05:36 21:08 (WEA 2)	20:47 (WEA 2) 21:13	06:12 21:13	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:41 (WEA 2) 21:45	05:37 21:09 (WEA 2)	20:47 (WEA 2) 21:11	06:13 21:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:42 (WEA 2) 21:45	05:38 21:09 (WEA 2)	20:47 (WEA 2) 21:10	06:15 21:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:41 (WEA 2) 21:44	05:39 21:09 (WEA 2)	20:47 (WEA 2) 21:08	06:16 21:08	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:42 (WEA 2) 21:44	05:39 21:09 (WEA 2)	20:48 (WEA 2) 21:06	06:18 21:06	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:43 (WEA 2) 21:43	05:40 21:09 (WEA 2)	20:47 (WEA 2) 21:04	06:19 21:04	07:04 18:58	07:38 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:44 (WEA 2) 21:42	05:41 21:09 (WEA 2)	20:47 (WEA 2) 21:03	06:20 21:03	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:43 (WEA 2) 21:42	05:42 21:09 (WEA 2)	20:47 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:51 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:44 (WEA 2) 21:41	05:43 21:09 (WEA 2)	20:47 (WEA 2) 21:10	06:23 21:09	07:09 18:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:44 (WEA 2) 21:40	05:44 21:09 (WEA 2)	20:47 (WEA 2) 21:05	06:25 21:05	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:45 (WEA 2) 21:39	05:45 21:09 (WEA 2)	20:47 (WEA 2) 21:06	06:26 21:06	07:11 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:45 (WEA 2) 21:38	05:46 21:09 (WEA 2)	20:47 (WEA 2) 21:08	06:28 21:08	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:45 (WEA 2) 21:37	05:48 21:09 (WEA 2)	20:47 (WEA 2) 21:07	06:29 21:07	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:46 (WEA 2) 21:36	05:49 21:09 (WEA 2)	20:47 (WEA 2) 21:06	06:31 21:06	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:46 (WEA 2) 21:35	05:50 21:09 (WEA 2)	20:48 (WEA 2) 21:06	06:32 21:06	07:17 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:46 (WEA 2) 21:34	05:51 21:09 (WEA 2)	20:48 (WEA 2) 21:05	06:34 21:05	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:47 (WEA 2) 21:33	05:52 21:09 (WEA 2)	20:49 (WEA 2) 21:04	06:35 21:04	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:22	05:30 21:47	20:47 (WEA 2) 21:32	05:53 21:09 (WEA 2)	20:49 (WEA 2) 21:03	06:36 21:03	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:47	20:47 (WEA 2) 21:31	05:55 21:09 (WEA 2)	20:49 (WEA 2) 21:02	06:38 21:02	07:23 18:35	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:47 (WEA 2) 21:30	05:56 21:09 (WEA 2)	20:49 (WEA 2) 21:01	06:39 21:01	07:25 18:33	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:48 (WEA 2) 21:29	05:57 21:09 (WEA 2)	20:50 (WEA 2) 21:00	06:41 21:00	07:26 18:30	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:47 (WEA 2) 21:27	05:58 21:09 (WEA 2)	20:51 (WEA 2) 21:00	06:42 21:00	07:28 18:28	08:14 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:48 (WEA 2) 21:26	06:00 21:09 (WEA 2)	20:52 (WEA 2) 21:02	06:44 21:02	07:29 18:26	08:15 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:47 (WEA 2) 21:25	06:01 21:09 (WEA 2)	20:53 (WEA 2) 21:00	06:45 21:00	07:31 18:24	08:17 16:42
29	08:14 17:26	07:22 19:01	06:20 19:01	06:17 20:48	05:38 21:31	05:32 21:48	20:48 (WEA 2) 21:23	06:02 21:09 (WEA 2)	20:56 (WEA 2) 21:00	06:47 21:00	07:32 18:22	08:18 16:42
30	08:13 17:28	07:20 19:04	06:18 20:04	06:15 21:32	05:37 21:24	05:33 21:47	20:47 (WEA 2) 21:22	06:04 21:09 (WEA 2)	20:57 (WEA 2) 21:00	06:48 21:00	07:34 18:20	08:19 16:41
31	08:12 17:29	07:18 20:05	06:16 20:05	06:13 21:33	05:36 21:24	05:34 21:03 (WEA 2)	20:47 (WEA 2) 21:20	06:05 21:00	20:58 (WEA 2) 21:00	06:50 21:00	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					252	580						
Red. Sonnenscheinwahrsch.					0,44	0,45	0,506					
Reduktion Betriebsdauer					0,93	0,93	0,98					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					58	139	127					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584



## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-11 - 16, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 18:20	06:16 20:07	05:35 20:53	20:34 (WEA 2) 21:34	05:33 21:47	20:44 (WEA 2) 21:17	06:06 20:22	20:47 (WEA 2) 19:17	06:51 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:34 (WEA 2) 21:35	05:34 21:47	20:44 (WEA 2) 21:17	06:08 20:58 (WEA 2)	20:47 (WEA 2) 19:15	06:53 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:35 (WEA 2) 21:36	05:35 21:47	20:44 (WEA 2) 21:16	06:09 20:59 (WEA 2)	20:47 (WEA 2) 19:13	06:54 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:11	06:11 20:57	05:33 21:37	20:35 (WEA 2) 21:37	05:35 21:46	20:44 (WEA 2) 21:14	06:11 21:00 (WEA 2)	20:47 (WEA 2) 19:11	06:55 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:36 (WEA 2) 21:38	05:36 21:46	20:43 (WEA 2) 21:13	06:12 21:00 (WEA 2)	20:47 (WEA 2) 19:09	06:57 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:36 (WEA 2) 21:39	05:37 21:45	20:43 (WEA 2) 21:11	06:13 21:01 (WEA 2)	20:47 (WEA 2) 19:07	06:58 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:37 (WEA 2) 21:40	05:38 21:45	20:43 (WEA 2) 21:10	06:15 21:02 (WEA 2)	20:47 (WEA 2) 19:05	06:58 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:37 (WEA 2) 21:40	05:39 21:44	20:43 (WEA 2) 21:08	06:16 21:02 (WEA 2)	20:47 (WEA 2) 19:03	06:59 17:05
9	08:32 16:56	07:58 17:45	07:05 18:37	06:59 20:19	06:03 21:05	05:31 21:41	20:38 (WEA 2) 21:41	05:39 21:44	20:43 (WEA 2) 21:06	06:18 21:03 (WEA 2)	20:47 (WEA 2) 19:04	07:03 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:39 (WEA 2) 21:42	05:40 21:43	20:41 (WEA 2) 21:04	06:19 21:03 (WEA 2)	20:47 (WEA 2) 19:02	07:04 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:40 (WEA 2) 21:43	05:41 21:42	20:41 (WEA 2) 21:03	06:20 21:03 (WEA 2)	20:47 (WEA 2) 19:01	07:06 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:40 (WEA 2) 21:43	05:42 21:42	20:41 (WEA 2) 21:01	06:22 21:01 (WEA 2)	20:47 (WEA 2) 19:59	07:07 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:41 (WEA 2) 21:44	05:43 21:41	20:41 (WEA 2) 21:04	06:23 21:04 (WEA 2)	20:47 (WEA 2) 19:56	07:09 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:42 (WEA 2) 21:44	05:44 21:40	20:41 (WEA 2) 21:05	06:25 21:05 (WEA 2)	20:47 (WEA 2) 19:54	07:10 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:43 (WEA 2) 21:45	05:45 21:39	20:41 (WEA 2) 21:05	06:26 21:05 (WEA 2)	20:47 (WEA 2) 19:52	07:11 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:43 (WEA 2) 21:45	05:46 21:38	20:41 (WEA 2) 21:05	06:28 21:05 (WEA 2)	20:47 (WEA 2) 19:50	07:13 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:43 (WEA 2) 21:46	05:48 21:37	20:41 (WEA 2) 21:06	06:29 21:06 (WEA 2)	20:47 (WEA 2) 19:48	07:14 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:44 (WEA 2) 21:46	05:49 21:36	20:40 (WEA 2) 21:06	06:31 21:06 (WEA 2)	20:47 (WEA 2) 19:46	07:16 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:44 (WEA 2) 21:47	05:50 21:35	20:41 (WEA 2) 21:06	06:32 21:04 (WEA 2)	20:47 (WEA 2) 19:43	07:17 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:45 (WEA 2) 21:47	05:51 21:34	20:41 (WEA 2) 21:05	06:34 21:04 (WEA 2)	20:47 (WEA 2) 19:41	07:19 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:46 (WEA 2) 21:47	05:52 21:33	20:41 (WEA 2) 21:04	06:35 21:04 (WEA 2)	20:47 (WEA 2) 19:39	07:20 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:46 (WEA 2) 21:47	05:53 21:32	20:41 (WEA 2) 21:03	06:36 21:03 (WEA 2)	20:47 (WEA 2) 19:37	07:22 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:45 (WEA 2) 21:48	05:55 21:31	20:41 (WEA 2) 21:02	06:38 21:02 (WEA 2)	20:47 (WEA 2) 19:35	07:23 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:45 (WEA 2) 21:48	05:56 21:30	20:41 (WEA 2) 21:01	06:39 21:01 (WEA 2)	20:47 (WEA 2) 19:33	07:25 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:46 (WEA 2) 21:48	05:57 21:29	20:41 (WEA 2) 21:05	06:41 21:05 (WEA 2)	20:47 (WEA 2) 19:30	07:26 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:46 (WEA 2) 21:48	05:58 21:27	20:42 (WEA 2) 21:05	06:42 21:05 (WEA 2)	20:47 (WEA 2) 19:28	07:28 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:46 (WEA 2) 21:48	06:00 21:26	20:43 (WEA 2) 21:05	06:44 21:05 (WEA 2)	20:47 (WEA 2) 19:26	07:29 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:45 (WEA 2) 21:48	06:01 21:25	20:43 (WEA 2) 21:05	06:45 21:05 (WEA 2)	20:47 (WEA 2) 19:24	07:31 16:42
29	08:14 17:26	07:22 18:02	06:20 18:50	06:18 20:50	05:38 21:31	05:32 21:48	20:45 (WEA 2) 21:48	06:02 21:23	20:43 (WEA 2) 21:04	06:47 21:04 (WEA 2)	20:47 (WEA 2) 19:22	07:32 16:42
30	08:13 17:28	07:20 18:04	06:18 18:51	06:17 20:51	05:37 21:32	05:33 21:48	20:44 (WEA 2) 21:48	06:04 21:22	20:45 (WEA 2) 21:04	06:48 21:04 (WEA 2)	20:47 (WEA 2) 19:20	07:34 16:41
31	08:12 17:29	07:18 18:05	06:16 18:53	06:15 20:52	05:36 21:33	05:34 21:48	20:44 (WEA 2) 21:48	06:05 21:20	20:46 (WEA 2) 21:04	06:50 21:04 (WEA 2)	20:47 (WEA 2) 19:20	07:34 16:41
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr.max.mögl.Beschattung					379	381	588	4				
Red.Sonnenscheinwahrsch.					0,44	0,45	0,48	0,48				
Reduktion Betriebsdauer					0,93	0,93	0,93	0,93				
Reduktion Windrichtung					0,57	0,57	0,57	0,57				
Gesamte Reduktion					0,23	0,24	0,25	0,25				
Met.wahrsch.Beschattung					88	92	148	1				

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	



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-12 - 31, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:36 (WEA 2) 21:47	05:34 21:19	20:44 (WEA 2) 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:36 (WEA 2) 21:47	05:34 21:17	20:43 (WEA 2) 21:17	06:53 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:37 (WEA 2) 21:47	05:35 21:17	20:44 (WEA 2) 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:37 (WEA 2) 21:46	05:35 21:14	20:44 (WEA 2) 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:38 (WEA 2) 21:46	05:36 21:13	20:43 (WEA 2) 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:37 (WEA 2) 21:45	05:37 21:11	20:44 (WEA 2) 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:38 (WEA 2) 21:45	05:38 21:09	20:44 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:39 (WEA 2) 21:44	05:39 21:09	20:44 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:38 (WEA 2) 21:44	05:39 21:06	20:44 (WEA 2) 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:39 (WEA 2) 21:43	05:40 21:09	20:43 (WEA 2) 21:04	07:04 20:03	07:49 18:58	07:38 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:40 (WEA 2) 21:42	05:41 21:09	20:44 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:39 (WEA 2) 21:42	05:42 21:06	20:44 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:40 (WEA 2) 21:41	05:43 21:06	20:44 (WEA 2) 21:06	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:40 (WEA 2) 21:40	05:44 21:06	20:44 (WEA 2) 21:05	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:41 (WEA 2) 21:39	05:45 21:09	20:44 (WEA 2) 21:06	07:11 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:41 (WEA 2) 21:38	05:46 21:08	20:44 (WEA 2) 21:04	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:41 (WEA 2) 21:37	05:48 21:07	20:44 (WEA 2) 21:02	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:42 (WEA 2) 21:36	05:49 21:06	20:44 (WEA 2) 21:00	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:42 (WEA 2) 21:35	05:50 21:06	20:46 (WEA 2) 21:04	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:42 (WEA 2) 21:34	05:51 21:05	20:46 (WEA 2) 21:04	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:43 (WEA 2) 21:33	05:52 21:04	20:46 (WEA 2) 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:43 (WEA 2) 21:32	05:53 21:03	20:46 (WEA 2) 21:02	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:43 (WEA 2) 21:31	05:55 21:04	20:47 (WEA 2) 21:02	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:43 (WEA 2) 21:30	05:56 21:04	20:47 (WEA 2) 21:01	07:25 19:33	08:11 18:31	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:43 (WEA 2) 21:29	05:57 21:05	20:48 (WEA 2) 21:00	07:26 19:30	08:12 18:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:43 (WEA 2) 21:27	05:58 21:05	20:49 (WEA 2) 21:00	07:28 19:28	08:13 18:27	08:32 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:44 (WEA 2) 21:26	06:00 21:05	20:50 (WEA 2) 21:02	07:29 19:26	08:16 18:25	08:33 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:43 (WEA 2) 21:25	06:01 21:05	20:51 (WEA 2) 21:00	07:31 19:24	08:17 18:23	08:33 16:42
29	08:14 17:26	07:22 19:01	06:20 20:02	06:17 20:50	05:38 21:31	05:32 21:48	20:44 (WEA 2) 21:23	06:02 21:06	20:53 (WEA 2) 21:02	07:32 19:22	08:18 18:22	08:33 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:15 21:32	05:37 21:27	05:33 21:47	20:44 (WEA 2) 21:22	06:04 21:06	20:54 (WEA 2) 21:02	07:34 19:20	08:19 18:20	08:33 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	06:15 21:33	05:36 21:26	05:36 21:02	20:44 (WEA 2) 21:20	06:05 21:02	20:50 (WEA 2) 20:24	07:35 19:22	08:20 18:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					294	680	579					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					68	163	145					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-13 - 6, Rue du Bois, 4421 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:44 (WEA 2) 21:47	05:34 21:19	20:51 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:44 (WEA 2) 21:47	05:34 21:19	20:50 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:45 (WEA 2) 21:47	05:35 21:16	20:51 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:44 (WEA 2) 21:46	05:35 21:16	20:51 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:45 (WEA 2) 21:46	05:36 21:15	20:51 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:45 (WEA 2) 21:45	05:37 21:14	20:51 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:45 (WEA 2) 21:45	05:38 21:14	20:51 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:46 (WEA 2) 21:44	05:39 21:12	20:52 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:46 (WEA 2) 21:44	05:40 21:12	20:52 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:46 (WEA 2) 21:43	05:40 21:12	20:51 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:38 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:47 (WEA 2) 21:42	05:41 21:12	20:52 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:46 (WEA 2) 21:42	05:42 21:11	20:52 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:51 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:47 (WEA 2) 21:41	05:43 21:10	20:52 (WEA 2) 21:09	06:23 19:56	07:09 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:47 (WEA 2) 21:40	05:44 21:11	20:53 (WEA 2) 21:07	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:47 (WEA 2) 21:39	05:45 21:12	20:53 (WEA 2) 21:09	06:26 19:52	07:11 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:48 (WEA 2) 21:38	05:46 21:10	20:53 (WEA 2) 21:08	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:48 (WEA 2) 21:37	05:48 21:10	20:54 (WEA 2) 21:07	06:29 19:48	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:48 (WEA 2) 21:36	05:49 21:12	20:54 (WEA 2) 21:06	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:48 (WEA 2) 21:35	05:50 21:12	20:55 (WEA 2) 21:06	06:32 19:43	07:17 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:48 (WEA 2) 21:34	05:51 21:12	20:56 (WEA 2) 21:05	06:34 19:41	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:49 (WEA 2) 21:33	05:52 21:13	20:57 (WEA 2) 21:04	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:46 (WEA 2) 21:32	05:53 21:13	20:57 (WEA 2) 21:03	06:36 19:37	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:46 (WEA 2) 21:31	05:55 21:13	20:58 (WEA 2) 21:02	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:49 (WEA 2) 21:30	05:56 21:13	20:59 (WEA 2) 21:00	06:39 19:33	07:25 18:31	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:45 (WEA 2) 21:29	05:57 21:14	20:50 (WEA 2) 21:10	06:41 19:30	07:26 18:29	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:44 (WEA 2) 21:27	05:58 21:14	20:50 (WEA 2) 21:11	06:42 19:28	07:28 18:24	08:13 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:45 (WEA 2) 21:28	06:00 21:15	20:50 (WEA 2) 21:12	06:44 19:26	07:29 18:25	08:14 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:45 (WEA 2) 21:28	06:01 21:15	20:50 (WEA 2) 21:12	06:45 19:24	07:31 18:23	08:15 16:42
29	08:14 17:26	07:22 19:01	06:20 19:01	06:17 20:49	05:38 21:31	05:32 21:48	20:44 (WEA 2) 21:28	06:02 21:15	20:51 (WEA 2) 21:12	06:47 19:22	07:32 18:22	08:16 16:42
30	08:13 17:28	07:20 19:04	06:18 19:04	06:15 20:51	05:37 21:32	05:33 21:47	20:44 (WEA 2) 21:27	06:04 21:15	20:50 (WEA 2) 21:12	06:48 19:20	07:34 18:20	08:17 16:41
31	08:12 17:29	07:18 19:05	06:17 19:05	06:14 20:51	05:36 21:33	05:34 21:48	20:45 (WEA 2) 21:03	06:05 21:20	20:50 (WEA 2) 21:04	06:50 20:24	07:22 18:18	08:18 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					139	712	403					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,56	0,56	0,56					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					32	170	101					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584



## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-14 - 32, Rue de Differdange, 4421 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 18:20	06:16 19:08	05:35 20:07	20:32 (WEA 2) 21:34	05:34 21:47	20:40 (WEA 2) 21:19	06:06 20:51 (WEA 2)	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 18:20	06:14 19:08	05:35 20:08	20:32 (WEA 2) 21:35	05:34 21:47	20:40 (WEA 2) 21:19	06:08 20:51 (WEA 2)	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 18:21	06:13 19:09	05:34 20:10	20:32 (WEA 2) 21:36	05:35 21:47	20:40 (WEA 2) 21:16	06:09 20:51 (WEA 2)	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 18:23	06:11 19:09	05:33 20:12	20:32 (WEA 2) 21:37	05:35 21:46	20:40 (WEA 2) 21:14	06:11 21:02 (WEA 2)	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 18:25	06:09 19:10	05:33 20:13	20:33 (WEA 2) 21:38	05:36 21:46	20:39 (WEA 2) 21:13	06:12 21:02 (WEA 2)	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 18:26	06:08 19:11	05:32 20:15	20:33 (WEA 2) 21:39	05:37 21:45	20:40 (WEA 2) 21:11	06:13 21:03 (WEA 2)	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 18:28	06:06 19:12	05:32 20:16	20:34 (WEA 2) 21:40	05:38 21:45	20:40 (WEA 2) 21:10	06:15 21:03 (WEA 2)	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 18:29	06:04 19:13	05:31 20:18	20:35 (WEA 2) 21:41	05:39 21:44	20:40 (WEA 2) 21:08	06:16 21:04 (WEA 2)	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 18:31	06:03 19:14	05:31 20:19	20:35 (WEA 2) 21:42	05:39 21:44	20:40 (WEA 2) 21:08	06:18 21:06 (WEA 2)	07:03 19:04	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 18:33	06:01 19:15	05:31 20:21	20:35 (WEA 2) 21:42	05:40 21:43	20:39 (WEA 2) 21:04	06:19 21:04 (WEA 2)	07:04 19:03	07:38 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 18:34	06:00 19:16	05:30 20:22	20:36 (WEA 2) 21:43	05:41 21:42	20:39 (WEA 2) 21:03	06:21 21:03 (WEA 2)	07:06 19:01	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 18:36	05:58 19:17	20:38 (WEA 2) 21:43	20:36 (WEA 2) 21:43	05:42 21:42	20:39 (WEA 2) 21:01	06:22 21:01 (WEA 2)	07:07 19:59	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 18:37	05:57 19:18	20:36 (WEA 2) 21:44	20:36 (WEA 2) 21:44	05:43 21:41	20:39 (WEA 2) 20:59	06:23 20:59 (WEA 2)	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 18:39	05:55 19:19	20:37 (WEA 2) 21:44	20:37 (WEA 2) 21:44	05:44 21:40	20:39 (WEA 2) 20:57	06:25 20:57 (WEA 2)	07:10 19:54	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 18:41	05:54 19:20	20:33 (WEA 2) 21:45	20:33 (WEA 2) 21:45	05:45 21:39	20:39 (WEA 2) 20:56	06:26 20:56 (WEA 2)	07:11 19:52	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 18:42	05:53 19:21	20:32 (WEA 2) 21:45	20:32 (WEA 2) 21:45	05:46 21:38	20:39 (WEA 2) 20:54	06:28 20:54 (WEA 2)	07:13 19:50	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 18:44	05:51 19:22	20:32 (WEA 2) 21:46	20:32 (WEA 2) 21:46	05:48 21:37	20:39 (WEA 2) 20:52	06:29 20:52 (WEA 2)	07:14 19:48	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 18:45	05:50 19:23	20:32 (WEA 2) 21:46	20:32 (WEA 2) 21:46	05:49 21:36	20:39 (WEA 2) 20:50	06:31 20:50 (WEA 2)	07:16 19:46	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 18:47	05:49 19:24	20:31 (WEA 2) 21:47	20:31 (WEA 2) 21:47	05:50 21:35	20:40 (WEA 2) 20:48	06:32 20:48 (WEA 2)	07:17 19:43	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 18:48	05:47 19:25	20:30 (WEA 2) 21:47	20:30 (WEA 2) 21:47	05:51 21:34	20:40 (WEA 2) 20:46	06:34 20:46 (WEA 2)	07:19 19:41	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 18:50	05:46 19:26	20:30 (WEA 2) 21:47	20:30 (WEA 2) 21:47	05:52 21:33	20:40 (WEA 2) 20:44	06:35 20:44 (WEA 2)	07:20 19:39	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 18:51	05:45 19:27	20:30 (WEA 2) 21:47	20:30 (WEA 2) 21:47	05:53 21:32	20:40 (WEA 2) 20:42	06:36 20:42 (WEA 2)	07:22 19:37	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 18:53	05:44 19:28	20:30 (WEA 2) 21:48	20:30 (WEA 2) 21:48	05:55 21:31	20:40 (WEA 2) 20:40	06:38 20:40 (WEA 2)	07:23 19:35	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 18:55	05:43 19:29	20:30 (WEA 2) 21:48	20:30 (WEA 2) 21:48	05:56 21:30	20:41 (WEA 2) 20:38	06:39 20:38 (WEA 2)	07:25 19:33	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 18:56	05:42 19:30	20:30 (WEA 2) 21:48	20:30 (WEA 2) 21:48	05:57 21:29	20:41 (WEA 2) 20:36	06:41 20:36 (WEA 2)	07:26 19:30	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 18:58	05:41 19:31	20:30 (WEA 2) 21:48	20:30 (WEA 2) 21:48	05:58 21:27	20:42 (WEA 2) 20:34	06:42 20:34 (WEA 2)	07:28 19:28	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 18:59	05:40 19:32	20:31 (WEA 2) 21:48	20:31 (WEA 2) 21:48	06:00 21:26	20:43 (WEA 2) 20:32	06:44 20:32 (WEA 2)	07:29 19:26	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 19:01	05:39 19:33	20:31 (WEA 2) 21:48	20:31 (WEA 2) 21:48	06:01 21:25	20:43 (WEA 2) 20:30	06:45 20:30 (WEA 2)	07:31 19:24	08:06 16:42
29	08:14 17:26	07:22 18:02	06:20 19:02	06:16 19:02	05:38 19:34	20:31 (WEA 2) 21:48	20:31 (WEA 2) 21:48	06:02 21:23	20:44 (WEA 2) 20:28	06:47 20:28 (WEA 2)	07:32 19:22	08:08 16:42
30	08:13 17:28	07:20 18:04	06:18 19:04	06:14 19:04	05:37 19:35	20:31 (WEA 2) 21:48	20:31 (WEA 2) 21:48	06:04 21:22	20:46 (WEA 2) 20:26	06:48 20:26 (WEA 2)	07:34 19:20	08:09 16:41
31	08:12 17:29	07:18 18:05	07:18 19:05	07:18 19:05	05:36 19:36	20:32 (WEA 2) 21:48	20:32 (WEA 2) 21:48	06:05 21:20	20:47 (WEA 2) 20:24	06:50 20:24 (WEA 2)	07:35 19:21	08:10 16:40
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					391	603	663	1				
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48	0,48				
Reduktion Betriebsdauer					0,93	0,93	0,93	0,93				
Reduktion Windrichtung					0,57	0,57	0,57	0,57				
Gesamte Reduktion					0,23	0,24	0,25	0,25				
Met. wahrsch. Beschattung					91	145	167	0				

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

Tag im Monat	Sonnenaufgang (SS:MM)	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-15 - 1, Rue Emile Mayrisch, 4470 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:35 (WEA 2) 21:47	05:34 21:19	20:41 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:34 (WEA 2) 21:47	05:34 21:19	20:41 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:35 (WEA 2) 21:47	05:35 21:19	20:41 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:35 (WEA 2) 21:46	05:35 21:14	20:42 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:35 (WEA 2) 21:46	05:36 21:19	20:41 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:35 (WEA 2) 21:45	05:37 21:19	20:41 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:36 (WEA 2) 21:45	05:38 21:19	20:42 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:36 (WEA 2) 21:44	05:39 21:19	20:42 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:36 (WEA 2) 21:44	05:40 21:19	20:42 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:36 (WEA 2) 21:43	05:40 21:19	20:43 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:38 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:37 (WEA 2) 21:42	05:41 21:19	20:42 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:36 (WEA 2) 21:42	05:42 21:19	20:42 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:37 (WEA 2) 21:41	05:43 21:10	20:43 (WEA 2) 21:06	06:23 20:59	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:37 (WEA 2) 21:40	05:44 21:10	20:43 (WEA 2) 20:57	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:38 (WEA 2) 21:39	05:45 21:10	20:43 (WEA 2) 20:56	06:26 19:52	07:12 18:48	07:57 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:38 (WEA 2) 21:38	05:46 21:10	20:43 (WEA 2) 20:54	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:38 (WEA 2) 21:37	05:48 21:10	20:44 (WEA 2) 20:52	06:29 19:48	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:38 (WEA 2) 21:36	05:49 21:10	20:44 (WEA 2) 20:50	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:39 (WEA 2) 21:35	05:50 21:10	20:46 (WEA 2) 20:48	06:32 19:43	07:17 18:40	08:02 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:38 (WEA 2) 21:34	05:51 21:10	20:46 (WEA 2) 20:46	06:34 19:41	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:37 (WEA 2) 21:33	05:52 21:10	20:46 (WEA 2) 20:44	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:36 (WEA 2) 21:32	05:53 21:10	20:47 (WEA 2) 20:42	06:36 19:37	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:36 (WEA 2) 21:31	05:55 21:10	20:48 (WEA 2) 20:40	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:35 (WEA 2) 21:30	05:56 21:10	20:48 (WEA 2) 20:38	06:39 19:33	07:25 18:31	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:35 (WEA 2) 21:29	05:57 21:10	20:40 (WEA 2) 20:36	06:41 19:30	07:26 17:29	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:34 (WEA 2) 21:27	05:58 21:10	20:52 (WEA 2) 20:34	06:42 19:28	07:28 17:27	08:14 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:35 (WEA 2) 21:28	06:00 21:10	20:54 (WEA 2) 21:26	06:44 19:26	07:29 17:25	08:15 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:35 (WEA 2) 21:28	06:01 21:10	20:57 (WEA 2) 21:25	06:45 19:24	07:31 17:23	08:16 16:42
29	08:14 17:26	07:22 19:02	06:20 20:02	06:18 20:50	05:38 21:31	05:32 21:48	20:35 (WEA 2) 21:28	06:02 21:10	20:58 (WEA 2) 21:23	06:47 19:22	07:32 17:22	08:17 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:28	05:33 21:47	20:34 (WEA 2) 21:27	06:04 21:10	20:59 (WEA 2) 21:22	06:48 19:20	07:34 17:20	08:19 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	06:16 21:33	05:36 21:28	05:34 21:03	20:35 (WEA 2) 21:03	06:05 21:20	20:50 (WEA 2) 20:24	06:50 19:22	07:22 17:18	08:20 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					282	836						
Red. Sonnenscheinwahrsch.					0,44	0,45	609					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					65	200	153					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-16 - 4, Rue Emile Mayrisch, 4470 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:42 (WEA 2) 21:47	05:34 21:47	20:47 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:42 (WEA 2) 21:47	05:34 21:47	20:46 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:42 (WEA 2) 21:47	05:35 21:47	20:47 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:42 (WEA 2) 21:46	05:35 21:46	20:48 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:42 (WEA 2) 21:46	05:36 21:46	20:47 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:41 (WEA 2) 21:45	05:37 21:45	20:48 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:42 (WEA 2) 21:45	05:38 21:45	20:48 (WEA 2) 21:10	06:15 20:09	06:58 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:42 (WEA 2) 21:44	05:39 21:44	20:49 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:42 (WEA 2) 21:44	05:40 21:44	20:49 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:42 (WEA 2) 21:43	05:40 21:43	20:50 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:43 (WEA 2) 21:42	05:41 21:42	20:49 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:42 (WEA 2) 21:42	05:42 21:42	20:50 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:42 (WEA 2) 21:41	05:43 21:41	20:51 (WEA 2) 21:00	06:23 20:59	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:42 (WEA 2) 21:40	05:44 21:40	20:51 (WEA 2) 20:57	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:43 (WEA 2) 21:39	05:45 21:39	20:52 (WEA 2) 21:09	06:26 19:52	07:12 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:43 (WEA 2) 21:38	05:46 21:38	20:52 (WEA 2) 21:08	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:43 (WEA 2) 21:37	05:48 21:37	20:53 (WEA 2) 21:07	06:29 19:48	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:43 (WEA 2) 21:36	05:49 21:36	20:54 (WEA 2) 21:06	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:43 (WEA 2) 21:35	05:50 21:35	20:56 (WEA 2) 21:06	06:32 19:43	07:17 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:43 (WEA 2) 21:34	05:51 21:34	20:58 (WEA 2) 21:05	06:34 19:41	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:44 (WEA 2) 21:33	05:52 21:33	20:59 (WEA 2) 21:04	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:44 (WEA 2) 21:32	05:53 21:32	20:50 (WEA 2) 21:04	06:36 19:37	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:48 (WEA 2) 21:34	05:55 21:31	20:56 (WEA 2) 21:04	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:46 (WEA 2) 21:30	05:56 21:30	20:58 (WEA 2) 21:06	06:39 19:33	07:25 18:31	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:45 (WEA 2) 21:29	05:57 21:29	20:59 (WEA 2) 21:05	06:41 19:30	07:26 17:29	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:44 (WEA 2) 21:27	05:58 21:27	20:55 (WEA 2) 21:04	06:42 19:28	07:28 17:27	08:14 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:44 (WEA 2) 21:26	06:00 21:26	20:52 (WEA 2) 21:06	06:44 19:26	07:29 17:25	08:15 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:44 (WEA 2) 21:25	06:01 21:25	20:54 (WEA 2) 21:08	06:45 19:24	07:31 17:23	08:16 16:42
29	08:14 17:26	07:22 19:01	06:22 20:02	06:20 20:50	05:38 21:31	05:32 21:48	20:43 (WEA 2) 21:23	06:02 21:23	20:56 (WEA 2) 21:09	06:47 19:22	07:32 17:22	08:17 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:15 21:32	05:37 21:20	05:33 21:47	20:42 (WEA 2) 21:22	06:04 21:22	20:58 (WEA 2) 21:06	06:48 19:20	07:34 17:20	08:19 16:41
31	08:12 17:29	07:18 20:05	06:17 20:05	06:14 21:33	05:36 21:03	05:34 21:03	20:43 (WEA 2) 21:03	06:05 21:03	20:59 (WEA 2) 21:04	06:50 20:24	07:22 17:18	08:20 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					131	854	432					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,56	0,56	0,56					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					30	203	108					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-17 - 62, Rue de Differdange, Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:28 (WEA 2) 21:47	05:34 21:47	20:36 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:28 (WEA 2) 21:47	05:34 21:47	20:36 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:29 (WEA 2) 21:47	05:35 21:47	20:36 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:29 (WEA 2) 21:46	05:35 21:46	20:36 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:30 (WEA 2) 21:46	05:36 21:46	20:36 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:30 (WEA 2) 21:45	05:37 21:45	20:36 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:30 (WEA 2) 21:45	05:38 21:45	20:36 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:31 (WEA 2) 21:44	05:39 21:44	20:36 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:31 (WEA 2) 21:44	05:40 21:44	20:37 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:31 (WEA 2) 21:43	05:40 21:43	20:36 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:32 (WEA 2) 21:42	05:41 21:42	20:36 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:32 (WEA 2) 21:42	05:42 21:42	20:36 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:32 (WEA 2) 21:41	05:43 21:41	20:36 (WEA 2) 21:05	06:23 19:56	07:09 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:32 (WEA 2) 21:44	05:44 21:40	20:36 (WEA 2) 21:05	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:32 (WEA 2) 21:45	05:45 21:39	20:36 (WEA 2) 21:05	06:26 19:52	07:12 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:33 (WEA 2) 21:45	05:46 21:38	20:36 (WEA 2) 21:05	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:34 (WEA 2) 21:46	05:48 21:37	20:36 (WEA 2) 21:05	06:29 19:48	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:34 (WEA 2) 21:46	05:49 21:36	20:37 (WEA 2) 21:05	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:34 (WEA 2) 21:47	05:50 21:35	20:38 (WEA 2) 21:06	06:32 19:43	07:17 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:34 (WEA 2) 21:47	05:51 21:34	20:38 (WEA 2) 21:05	06:34 19:41	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:35 (WEA 2) 21:47	05:52 21:33	20:38 (WEA 2) 21:04	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:35 (WEA 2) 21:47	05:53 21:32	20:38 (WEA 2) 21:03	06:36 19:37	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:35 (WEA 2) 21:48	05:55 21:31	20:38 (WEA 2) 21:02	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:35 (WEA 2) 21:48	05:56 21:30	20:39 (WEA 2) 21:01	06:39 19:33	07:25 18:31	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:36 (WEA 2) 21:48	05:57 21:29	20:39 (WEA 2) 21:05	06:41 19:30	07:26 17:29	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:35 (WEA 2) 21:48	05:58 21:27	20:41 (WEA 2) 21:05	06:42 19:28	07:28 17:27	08:13 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:36 (WEA 2) 21:48	06:00 21:26	20:41 (WEA 2) 21:05	06:44 19:26	07:29 17:25	08:16 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:36 (WEA 2) 21:48	06:01 21:25	20:42 (WEA 2) 21:05	06:45 19:24	07:31 17:23	08:17 16:42
29	08:14 17:26	07:22 18:16	06:22 19:01	06:20 20:48	05:38 21:31	05:32 21:48	20:36 (WEA 2) 21:48	06:02 21:23	20:43 (WEA 2) 21:05	06:47 19:22	07:32 17:22	08:18 16:42
30	08:13 17:28	07:20 18:04	06:18 19:04	06:16 20:51	05:37 21:32	05:33 21:47	20:36 (WEA 2) 21:47	06:04 21:22	20:45 (WEA 2) 21:05	06:48 19:20	07:34 17:20	08:19 16:41
31	08:12 17:29	07:18 18:05	06:18 19:05	06:16 20:55	05:36 21:33	05:36 21:48	20:36 (WEA 2) 21:48	06:05 21:20	20:48 (WEA 2) 21:05	06:50 20:24	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					429	763	744					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					100	184	187					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-18 - 69, Rue de Differdange, Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:34 (WEA 2) 21:47	05:34 21:19	20:40 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:34 (WEA 2) 21:47	05:34 21:19	20:39 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:34 (WEA 2) 21:47	05:35 21:19	20:40 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:34 (WEA 2) 21:46	05:35 21:11	20:40 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:34 (WEA 2) 21:46	05:36 21:10	20:40 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:34 (WEA 2) 21:45	05:37 21:11	20:40 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:35 (WEA 2) 21:45	05:38 21:11	20:41 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:35 (WEA 2) 21:44	05:39 21:11	20:41 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:35 (WEA 2) 21:44	05:40 21:11	20:42 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:35 (WEA 2) 21:43	05:40 21:11	20:42 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:35 (WEA 2) 21:42	05:41 21:11	20:41 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:35 (WEA 2) 21:42	05:42 21:11	20:42 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:35 (WEA 2) 21:41	05:43 21:10	20:42 (WEA 2) 21:09	06:23 19:56	07:09 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:36 (WEA 2) 21:40	05:44 21:10	20:42 (WEA 2) 20:57	06:25 19:54	07:10 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:36 (WEA 2) 21:39	05:45 21:09	20:43 (WEA 2) 20:56	06:26 19:52	07:12 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:36 (WEA 2) 21:38	05:46 21:08	20:43 (WEA 2) 20:54	06:28 19:50	07:13 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:36 (WEA 2) 21:37	05:48 21:07	20:44 (WEA 2) 20:52	06:29 19:48	07:14 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:37 (WEA 2) 21:36	05:49 21:06	20:44 (WEA 2) 20:50	06:31 19:46	07:16 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:37 (WEA 2) 21:35	05:50 21:06	20:46 (WEA 2) 20:48	06:32 19:43	07:17 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:37 (WEA 2) 21:34	05:51 21:05	20:46 (WEA 2) 20:46	06:34 19:41	07:19 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:38 (WEA 2) 21:33	05:52 21:04	20:47 (WEA 2) 20:44	06:35 19:39	07:20 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:38 (WEA 2) 21:32	05:53 21:03	20:48 (WEA 2) 20:42	06:36 19:37	07:22 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:38 (WEA 2) 21:31	05:55 21:02	20:49 (WEA 2) 20:40	06:38 19:35	07:23 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:38 (WEA 2) 21:30	05:56 21:01	20:50 (WEA 2) 20:38	06:39 19:33	07:25 18:31	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:38 (WEA 2) 21:29	05:57 21:09	20:52 (WEA 2) 20:36	06:41 19:30	07:26 17:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:38 (WEA 2) 21:27	05:58 21:08	06:42 20:34	07:28 19:28	07:14 17:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:39 (WEA 2) 21:26	06:00 21:09	06:44 20:32	07:29 19:26	07:16 17:25	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:39 (WEA 2) 21:25	06:01 21:09	06:45 20:30	07:31 19:24	07:17 17:23	08:06 16:42
29	08:14 17:26	07:22 19:02	06:20 20:50	06:18 21:31	05:38 21:27	05:32 21:48	20:34 (WEA 2) 21:23	06:02 21:10	06:47 20:28	07:32 19:22	07:19 17:22	08:08 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:28	05:33 21:47	20:34 (WEA 2) 21:22	06:04 21:09	06:48 20:26	07:34 19:20	07:21 17:20	08:09 16:41
31	08:12 17:29	07:18 20:05	06:18 20:50	06:16 21:33	05:36 21:29	05:34 21:03	20:34 (WEA 2) 21:03	06:05 21:20	06:50 20:24	07:22 17:18	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					269	904	615					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					62	217	154					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-19 - 35, Rue des Erables, 4423 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:42 (WEA 2) 21:47	05:34 21:15 (WEA 2)	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:41 (WEA 2) 21:47	05:34 21:15 (WEA 2)	06:08 21:17	06:53 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:42 (WEA 2) 21:47	05:35 21:16	06:09 21:18	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:41 (WEA 2) 21:46	05:35 21:15 (WEA 2)	06:11 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:41 (WEA 2) 21:46	05:36 21:15 (WEA 2)	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:41 (WEA 2) 21:45	05:37 21:14 (WEA 2)	06:13 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:41 (WEA 2) 21:45	05:38 21:14 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:41 (WEA 2) 21:44	05:39 21:14 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:41 (WEA 2) 21:44	05:40 21:14 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:41 (WEA 2) 21:43	05:40 21:13 (WEA 2)	06:19 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:41 (WEA 2) 21:42	05:41 21:12 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:41 (WEA 2) 21:42	05:42 21:11 (WEA 2)	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:41 (WEA 2) 21:41	05:43 21:10 (WEA 2)	06:23 20:59	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:41 (WEA 2) 21:40	05:44 21:10 (WEA 2)	06:25 20:57	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:41 (WEA 2) 21:39	05:45 21:09 (WEA 2)	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:42 (WEA 2) 21:38	05:46 21:08 (WEA 2)	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:42 (WEA 2) 21:37	05:48 21:07 (WEA 2)	06:29 20:52	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:42 (WEA 2) 21:37	05:49 21:06 (WEA 2)	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:42 (WEA 2) 21:35	05:50 21:06 (WEA 2)	06:32 20:48	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:42 (WEA 2) 21:34	05:51 21:03 (WEA 2)	06:34 20:46	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:43 (WEA 2) 21:33	05:52 21:04 (WEA 2)	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:43 (WEA 2) 21:32	05:53 21:03 (WEA 2)	06:36 20:42	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:43 (WEA 2) 21:31	05:55 21:03 (WEA 2)	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:43 (WEA 2) 21:30	05:56 21:04 (WEA 2)	06:39 20:38	07:25 19:33	08:11 18:31	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:44 (WEA 2) 21:29	05:57 21:03 (WEA 2)	06:41 20:36	07:26 19:30	08:12 18:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:44 (WEA 2) 21:27	05:58 21:03 (WEA 2)	06:42 20:34	07:28 19:28	08:14 18:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:44 (WEA 2) 21:26	06:00 21:03 (WEA 2)	06:44 20:32	07:29 19:26	08:16 18:25	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:44 (WEA 2) 21:25	06:01 21:04 (WEA 2)	06:45 20:30	07:31 19:24	08:17 18:23	08:06 16:42
29	08:14 17:26	07:22 18:02	06:20 19:01	06:17 20:50	05:38 21:31	05:32 21:48	20:45 (WEA 2) 21:23	06:02 21:03 (WEA 2)	06:47 20:28	07:32 19:22	08:18 18:22	08:08 16:42
30	08:13 17:28	07:20 18:04	06:18 19:01	06:15 20:51	05:37 21:32	05:33 21:47	20:45 (WEA 2) 21:22	06:04 21:04 (WEA 2)	06:48 20:26	07:34 19:20	08:19 18:20	08:09 16:41
31	08:12 17:29	07:18 18:05	06:17 19:05	06:14 20:56	05:36 21:33	05:34 21:48	20:46 (WEA 2) 21:20	06:05 21:05 (WEA 2)	06:50 20:24	07:22 19:18	08:20 18:25	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					112	873	419					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,56	0,56	0,56					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					26	208	104					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-20 - 69, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:27 (WEA 2) 21:47	05:34 21:03 (WEA 2)	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:27 (WEA 2) 21:47	05:34 21:02 (WEA 2)	06:08 21:17	06:53 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:28 (WEA 2) 21:47	05:35 21:03 (WEA 2)	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:28 (WEA 2) 21:46	05:35 21:04 (WEA 2)	06:11 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:29 (WEA 2) 21:46	05:36 21:03 (WEA 2)	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:28 (WEA 2) 21:45	05:37 21:04 (WEA 2)	06:13 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:29 (WEA 2) 21:45	05:38 21:04 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:30 (WEA 2) 21:44	05:39 21:05 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:29 (WEA 2) 21:44	05:40 21:05 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:30 (WEA 2) 21:43	05:40 21:05 (WEA 2)	06:19 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:31 (WEA 2) 21:42	05:41 21:05 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:30 (WEA 2) 21:42	05:42 21:05 (WEA 2)	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:31 (WEA 2) 21:41	05:43 21:05 (WEA 2)	06:23 21:05	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:31 (WEA 2) 21:44	05:44 21:05 (WEA 2)	06:25 20:57	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:31 (WEA 2) 21:45	05:45 21:05 (WEA 2)	06:26 21:05	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:32 (WEA 2) 21:45	05:46 21:05 (WEA 2)	06:28 21:05	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:32 (WEA 2) 21:46	05:48 21:05 (WEA 2)	06:29 21:05	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:32 (WEA 2) 21:46	05:49 21:05 (WEA 2)	06:31 21:05	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:32 (WEA 2) 21:47	05:50 21:05 (WEA 2)	06:32 21:06	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:32 (WEA 2) 21:47	05:51 21:05 (WEA 2)	06:34 21:06	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:33 (WEA 2) 21:47	05:52 21:04 (WEA 2)	06:35 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:33 (WEA 2) 21:47	05:53 21:03 (WEA 2)	06:36 21:03	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:33 (WEA 2) 21:48	05:55 21:02 (WEA 2)	06:38 21:02	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:33 (WEA 2) 21:48	05:56 21:01 (WEA 2)	06:39 21:01	07:25 19:33	08:11 18:31	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:34 (WEA 2) 21:48	05:57 21:01 (WEA 2)	06:41 21:01	07:26 19:30	08:12 18:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:34 (WEA 2) 21:48	05:58 21:01 (WEA 2)	06:42 21:01	07:28 19:28	08:14 18:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:34 (WEA 2) 21:48	06:00 21:01 (WEA 2)	06:44 21:01	07:29 19:26	08:15 18:25	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:34 (WEA 2) 21:48	06:01 21:01 (WEA 2)	06:45 21:01	07:31 19:24	08:17 18:23	08:06 16:42
29	08:14 17:26	07:22 19:02	06:20 20:50	06:18 21:31	05:38 21:30	05:32 21:48	20:34 (WEA 2) 21:48	06:02 21:02 (WEA 2)	06:47 21:02	07:32 19:22	08:18 18:22	08:08 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:30	05:33 21:47	20:34 (WEA 2) 21:47	06:04 21:22	06:48 21:22	07:34 19:20	08:19 18:20	08:33 16:41
31	08:12 17:29	07:18 20:05	06:18 20:55	06:16 21:33	05:36 21:30	05:33 21:48	20:34 (WEA 2) 21:48	06:05 21:20	06:50 20:24	07:22 17:18	08:22 18:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					432	834	762					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					101	201	192					

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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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-21 - 74, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:26 (WEA 2) 21:47	05:34 21:03 (WEA 2)	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:26 (WEA 2) 21:47	05:34 21:03 (WEA 2)	06:08 21:17	06:53 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:27 (WEA 2) 21:47	05:35 21:04 (WEA 2)	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:26 (WEA 2) 21:46	05:35 21:04 (WEA 2)	06:11 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:27 (WEA 2) 21:46	05:36 21:04 (WEA 2)	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:27 (WEA 2) 21:45	05:37 21:04 (WEA 2)	06:13 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:27 (WEA 2) 21:45	05:38 21:05 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:28 (WEA 2) 21:44	05:39 21:05 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:27 (WEA 2) 21:44	05:40 21:05 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:28 (WEA 2) 21:43	05:40 21:06 (WEA 2)	06:19 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:29 (WEA 2) 21:42	05:41 21:05 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:28 (WEA 2) 21:42	05:42 21:05 (WEA 2)	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:28 (WEA 2) 21:41	05:43 21:05 (WEA 2)	06:23 21:05	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:29 (WEA 2) 21:40	05:44 21:05 (WEA 2)	06:25 20:57	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:34 (WEA 2) 21:45	05:45 21:05 (WEA 2)	06:26 21:05	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:32 (WEA 2) 21:45	05:46 21:05 (WEA 2)	06:28 21:05	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:31 (WEA 2) 21:46	05:48 21:05 (WEA 2)	06:29 21:05	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:30 (WEA 2) 21:46	05:49 21:05 (WEA 2)	06:31 21:05	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:29 (WEA 2) 21:47	05:50 21:05 (WEA 2)	06:32 21:05	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:28 (WEA 2) 21:47	05:51 21:05 (WEA 2)	06:34 21:05	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:27 (WEA 2) 21:47	05:52 21:05 (WEA 2)	06:35 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:27 (WEA 2) 21:47	05:53 21:05 (WEA 2)	06:36 21:03	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:26 (WEA 2) 21:48	05:55 21:05 (WEA 2)	06:38 21:02	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:26 (WEA 2) 21:48	05:56 21:05 (WEA 2)	06:39 21:01	07:25 19:33	08:11 18:31	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:26 (WEA 2) 21:48	05:57 21:02 (WEA 2)	06:41 21:29	07:26 19:30	08:12 17:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:25 (WEA 2) 21:48	05:58 21:03 (WEA 2)	06:42 21:27	07:28 19:28	08:14 17:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:26 (WEA 2) 21:48	06:00 21:02 (WEA 2)	06:44 21:26	07:29 19:26	08:16 17:25	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:26 (WEA 2) 21:48	06:01 21:02 (WEA 2)	06:45 21:25	07:31 19:24	08:17 17:23	08:06 16:42
29	08:14 17:26	07:22 19:01	06:20 20:02	06:18 20:50	05:38 21:31	05:32 21:48	20:26 (WEA 2) 21:48	06:02 21:03 (WEA 2)	06:47 21:23	07:32 19:22	08:18 17:22	08:08 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:31	05:33 21:47	20:26 (WEA 2) 21:47	06:04 21:03 (WEA 2)	06:48 21:22	07:34 19:20	08:19 17:20	08:33 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	06:16 21:33	05:36 21:32	05:36 21:48	20:26 (WEA 2) 21:48	06:05 21:20	06:50 20:24	07:22 17:18	08:33 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					431	912	787					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					100	219	198					

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-22 - 73, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:34 (WEA 2) 21:47	05:34 21:19	20:38 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:33 (WEA 2) 21:47	05:34 21:19	20:38 (WEA 2) 21:19	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:34 (WEA 2) 21:47	05:35 21:19	20:39 (WEA 2) 21:19	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:33 (WEA 2) 21:46	05:35 21:19	20:39 (WEA 2) 21:19	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:34 (WEA 2) 21:46	05:36 21:19	20:39 (WEA 2) 21:19	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:33 (WEA 2) 21:45	05:37 21:19	20:39 (WEA 2) 21:19	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:33 (WEA 2) 21:45	05:38 21:19	20:40 (WEA 2) 21:19	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:34 (WEA 2) 21:44	05:39 21:19	20:40 (WEA 2) 21:19	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:33 (WEA 2) 21:44	05:40 21:19	20:41 (WEA 2) 21:19	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:34 (WEA 2) 21:43	05:40 21:19	20:41 (WEA 2) 21:19	06:19 20:03	07:04 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:34 (WEA 2) 21:42	05:41 21:19	20:41 (WEA 2) 21:19	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:33 (WEA 2) 21:42	05:42 21:19	20:41 (WEA 2) 21:19	06:22 20:01	07:07 19:59	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:34 (WEA 2) 21:41	05:43 21:19	20:42 (WEA 2) 21:19	06:23 20:59	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:34 (WEA 2) 21:40	05:44 21:19	20:42 (WEA 2) 21:19	06:25 20:57	07:10 19:54	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:34 (WEA 2) 21:39	05:45 21:19	20:43 (WEA 2) 21:19	06:26 20:56	07:12 19:52	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:35 (WEA 2) 21:38	05:46 21:19	20:43 (WEA 2) 21:19	06:28 20:54	07:13 19:50	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:35 (WEA 2) 21:37	05:48 21:19	20:44 (WEA 2) 21:19	06:29 20:52	07:14 19:48	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:35 (WEA 2) 21:37	05:49 21:19	20:45 (WEA 2) 21:19	06:31 20:50	07:16 19:46	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:35 (WEA 2) 21:35	05:50 21:19	20:47 (WEA 2) 21:19	06:32 20:48	07:17 19:43	08:02 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:35 (WEA 2) 21:34	05:51 21:19	20:48 (WEA 2) 21:19	06:34 20:46	07:19 19:41	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:36 (WEA 2) 21:33	05:52 21:19	20:49 (WEA 2) 21:19	06:35 20:44	07:20 19:39	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:36 (WEA 2) 21:32	05:53 21:19	20:50 (WEA 2) 21:19	06:36 20:42	07:22 19:37	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:36 (WEA 2) 21:31	05:55 21:19	20:52 (WEA 2) 21:19	06:38 20:40	07:23 19:35	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:36 (WEA 2) 21:30	05:56 21:19	20:53 (WEA 2) 21:19	06:39 20:38	07:25 19:33	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:37 (WEA 2) 21:29	05:57 21:19	20:54 (WEA 2) 21:19	06:41 20:36	07:26 19:30	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:37 (WEA 2) 21:27	05:58 21:19	20:55 (WEA 2) 21:19	06:42 20:34	07:28 19:28	08:14 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:37 (WEA 2) 21:26	06:00 21:19	20:56 (WEA 2) 21:19	06:44 20:32	07:29 19:26	08:16 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:37 (WEA 2) 21:25	06:01 21:19	20:57 (WEA 2) 21:19	06:45 20:30	07:31 19:24	08:17 16:42
29	08:14 17:26	07:22 19:02	06:20 20:50	06:18 21:31	05:38 21:27	05:32 21:48	20:38 (WEA 2) 21:23	06:02 21:19	20:58 (WEA 2) 21:19	06:47 20:28	07:32 19:22	08:18 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:27	05:33 21:47	20:38 (WEA 2) 21:22	06:04 21:19	20:59 (WEA 2) 21:19	06:48 20:26	07:34 19:20	08:19 16:41
31	08:12 17:29	07:18 20:05	06:16 20:50	06:14 21:33	05:36 21:29	05:34 21:03	20:34 (WEA 2) 21:03	06:05 21:20	20:50 (WEA 2) 20:24	06:50 20:24	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					238	953						
Red. Sonnenscheinwahrsch.					0,44	0,45						
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,56	0,56						
Gesamte Reduktion					0,23	0,24						
Met. wahrsch. Beschattung					55	228						

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-23 - 80, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:26 (WEA 2) 21:47	05:34 21:47	20:32 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:26 (WEA 2) 21:47	05:34 21:47	20:32 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:26 (WEA 2) 21:47	05:35 21:47	20:32 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:26 (WEA 2) 21:46	05:35 21:46	20:33 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:27 (WEA 2) 21:46	05:36 21:46	20:32 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:26 (WEA 2) 21:45	05:37 21:45	20:33 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:27 (WEA 2) 21:45	05:38 21:45	20:33 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:28 (WEA 2) 21:44	05:39 21:44	20:33 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:27 (WEA 2) 21:44	05:40 21:44	20:34 (WEA 2) 21:06	06:18 21:06	07:03 20:05	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:28 (WEA 2) 21:43	05:40 21:43	20:34 (WEA 2) 21:04	06:19 21:04	07:04 20:03	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:28 (WEA 2) 21:42	05:41 21:42	20:33 (WEA 2) 21:03	06:21 21:03	07:06 20:01	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:28 (WEA 2) 21:42	05:42 21:42	20:34 (WEA 2) 21:01	06:22 21:01	07:07 19:59	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:28 (WEA 2) 21:41	05:43 21:41	20:34 (WEA 2) 21:06	06:23 21:06	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:28 (WEA 2) 21:40	05:44 21:40	20:34 (WEA 2) 21:05	06:25 21:05	07:10 19:54	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:29 (WEA 2) 21:39	05:45 21:39	20:35 (WEA 2) 21:06	06:26 21:06	07:12 19:52	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:29 (WEA 2) 21:38	05:46 21:38	20:35 (WEA 2) 21:05	06:28 21:05	07:13 19:50	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:29 (WEA 2) 21:37	05:48 21:37	20:35 (WEA 2) 21:05	06:29 21:05	07:14 19:48	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:29 (WEA 2) 21:37	05:49 21:37	20:36 (WEA 2) 21:05	06:31 21:05	07:16 19:46	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:29 (WEA 2) 21:35	05:50 21:35	20:37 (WEA 2) 21:06	06:32 21:06	07:17 19:43	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:29 (WEA 2) 21:34	05:51 21:34	20:37 (WEA 2) 21:05	06:34 21:05	07:19 19:41	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:28 (WEA 2) 21:33	05:30 21:33	20:38 (WEA 2) 21:04	06:35 21:04	07:20 19:39	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:28 (WEA 2) 21:32	05:53 21:32	20:38 (WEA 2) 21:03	06:36 21:03	07:22 19:37	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:27 (WEA 2) 21:31	05:55 21:31	20:39 (WEA 2) 21:02	06:38 21:02	07:23 19:35	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:27 (WEA 2) 21:30	05:56 21:30	20:40 (WEA 2) 21:01	06:39 21:01	07:25 19:33	08:00 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:26 (WEA 2) 21:48	05:57 21:48	20:41 (WEA 2) 21:29	06:41 21:29	07:26 19:30	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:26 (WEA 2) 21:48	05:58 21:48	20:43 (WEA 2) 21:27	06:42 21:27	07:28 19:28	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:27 (WEA 2) 21:48	06:00 21:48	20:44 (WEA 2) 21:26	06:44 21:26	07:29 19:26	08:05 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:26 (WEA 2) 21:48	06:01 21:48	20:47 (WEA 2) 21:25	06:45 21:25	07:31 19:24	08:06 16:42
29	08:14 17:26	07:22 19:01	06:20 19:01	06:17 20:50	05:38 21:31	05:32 21:48	20:26 (WEA 2) 21:48	06:02 21:48	20:55 (WEA 2) 21:23	06:47 21:23	07:32 19:22	08:08 16:42
30	08:13 17:28	07:20 19:04	06:18 19:04	06:15 20:51	05:37 21:32	05:33 21:47	20:26 (WEA 2) 21:47	06:04 21:47	20:55 (WEA 2) 21:22	06:48 21:22	07:34 19:20	08:09 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	06:15 21:33	05:36 21:33	05:36 21:33	20:26 (WEA 2) 21:33	06:05 21:33	20:55 (WEA 2) 21:24	06:50 21:24	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					403	958	778					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					94	230	196					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-24 - 90, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:27 (WEA 2) 21:47	05:34 21:47	20:33 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:27 (WEA 2) 21:47	05:34 21:47	20:32 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:27 (WEA 2) 21:47	05:35 21:47	20:33 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:27 (WEA 2) 21:46	05:35 21:46	20:33 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:28 (WEA 2) 21:46	05:36 21:46	20:33 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:27 (WEA 2) 21:45	05:37 21:45	20:33 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:28 (WEA 2) 21:45	05:38 21:45	20:34 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:28 (WEA 2) 21:44	05:39 21:44	20:34 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:28 (WEA 2) 21:44	05:40 21:44	20:35 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:28 (WEA 2) 21:43	05:40 21:43	20:35 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:29 (WEA 2) 21:42	05:41 21:42	20:34 (WEA 2) 21:03	06:21 20:01	07:06 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:28 (WEA 2) 21:42	05:42 21:42	20:35 (WEA 2) 21:01	06:22 20:07	07:07 19:59	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:28 (WEA 2) 21:41	05:43 21:41	20:35 (WEA 2) 21:07	06:23 20:59	07:09 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:29 (WEA 2) 21:40	05:44 21:40	20:36 (WEA 2) 21:07	06:25 20:57	07:10 19:54	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:29 (WEA 2) 21:39	05:45 21:39	20:36 (WEA 2) 21:07	06:26 20:56	07:12 19:52	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:29 (WEA 2) 21:38	05:46 21:38	20:36 (WEA 2) 21:06	06:28 20:54	07:13 19:50	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:29 (WEA 2) 21:37	05:48 21:37	20:37 (WEA 2) 21:06	06:29 20:52	07:14 19:48	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:29 (WEA 2) 21:37	05:49 21:37	20:37 (WEA 2) 21:06	06:31 20:50	07:16 19:46	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:30 (WEA 2) 21:35	05:50 21:35	20:39 (WEA 2) 21:06	06:32 20:48	07:17 19:43	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:32 (WEA 2) 21:34	05:51 21:34	20:39 (WEA 2) 21:05	06:34 20:46	07:19 19:41	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:31 (WEA 2) 21:33	05:52 21:33	20:40 (WEA 2) 21:04	06:35 20:44	07:20 19:39	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:30 (WEA 2) 21:32	05:53 21:32	20:41 (WEA 2) 21:03	06:36 20:42	07:22 19:37	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:29 (WEA 2) 21:31	05:55 21:31	20:42 (WEA 2) 21:02	06:38 20:40	07:23 19:35	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:29 (WEA 2) 21:30	05:56 21:30	20:43 (WEA 2) 21:01	06:39 20:38	07:25 19:33	08:11 16:46
25	08:19 17:20	07:29 18:11	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:28 (WEA 2) 21:29	05:57 21:29	20:44 (WEA 2) 21:05	06:41 20:59	07:26 19:30	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:29 (WEA 2) 21:27	05:58 21:27	20:47 (WEA 2) 21:06	06:42 20:58	07:28 19:28	08:13 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:28 (WEA 2) 21:26	06:00 21:26	20:58 (WEA 2) 21:06	06:44 20:32	07:29 19:26	08:15 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:28 (WEA 2) 21:25	06:01 21:25	20:58 (WEA 2) 21:03	06:45 20:30	07:31 19:24	08:17 16:42
29	08:14 17:26	07:22 19:01	06:20 19:01	06:17 20:49	05:38 21:31	05:32 21:48	20:27 (WEA 2) 21:23	06:02 21:23	20:58 (WEA 2) 21:06	06:47 20:28	07:32 19:22	08:18 16:42
30	08:13 17:28	07:20 19:04	06:18 19:04	06:15 20:51	05:37 21:32	05:33 21:47	20:27 (WEA 2) 21:22	06:04 21:22	20:58 (WEA 2) 21:06	06:48 20:26	07:34 19:20	08:19 16:41
31	08:12 17:29	07:18 19:05	06:16 19:05	06:13 20:50	05:36 21:33	05:34 21:48	20:27 (WEA 2) 21:20	06:05 21:20	20:58 (WEA 2) 21:06	06:50 20:24	07:22 17:18	08:20 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					361	999	743					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,93					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					84	240	186					

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

Tag im Monat	Sonnenaufgang (SS:MM)	Sonnenuntergang (SS:MM)	Minuten mit Schatten	Zeitpunkt (SS:MM) Schattenanfang (WEA mit erstem Schatten)	Zeitpunkt (SS:MM) Schattenende (WEA mit letztem Schatten)
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## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-25 - 25, Rue des Erables, 4423 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:36 21:34	20:49 (WEA 2) 21:47	05:34 21:47	20:50 (WEA 2) 21:19	06:06 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:48 (WEA 2) 21:47	05:34 21:47	20:50 (WEA 2) 21:17	06:08 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:48 (WEA 2) 21:47	05:35 21:47	20:51 (WEA 2) 21:16	06:09 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:47 (WEA 2) 21:46	05:35 21:46	20:52 (WEA 2) 21:14	06:11 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:47 (WEA 2) 21:46	05:36 21:46	20:52 (WEA 2) 21:13	06:12 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:46 (WEA 2) 21:45	05:37 21:45	20:52 (WEA 2) 21:11	06:13 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:46 (WEA 2) 21:45	05:38 21:45	20:53 (WEA 2) 21:10	06:15 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:47 (WEA 2) 21:44	05:39 21:44	20:54 (WEA 2) 21:08	06:16 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:46 (WEA 2) 21:44	05:40 21:44	20:55 (WEA 2) 21:06	06:18 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:46 (WEA 2) 21:43	05:40 21:43	20:56 (WEA 2) 21:04	06:19 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:46 (WEA 2) 21:42	05:41 21:42	20:56 (WEA 2) 21:03	06:21 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:45 (WEA 2) 21:42	05:42 21:42	20:58 (WEA 2) 21:01	06:22 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:46 (WEA 2) 21:41	05:43 21:41	20:59 (WEA 2) 21:01	06:23 20:59	07:53 19:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:46 (WEA 2) 21:40	05:44 21:40	21:01 (WEA 2) 20:57	06:25 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:46 (WEA 2) 21:39	05:45 21:39	21:09 (WEA 2) 20:56	06:26 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:46 (WEA 2) 21:38	05:46 21:38	20:56 (WEA 2) 20:54	06:28 19:50	07:13 18:46	07:58 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:46 (WEA 2) 21:37	05:48 21:37	20:54 (WEA 2) 20:52	06:29 19:48	07:14 18:44	08:00 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:46 (WEA 2) 21:37	05:49 21:37	20:51 (WEA 2) 20:50	06:31 19:46	07:16 18:42	08:01 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:46 (WEA 2) 21:35	05:50 21:35	20:52 (WEA 2) 20:48	06:32 19:43	07:17 18:40	08:03 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:46 (WEA 2) 21:34	05:51 21:34	20:53 (WEA 2) 20:46	06:34 19:41	07:19 18:38	08:04 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:47 (WEA 2) 21:33	05:52 21:33	20:54 (WEA 2) 20:46	06:35 19:39	07:20 18:36	08:06 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:47 (WEA 2) 21:32	05:53 21:32	20:55 (WEA 2) 20:42	06:36 19:37	07:22 18:34	08:08 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:47 (WEA 2) 21:31	05:55 21:31	20:56 (WEA 2) 20:40	06:38 19:35	07:23 18:33	08:09 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:48 (WEA 2) 21:30	05:56 21:30	20:57 (WEA 2) 20:38	06:39 19:33	07:25 18:31	08:11 16:46
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:48 (WEA 2) 21:29	05:57 21:29	20:58 (WEA 2) 20:36	06:41 19:30	07:26 17:29	08:12 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:48 (WEA 2) 21:27	05:58 21:27	20:59 (WEA 2) 20:34	06:42 19:28	07:28 17:27	08:14 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:49 (WEA 2) 21:26	06:00 21:26	20:50 (WEA 2) 20:32	06:44 19:26	07:29 17:25	08:16 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:49 (WEA 2) 21:25	06:01 21:25	20:51 (WEA 2) 20:30	06:45 19:24	07:31 17:23	08:17 16:42
29	08:14 17:26	07:22 19:01	06:20 20:02	05:38 20:50	05:38 21:31	05:32 21:48	20:50 (WEA 2) 21:23	06:02 21:23	20:52 (WEA 2) 20:28	06:47 19:22	07:32 17:22	08:18 16:42
30	08:13 17:28	07:20 19:04	06:18 20:04	05:37 20:51	05:37 21:32	05:33 21:47	20:52 (WEA 2) 21:22	06:04 21:22	20:53 (WEA 2) 20:26	06:48 19:20	07:34 17:20	08:19 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	05:36 21:33	05:36 21:03	06:05 21:20	20:51 (WEA 2) 21:03	06:05 21:20	20:52 (WEA 2) 20:24	06:50 19:54	07:22 17:18	08:20 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					26	768						
Red. Sonnenscheinwahrsch.					0,44	0,45						
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,56	0,56						
Gesamte Reduktion					0,23	0,24						
Met. wahrsch. Beschattung					6	182						

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)



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-26 - 85, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:37 (WEA 2) 21:47	05:34 21:12 (WEA 2)	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:36 (WEA 2) 21:47	05:34 21:12 (WEA 2)	06:08 21:17	06:53 20:20	07:37 19:15	07:25 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:36 (WEA 2) 21:47	05:35 21:12 (WEA 2)	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:36 (WEA 2) 21:46	05:35 21:13 (WEA 2)	06:11 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:36 (WEA 2) 21:46	05:36 21:12 (WEA 2)	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:36 (WEA 2) 21:45	05:37 21:12 (WEA 2)	06:13 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:36 (WEA 2) 21:45	05:38 21:12 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:36 (WEA 2) 21:44	05:39 21:12 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:36 (WEA 2) 21:44	05:40 21:12 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:36 (WEA 2) 21:43	05:40 21:12 (WEA 2)	06:19 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:36 (WEA 2) 21:42	05:41 21:11 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:35 (WEA 2) 21:42	05:42 21:11 (WEA 2)	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:36 (WEA 2) 21:41	05:43 21:10 (WEA 2)	06:23 21:09	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:36 (WEA 2) 21:40	05:44 21:10 (WEA 2)	06:25 20:57	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:36 (WEA 2) 21:39	05:45 21:09 (WEA 2)	06:26 21:06	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:36 (WEA 2) 21:38	05:46 21:08 (WEA 2)	06:28 21:04	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:37 (WEA 2) 21:37	05:48 21:07 (WEA 2)	06:29 21:02	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:37 (WEA 2) 21:37	05:49 21:06 (WEA 2)	06:31 21:00	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:37 (WEA 2) 21:35	05:50 21:06 (WEA 2)	06:32 21:04	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:37 (WEA 2) 21:34	05:51 21:04 (WEA 2)	06:34 21:06	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:38 (WEA 2) 21:33	05:52 21:11 (WEA 2)	06:35 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:38 (WEA 2) 21:32	05:53 21:11 (WEA 2)	06:36 21:02	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:38 (WEA 2) 21:31	05:55 21:11 (WEA 2)	06:38 21:00	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:43 (WEA 2) 21:31	05:56 21:11 (WEA 2)	06:39 21:00	07:25 19:33	08:11 18:31	08:00 16:46
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:41 (WEA 2) 21:30	05:57 21:11 (WEA 2)	06:41 21:00	07:26 19:30	08:12 18:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:41 (WEA 2) 21:27	05:58 21:11 (WEA 2)	06:42 21:00	07:28 19:28	08:14 18:27	08:32 16:42
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:40 (WEA 2) 21:28	06:00 21:12 (WEA 2)	06:44 21:02	07:29 19:26	08:15 18:25	08:33 16:43
28	08:15 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:39 (WEA 2) 21:28	06:01 21:12 (WEA 2)	06:45 21:00	07:31 19:24	08:17 18:23	08:31 16:42
29	08:14 17:26	07:22 19:01	06:20 20:02	06:18 20:50	05:38 21:31	05:32 21:48	20:38 (WEA 2) 21:28	06:02 21:12 (WEA 2)	06:47 21:00	07:32 19:22	08:18 18:22	08:33 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 21:25	05:33 21:47	20:37 (WEA 2) 21:22	06:04 21:12 (WEA 2)	06:48 21:00	07:34 19:20	08:19 18:20	08:33 16:41
31	08:12 17:29	07:18 20:05	06:16 20:05	06:14 21:33	05:36 21:26	06:05 21:20	20:37 (WEA 2) 21:03 (WEA 2)	06:06 21:20	06:50 20:24	07:22 17:18	08:18 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					165	952	507					
Red. Sonnenscheinwahrsch.					0,44	0,45	0,48					
Reduktion Betriebsdauer					0,93	0,93	0,96					
Reduktion Windrichtung					0,56	0,56	0,56					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					38	227	126					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-27 - 95, Rue de Differdange, 4437 Soleuvre  
Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

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

1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:36 21:34	20:43 (WEA 2) 21:03 (WEA 2)	05:34 21:47	20:45 (WEA 2) 21:19	06:06 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:42 (WEA 2) 21:04 (WEA 2)	05:34 21:47	20:45 (WEA 2) 21:17	06:08 20:20	07:37 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:42 (WEA 2) 21:05 (WEA 2)	05:35 21:47	20:45 (WEA 2) 21:14	06:09 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:41 (WEA 2) 21:06 (WEA 2)	05:35 21:46	20:46 (WEA 2) 21:14	06:11 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:42 (WEA 2) 21:07 (WEA 2)	05:36 21:46	20:46 (WEA 2) 21:13	06:12 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:41 (WEA 2) 21:07 (WEA 2)	05:37 21:45	20:47 (WEA 2) 21:11	06:13 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:41 (WEA 2) 21:08 (WEA 2)	05:38 21:45	20:48 (WEA 2) 21:10	06:15 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:41 (WEA 2) 21:09 (WEA 2)	05:39 21:44	20:48 (WEA 2) 21:13	06:16 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:40 (WEA 2) 21:08 (WEA 2)	05:40 21:44	20:49 (WEA 2) 21:13	06:18 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:41 (WEA 2) 21:09 (WEA 2)	05:40 21:43	20:50 (WEA 2) 21:14	06:19 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:41 (WEA 2) 21:10 (WEA 2)	05:41 21:42	20:50 (WEA 2) 21:11	06:21 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:40 (WEA 2) 21:09 (WEA 2)	05:42 21:42	20:51 (WEA 2) 21:10	06:22 20:01	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:40 (WEA 2) 21:10 (WEA 2)	05:43 21:41	20:53 (WEA 2) 21:10	06:23 20:09	07:53 18:56	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:40 (WEA 2) 21:10 (WEA 2)	05:44 21:40	20:54 (WEA 2) 21:08	06:25 20:57	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:40 (WEA 2) 21:11 (WEA 2)	05:45 21:39	20:56 (WEA 2) 21:07	06:26 20:56	07:12 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:41 (WEA 2) 21:11 (WEA 2)	05:46 21:38	20:59 (WEA 2) 21:04	06:28 20:54	07:13 19:50	07:58 18:46
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:41 (WEA 2) 21:11 (WEA 2)	05:48 21:37	21:04 (WEA 2) 21:04	06:29 20:52	07:14 19:48	08:00 18:44
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:41 (WEA 2) 21:12 (WEA 2)	05:49 21:37	21:04 (WEA 2) 21:04	06:31 20:50	07:16 19:46	08:01 18:42
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:41 (WEA 2) 21:12 (WEA 2)	05:50 21:35	21:04 (WEA 2) 21:04	06:32 20:48	07:17 19:43	08:02 18:40
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:41 (WEA 2) 21:12 (WEA 2)	05:51 21:34	21:04 (WEA 2) 21:04	06:34 20:46	07:19 19:41	08:04 18:38
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:42 (WEA 2) 21:13 (WEA 2)	05:52 21:33	21:04 (WEA 2) 21:04	06:35 20:44	07:20 19:39	08:06 18:36
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:42 (WEA 2) 21:13 (WEA 2)	05:53 21:32	21:04 (WEA 2) 21:04	06:36 20:42	07:22 19:37	08:08 18:34
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:42 (WEA 2) 21:13 (WEA 2)	05:55 21:31	21:04 (WEA 2) 21:04	06:38 20:40	07:23 19:35	08:09 18:33
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:43 (WEA 2) 21:14 (WEA 2)	05:56 21:30	21:04 (WEA 2) 21:04	06:39 20:38	07:25 19:33	08:11 18:31
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:43 (WEA 2) 21:14 (WEA 2)	05:57 21:29	21:04 (WEA 2) 21:04	06:41 20:36	07:26 19:30	07:12 17:29
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:43 (WEA 2) 21:13 (WEA 2)	05:58 21:27	21:04 (WEA 2) 21:04	06:42 20:34	07:28 19:28	07:14 17:27
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:44 (WEA 2) 21:14 (WEA 2)	06:00 21:26	21:04 (WEA 2) 21:04	06:44 20:32	07:29 19:26	07:16 17:25
28	08:16 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:43 (WEA 2) 21:14 (WEA 2)	06:01 21:25	21:04 (WEA 2) 21:04	06:45 20:30	07:31 19:24	07:17 17:23
29	08:14 17:26	07:22 19:01	06:20 20:02	05:38 20:50	05:38 21:31	05:32 21:48	20:44 (WEA 2) 21:14 (WEA 2)	06:02 21:23	21:04 (WEA 2) 21:04	06:47 20:28	07:32 19:22	07:19 17:22
30	08:13 17:28	07:20 19:04	06:18 20:04	05:37 20:51	05:37 21:32	05:33 21:47	20:45 (WEA 2) 21:14 (WEA 2)	06:04 21:22	21:04 (WEA 2) 21:04	06:48 20:26	07:34 19:20	07:21 17:20
31	08:12 17:29	07:18 20:05	06:16 20:05	05:36 21:33	05:36 21:03	06:05 21:20	20:44 (WEA 2) 21:03 (WEA 2)	06:05 21:20	21:04 (WEA 2) 21:04	06:50 20:24	07:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					56	860						
Red. Sonnenscheinwahrsch.					0,44	0,45						
Reduktion Betriebsdauer					0,93	0,93						
Reduktion Windrichtung					0,56	0,56						
Gesamte Reduktion					0,23	0,24						
Met. wahrsch. Beschattung					13	204						

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-28 - 100, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:35 21:34	20:30 (WEA 2) 21:01 (WEA 2)	05:34 21:47	20:34 (WEA 2) 21:19	06:06 20:22	06:51 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:29 (WEA 2) 21:47	05:34 21:48	20:34 (WEA 2) 21:17	06:08 20:20	06:53 19:15	07:25 17:15
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:30 (WEA 2) 21:02 (WEA 2)	05:35 21:47	20:35 (WEA 2) 21:16	06:09 20:18	06:54 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:29 (WEA 2) 21:02 (WEA 2)	05:35 21:46	20:35 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:30 (WEA 2) 21:02 (WEA 2)	05:36 21:46	20:35 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:29 (WEA 2) 21:02 (WEA 2)	05:37 21:45	20:35 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:29 (WEA 2) 21:03 (WEA 2)	05:38 21:45	20:36 (WEA 2) 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:30 (WEA 2) 21:04 (WEA 2)	05:39 21:44	20:36 (WEA 2) 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:29 (WEA 2) 21:03 (WEA 2)	05:40 21:44	20:37 (WEA 2) 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:30 (WEA 2) 21:04 (WEA 2)	05:40 21:43	20:37 (WEA 2) 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:30 (WEA 2) 21:04 (WEA 2)	05:41 21:42	20:37 (WEA 2) 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:29 (WEA 2) 21:04 (WEA 2)	05:42 21:42	20:37 (WEA 2) 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:30 (WEA 2) 21:04 (WEA 2)	05:43 21:41	20:38 (WEA 2) 21:08	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:30 (WEA 2) 21:04 (WEA 2)	05:44 21:40	20:38 (WEA 2) 21:07	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:30 (WEA 2) 21:05 (WEA 2)	05:45 21:39	20:39 (WEA 2) 21:07	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:31 (WEA 2) 21:05 (WEA 2)	05:46 21:38	20:39 (WEA 2) 21:07	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:31 (WEA 2) 21:05 (WEA 2)	05:48 21:37	20:40 (WEA 2) 21:02	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:31 (WEA 2) 21:05 (WEA 2)	05:49 21:37	20:41 (WEA 2) 21:06	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:31 (WEA 2) 21:05 (WEA 2)	05:50 21:35	20:43 (WEA 2) 21:06	07:17 19:43	08:03 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:31 (WEA 2) 21:06 (WEA 2)	05:51 21:34	20:43 (WEA 2) 21:05	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:32 (WEA 2) 21:07 (WEA 2)	05:52 21:33	20:44 (WEA 2) 21:04	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:32 (WEA 2) 21:07 (WEA 2)	05:53 21:32	20:46 (WEA 2) 21:03	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:33 (WEA 2) 21:07 (WEA 2)	05:55 21:31	20:47 (WEA 2) 21:01	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:32 (WEA 2) 21:06 (WEA 2)	05:56 21:30	20:50 (WEA 2) 20:58 (WEA 2)	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:32 (WEA 2) 21:07 (WEA 2)	05:57 21:29	06:41 20:36	07:26 19:30	08:12 18:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:32 (WEA 2) 21:07 (WEA 2)	05:58 21:27	06:42 20:34	07:28 19:28	08:14 18:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:33 (WEA 2) 21:08 (WEA 2)	06:00 21:26	06:44 20:32	07:29 19:26	08:16 18:25	08:05 16:43
28	08:16 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:33 (WEA 2) 21:08 (WEA 2)	06:01 21:25	06:45 20:30	07:31 19:24	08:17 18:23	08:06 16:42
29	08:14 17:26	07:22 19:01	06:20 20:02	06:17 20:50	05:38 21:31	05:32 21:48	20:30 (WEA 2) 21:08 (WEA 2)	06:02 21:23	06:47 20:28	07:32 19:22	08:19 18:22	08:08 16:42
30	08:13 17:28	07:20 19:04	06:18 20:04	06:15 20:51	05:37 21:32	05:33 21:47	20:30 (WEA 2) 21:08 (WEA 2)	06:04 21:22	06:48 20:26	07:34 19:20	08:21 18:20	08:09 16:41
31	08:12 17:29	07:18 20:05	06:18 20:05	06:15 21:33	05:36 21:31	05:36 21:01	20:30 (WEA 2) 21:01 (WEA 2)	06:05 21:20	06:50 20:24	07:22 17:18	08:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					282	1017						
Red. Sonnenscheinwahrsch.					0,44	0,45	666					
Reduktion Betriebsdauer					0,93	0,93	0,48					
Reduktion Windrichtung					0,57	0,57	0,57					
Gesamte Reduktion					0,23	0,24	0,25					
Met. wahrsch. Beschattung					65	244	167					

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

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



## 21-1-3087-000-SU Schattenwurfprognose Sanem

Projekt:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-29 - 106, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1,26	2,39	4,13	6,27	6,74	7,37	7,52	6,90	5,33	3,00	1,37	1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Jun	Jul	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:36 21:34	20:37 (WEA 2) 21:47	05:34 21:12 (WEA 2)	06:06 21:19	06:51 20:22	07:35 19:17	07:24 17:16
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:36 (WEA 2) 21:47	05:34 21:11 (WEA 2)	06:08 21:17	06:53 20:20	07:37 19:15	07:25 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:37 (WEA 2) 21:47	05:35 21:12 (WEA 2)	06:09 21:16	06:54 20:18	07:38 19:13	07:27 17:13
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:36 (WEA 2) 21:46	05:35 21:11 (WEA 2)	06:11 21:14	06:55 20:16	07:40 19:11	07:29 17:11
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:36 (WEA 2) 21:46	05:36 21:11 (WEA 2)	06:12 21:13	06:57 20:14	07:41 19:09	07:30 17:10
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:35 (WEA 2) 21:45	05:37 21:11 (WEA 2)	06:13 21:11	06:58 20:11	07:43 19:07	07:32 17:08
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:36 (WEA 2) 21:45	05:38 21:11 (WEA 2)	06:15 21:10	07:00 20:09	07:44 19:05	07:34 17:07
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:36 (WEA 2) 21:44	05:39 21:11 (WEA 2)	06:16 21:08	07:01 20:07	07:46 19:03	07:35 17:05
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:35 (WEA 2) 21:44	05:40 21:11 (WEA 2)	06:18 21:06	07:03 20:05	07:47 19:00	07:37 17:04
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:36 (WEA 2) 21:43	05:40 21:11 (WEA 2)	06:19 21:04	07:04 20:03	07:49 18:58	07:39 17:02
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:36 (WEA 2) 21:42	05:41 21:11 (WEA 2)	06:21 21:03	07:06 20:01	07:50 18:56	07:40 17:01
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:35 (WEA 2) 21:42	05:42 21:11 (WEA 2)	06:22 21:01	07:07 19:59	07:52 18:54	07:42 16:59
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:35 (WEA 2) 21:41	05:43 21:09 (WEA 2)	06:23 21:09	07:09 19:56	07:53 18:52	07:43 16:58
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:35 (WEA 2) 21:40	05:44 21:11 (WEA 2)	06:25 20:57	07:10 19:54	07:55 18:50	07:45 16:57
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:36 (WEA 2) 21:39	05:45 21:07 (WEA 2)	06:26 20:56	07:12 19:52	07:57 18:48	07:47 16:55
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:36 (WEA 2) 21:38	05:46 21:11 (WEA 2)	06:28 20:54	07:13 19:50	07:58 18:46	07:48 16:54
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:36 (WEA 2) 21:37	05:48 21:11 (WEA 2)	06:29 20:52	07:14 19:48	08:00 18:44	07:50 16:53
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:36 (WEA 2) 21:37	05:49 21:11 (WEA 2)	06:31 20:50	07:16 19:46	08:01 18:42	07:51 16:52
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:36 (WEA 2) 21:35	05:50 21:11 (WEA 2)	06:32 20:48	07:17 19:43	08:02 18:40	07:53 16:51
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:36 (WEA 2) 21:34	05:51 21:11 (WEA 2)	06:34 20:46	07:19 19:41	08:04 18:38	07:54 16:50
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:37 (WEA 2) 21:33	05:52 21:11 (WEA 2)	06:35 20:44	07:20 19:39	08:06 18:36	07:56 16:49
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:37 (WEA 2) 21:32	05:53 21:11 (WEA 2)	06:36 20:42	07:22 19:37	08:08 18:34	07:57 16:48
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:37 (WEA 2) 21:31	05:55 21:11 (WEA 2)	06:38 20:40	07:23 19:35	08:09 18:33	07:59 16:47
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:38 (WEA 2) 21:30	05:56 21:11 (WEA 2)	06:39 20:38	07:25 19:33	08:11 18:31	08:01 16:46
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:38 (WEA 2) 21:29	05:57 21:11 (WEA 2)	06:41 20:36	07:26 19:30	08:12 17:29	08:02 16:45
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:44 (WEA 2) 21:27	05:58 21:11 (WEA 2)	06:42 20:34	07:28 19:28	08:14 17:27	08:03 16:44
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:42 (WEA 2) 21:28	06:00 21:12 (WEA 2)	06:44 20:32	07:29 19:26	08:16 17:25	08:05 16:43
28	08:16 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:40 (WEA 2) 21:28	06:01 21:11 (WEA 2)	06:45 20:30	07:31 19:24	08:17 17:23	08:06 16:42
29	08:14 17:26	07:22 19:01	06:22 20:02	06:20 20:50	05:38 21:31	05:32 21:48	20:39 (WEA 2) 21:23	06:02 21:12 (WEA 2)	06:47 20:28	07:32 19:22	08:18 17:22	08:08 16:42
30	08:13 17:28	07:20 20:04	06:18 20:51	06:16 21:32	05:37 22	05:33 21:47	20:38 (WEA 2) 21:22	06:04 21:11 (WEA 2)	06:48 20:26	07:34 19:20	08:19 17:20	08:33 16:41
31	08:12 17:29	07:18 20:05	06:16 20:55	06:14 21:33	05:36 24	05:33 21:48	20:38 (WEA 2) 21:20	06:05 21:11 (WEA 2)	06:50 20:24	07:22 17:18	08:22 17:18	08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung					113							
Red. Sonnenscheinwahrsch.					0,44							
Reduktion Betriebsdauer					0,93							
Reduktion Windrichtung					0,56							
Gesamte Reduktion					0,23							
Met. wahrsch. Beschattung					26							

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:

21-1-3087-000  
ENECO Ingénieurs-Conseils S.A.  
22, rue Edmond Reuter  
5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
Sanem, Kanton  
Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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



Robin Umminger / robin.umminger@ramboll.com

Berechnet:

08.07.2022 13:02/3.5.584

## SHADOW - Kalender

Berechnung: Zusatzbelastung Schattenrezeptor: S-30 - 112, Rue de Differdange, 4437 Soleuvre

Annahmen für Schattenwurfberechnung

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) []

Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1,26 2,39 4,13 6,27 6,74 7,37 7,52 6,90 5,33 3,00 1,37 1,03

Betriebsdauer je Sektor

N	NNO	ONO	O	OSO	SSO	S	SSW	WSW	W	WNW	NNW	Summe
300	483	640	678	577	410	544	1.204	1.449	999	547	327	8.159

	Januar	Februar	März	April	Mai	Juni	Juli	August	September	Oktober	November	Dezember
1	08:33 16:47	08:10 17:31	07:21 18:18	07:16 20:07	06:16 20:53	05:36 21:34	05:34 21:47	20:49 (WEA 2) 21:13 (WEA 2)	06:06 20:22	06:51 19:17	07:35 17:16	07:24 16:40
2	08:33 16:48	08:09 17:33	07:19 18:20	07:14 20:08	06:14 20:54	05:35 21:35	20:51 (WEA 2) 21:47	20:49 (WEA 2) 21:12 (WEA 2)	06:08 20:20	06:53 19:15	07:37 17:15	07:25 16:40
3	08:33 16:49	08:07 17:34	07:17 18:21	07:12 20:10	06:13 20:56	05:34 21:36	20:50 (WEA 2) 21:47	20:50 (WEA 2) 21:12 (WEA 2)	06:09 20:20	06:54 19:13	07:38 17:13	07:27 16:39
4	08:33 16:50	08:06 17:36	07:15 18:23	07:10 20:12	06:11 20:57	05:33 21:37	20:48 (WEA 2) 21:46	20:51 (WEA 2) 21:14	06:11 20:16	06:55 19:11	07:40 17:11	07:29 16:39
5	08:33 16:51	08:04 17:38	07:13 18:25	07:07 20:13	06:09 20:59	05:33 21:38	20:47 (WEA 2) 21:46	20:51 (WEA 2) 21:13	06:12 20:14	06:57 19:09	07:41 17:10	07:30 16:38
6	08:33 16:52	08:03 17:40	07:11 18:26	07:05 20:15	06:08 21:00	05:32 21:39	20:46 (WEA 2) 21:45	20:52 (WEA 2) 21:11	06:13 20:11	06:58 19:07	07:43 17:08	07:32 16:38
7	08:32 16:54	08:01 17:41	07:09 18:28	07:03 20:16	06:06 21:02	05:32 21:40	20:46 (WEA 2) 21:45	20:53 (WEA 2) 21:10	06:15 20:09	07:00 19:05	07:44 17:07	07:34 16:38
8	08:32 16:55	08:00 17:43	07:07 18:29	07:01 20:18	06:04 21:03	05:31 21:40	20:46 (WEA 2) 21:44	20:55 (WEA 2) 21:08	06:16 20:07	07:01 19:03	07:46 17:05	07:35 16:38
9	08:32 16:56	07:58 17:45	07:05 18:31	06:59 20:19	06:03 21:05	05:31 21:41	20:45 (WEA 2) 21:44	20:56 (WEA 2) 21:06	06:18 20:05	07:03 19:00	07:47 17:04	07:37 16:20
10	08:31 16:57	07:57 17:46	07:03 18:33	06:57 20:21	06:01 21:06	05:31 21:42	20:45 (WEA 2) 21:43	20:58 (WEA 2) 21:04	06:19 20:03	07:04 18:58	07:49 17:02	07:39 16:37
11	08:31 16:59	07:55 17:48	07:01 18:34	06:55 20:22	06:00 21:08	05:30 21:43	20:45 (WEA 2) 21:42	20:59 (WEA 2) 21:03	06:21 20:06	07:06 18:56	07:50 17:01	07:40 16:37
12	08:30 17:00	07:53 17:50	06:59 18:36	06:53 20:24	05:58 21:09	05:30 21:43	20:44 (WEA 2) 21:42	20:58 (WEA 2) 21:01	06:22 19:59	07:07 18:54	07:52 16:59	07:42 16:37
13	08:30 17:01	07:52 17:51	06:57 18:37	06:51 20:25	05:57 21:10	05:30 21:44	20:44 (WEA 2) 21:41	20:59 (WEA 2) 20:59	06:23 19:56	07:09 18:52	07:53 16:58	07:43 16:37
14	08:29 17:03	07:50 17:53	06:55 18:39	06:49 20:27	05:55 21:12	05:30 21:44	20:44 (WEA 2) 21:40	20:58 (WEA 2) 20:57	06:25 19:54	07:10 18:50	07:55 16:57	07:45 16:37
15	08:28 17:04	07:48 17:55	06:52 18:41	06:47 20:28	05:54 21:13	05:29 21:45	20:44 (WEA 2) 21:39	20:58 (WEA 2) 20:56	06:26 19:52	07:12 18:48	07:57 16:55	07:47 16:37
16	08:28 17:06	07:46 17:56	06:50 18:42	06:45 20:30	05:53 21:15	05:29 21:45	20:44 (WEA 2) 21:38	20:58 (WEA 2) 20:54	06:28 19:50	07:13 18:46	07:58 16:54	07:48 16:37
17	08:27 17:07	07:44 17:58	06:48 18:44	06:43 20:31	05:51 21:16	05:29 21:46	20:44 (WEA 2) 21:37	20:58 (WEA 2) 20:52	06:29 19:48	07:14 18:44	08:00 16:53	07:50 16:38
18	08:26 17:09	07:43 18:00	06:46 18:45	06:41 20:33	05:50 21:17	05:29 21:46	20:44 (WEA 2) 21:37	20:58 (WEA 2) 20:50	06:31 19:46	07:16 18:42	08:01 16:52	07:51 16:38
19	08:25 17:10	07:41 18:02	06:44 18:47	06:39 20:35	05:49 21:19	05:29 21:47	20:44 (WEA 2) 21:35	20:58 (WEA 2) 20:48	06:32 19:43	07:17 18:40	08:03 16:51	07:53 16:38
20	08:24 17:12	07:39 18:03	06:42 18:48	06:37 20:36	05:47 21:20	05:29 21:47	20:44 (WEA 2) 21:34	20:58 (WEA 2) 20:46	06:34 19:41	07:19 18:38	08:04 16:50	07:54 16:39
21	08:23 17:13	07:37 18:05	06:40 18:50	06:35 20:38	05:46 21:21	05:30 21:47	20:45 (WEA 2) 21:33	20:58 (WEA 2) 20:44	06:35 19:39	07:20 18:36	08:06 16:49	07:56 16:39
22	08:22 17:15	07:35 18:07	06:37 18:51	06:33 20:39	05:45 21:23	05:30 21:47	20:45 (WEA 2) 21:32	20:58 (WEA 2) 20:42	06:36 19:37	07:22 18:34	08:08 16:48	07:58 16:39
23	08:21 17:16	07:33 18:08	06:35 18:53	06:31 20:41	05:44 21:24	05:30 21:48	20:45 (WEA 2) 21:31	20:58 (WEA 2) 20:40	06:38 19:35	07:23 18:33	08:09 16:47	07:59 16:40
24	08:20 17:18	07:31 18:10	06:33 18:55	06:29 20:42	05:43 21:25	05:30 21:48	20:46 (WEA 2) 21:30	20:58 (WEA 2) 20:38	06:39 19:33	07:25 18:31	08:11 16:46	08:01 16:40
25	08:19 17:20	07:29 18:12	06:31 18:56	06:27 20:44	05:42 21:26	05:31 21:48	20:46 (WEA 2) 21:29	20:58 (WEA 2) 20:36	06:41 19:30	07:26 17:29	07:12 16:45	08:02 16:41
26	08:18 17:21	07:27 18:13	06:29 18:58	06:25 20:45	05:41 21:27	05:31 21:48	20:46 (WEA 2) 21:27	20:58 (WEA 2) 20:34	06:42 19:28	07:28 17:27	07:14 16:44	08:03 16:42
27	08:17 17:23	07:25 18:15	06:27 18:59	06:23 20:47	05:40 21:29	05:31 21:48	20:47 (WEA 2) 21:26	20:58 (WEA 2) 20:32	06:44 19:26	07:29 17:25	07:16 16:43	08:05 16:42
28	08:16 17:24	07:23 18:16	06:25 19:01	06:22 20:48	05:39 21:30	05:32 21:48	20:47 (WEA 2) 21:25	20:58 (WEA 2) 20:30	06:45 19:24	07:31 17:23	07:17 16:42	08:06 16:43
29	08:14 17:26		07:22 20:02	06:20 20:50	05:38 21:31	05:32 21:48	20:48 (WEA 2) 21:23	20:58 (WEA 2) 20:28	06:47 19:22	07:32 17:19	07:19 16:42	08:08 16:44
30	08:13 17:28		07:20 20:04	06:18 20:51	05:37 21:32	05:33 21:47	20:48 (WEA 2) 21:22	20:58 (WEA 2) 20:26	06:48 19:20	07:34 17:20	07:21 16:41	08:09 16:45
31	08:12 17:29		07:18 20:05		05:36 21:33		21:13 (WEA 2) 21:20	20:58 (WEA 2) 20:24	06:50 19:20	07:22 17:18		08:33 16:46
Sonnenscheinstunden	269	283	368	411	475	486	490	447	379	335	275	255
astr. max. mögl. Beschattung						674	183					
Red. Sonnenscheinwahrsch.						0,45	0,48					
Reduktion Betriebsdauer						0,93	0,93					
Reduktion Windrichtung						0,56	0,56					
Gesamte Reduktion						0,24	0,25					
Met. wahrsch. Beschattung						160	45					

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

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

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

Lizenzierter Anwender:

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

RAMBOLL

Robin Umminger / robin.umminger@ramboll.com

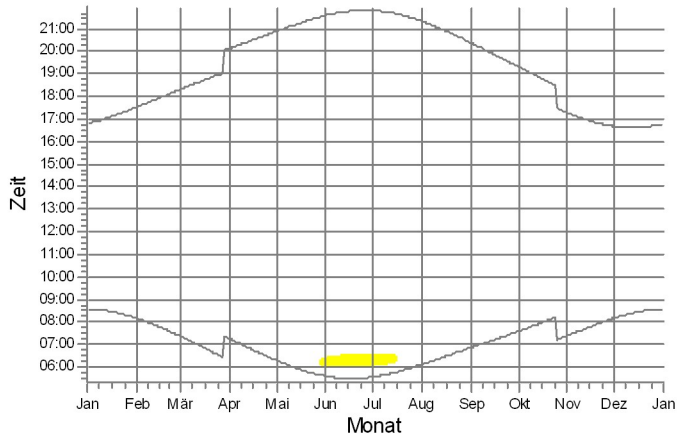
Berechnet:

08.07.2022 13:02/3.5.584

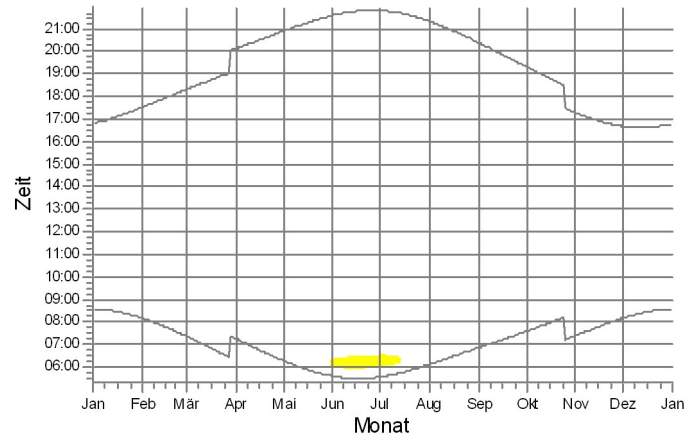
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

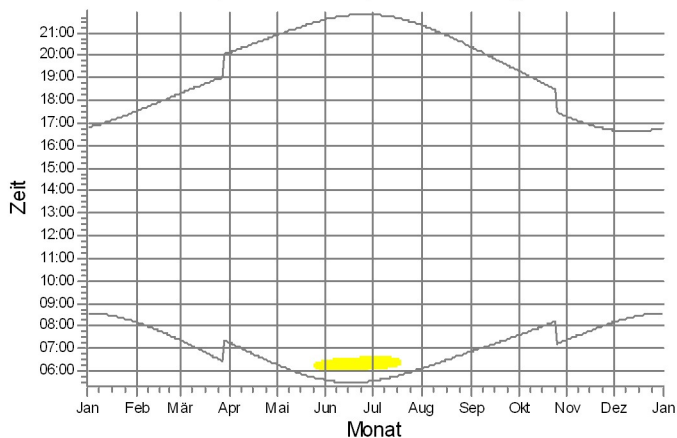
D-01: 61, Rue Emile Mark, 4620 Differdange



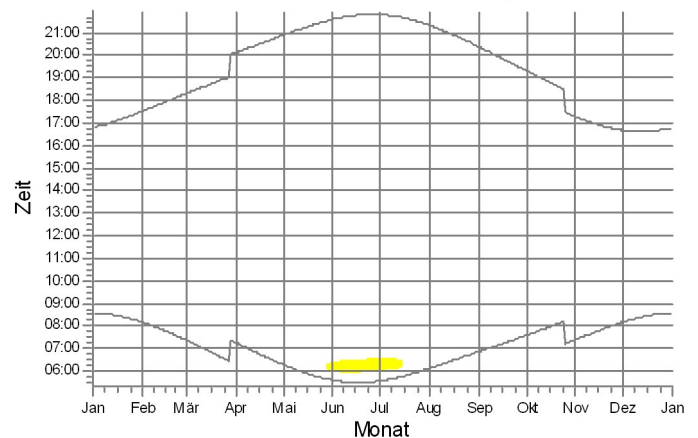
D-02: 76, Rue Emile Mark, 4620 Differdange



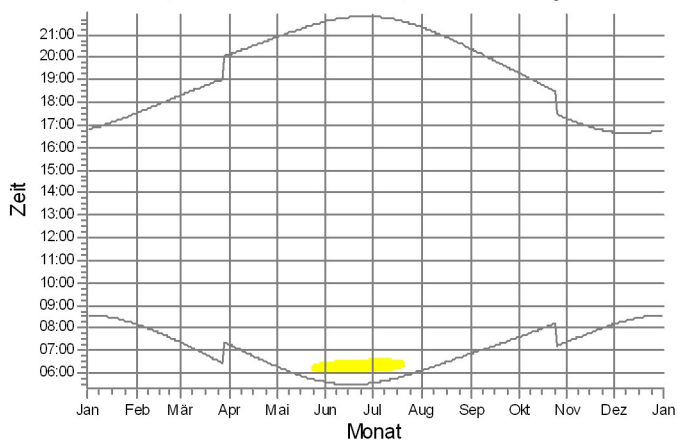
D-03: 68, Rue Emile Mark, 4620 Differdange



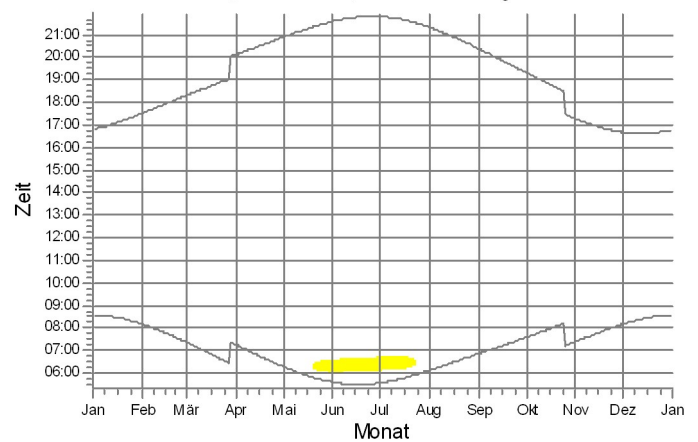
D-04: 19, Rue du Gaz, 4573 Differdange



D-05: 3, Rue John Ernest Dolibois, 4573 Differdange



D-06: 2, Rue du Gaz, 4573 Differdange



WEA

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

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Windpark Sanem, Gemeinde  
 Sanem, Kanton  
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 DE-34131 Kassel

RAMBOLL

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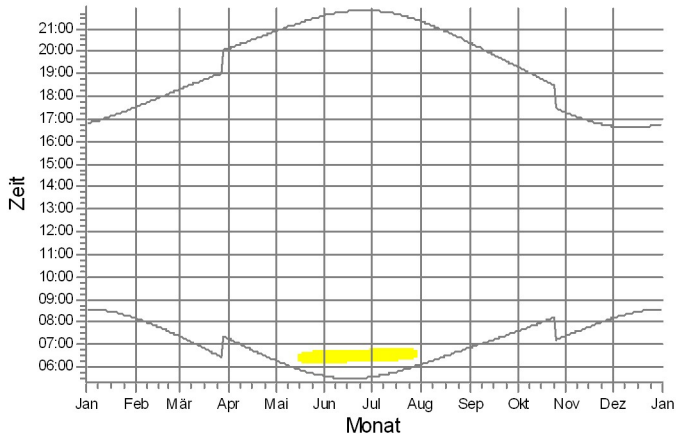
Berechnet:

08.07.2022 13:02/3.5.584

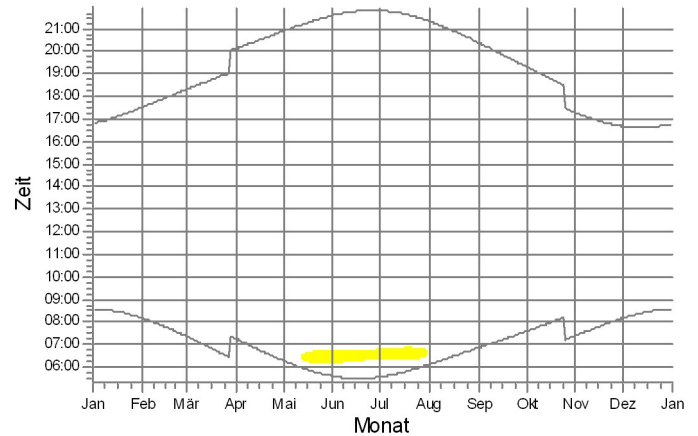
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

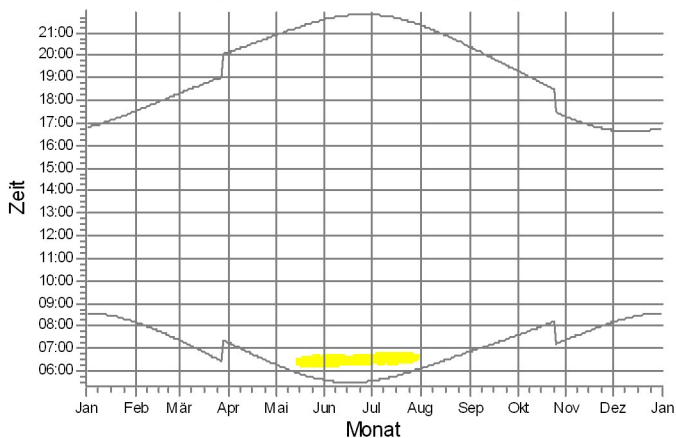
D-07: 62A, Rue Emile Mark, 4620 Differdange



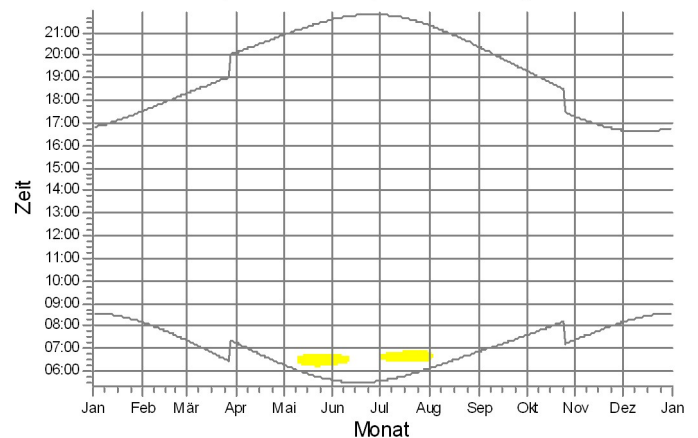
D-08: 62, Rue Emile Mark, 4620 Differdange



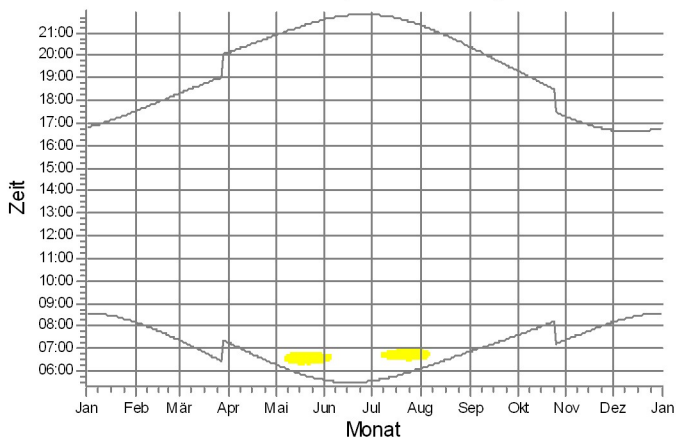
D-09: 60, Rue Emile Mark, 4620 Differdange



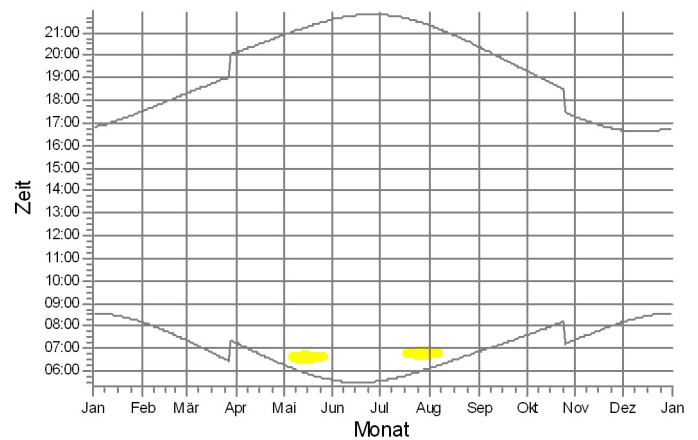
D-10: 40, Rue Emile Mark, 4620 Differdange



D-11: Rue Emile Mark, 4620 Differdange



D-12: 53, Rue Emile Mark, 4620 Differdange



WEA

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



Projekt:

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 DE-34131 Kassel

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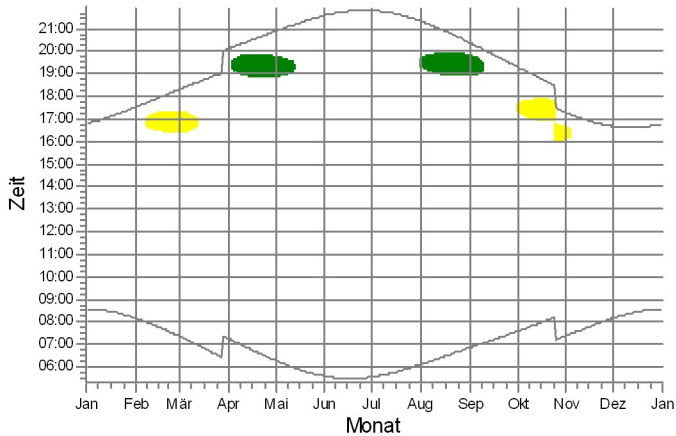
Berechnet:

08.07.2022 13:02/3.5.584

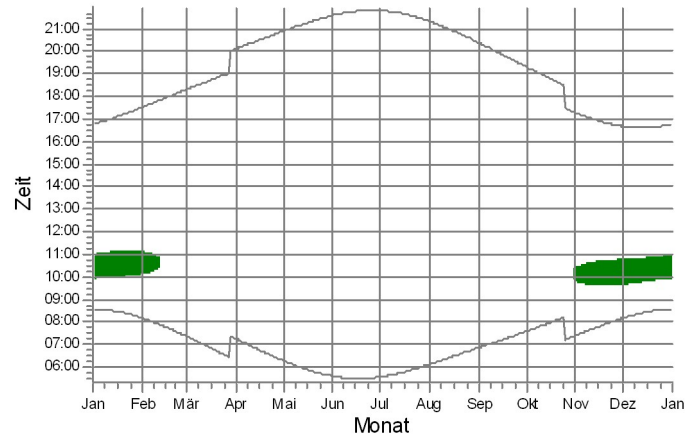
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

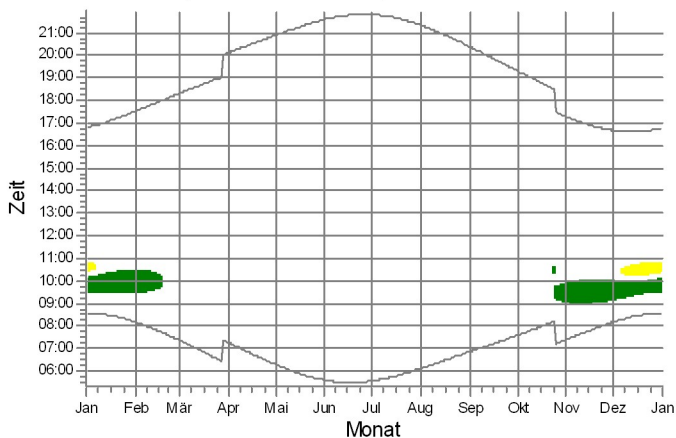
I-01: Z.I. Gadderscheier



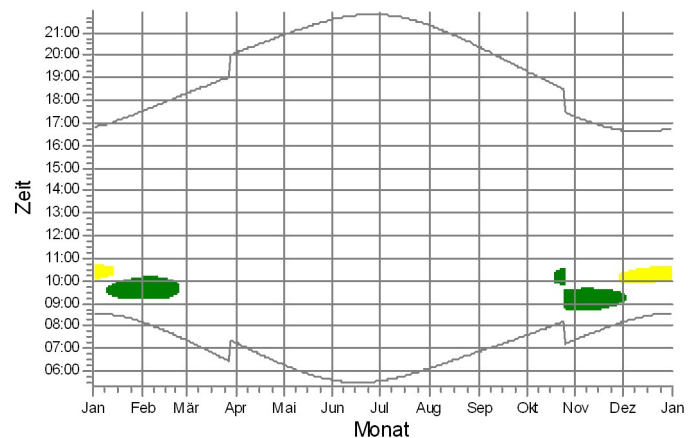
I-02: 3, Z.A. Gadderscheier, 4570 Niederkorn



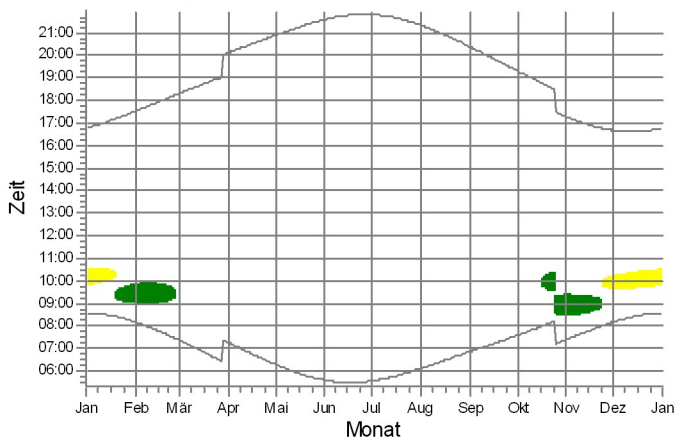
I-03: 3, Z.A. Gadderscheier, 4570 Niederkorn



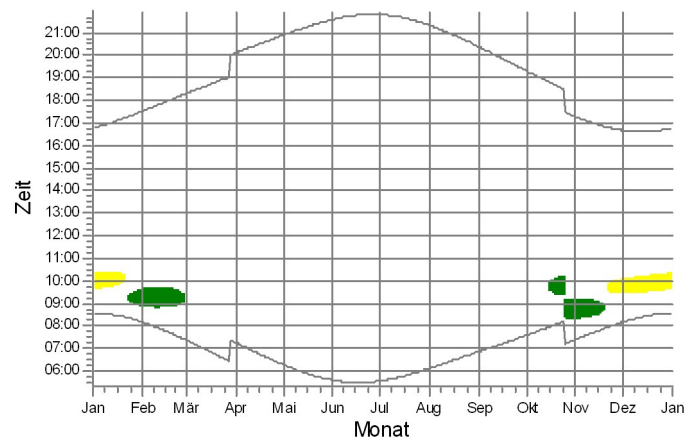
I-04: 3, Z.A. Gadderscheier, 4570 Niederkorn



I-05: 1, Z.A. Gadderscheier, 4570 Niederkorn



I-06: 1, Z.A. Gadderscheier, 4570 Niederkorn



WEA



WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



Projekt:

21-1-3087-000  
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Beschreibung:

Windpark Sanem, Gemeinde  
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RAMBOLL

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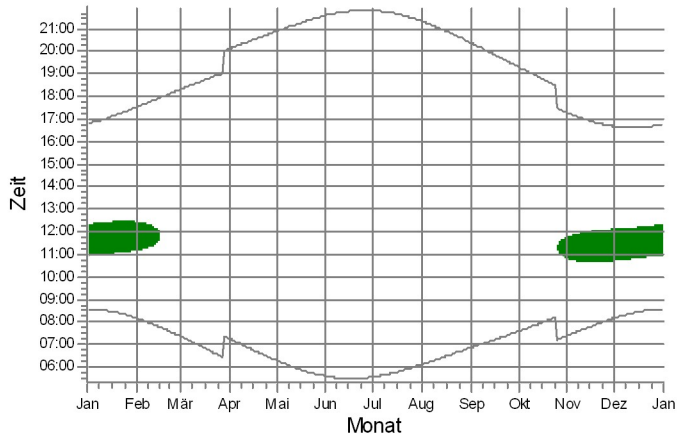
Berechnet:

08.07.2022 13:02/3.5.584

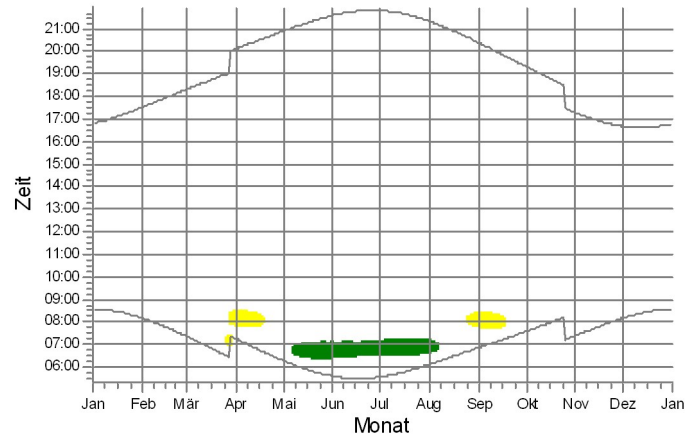
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

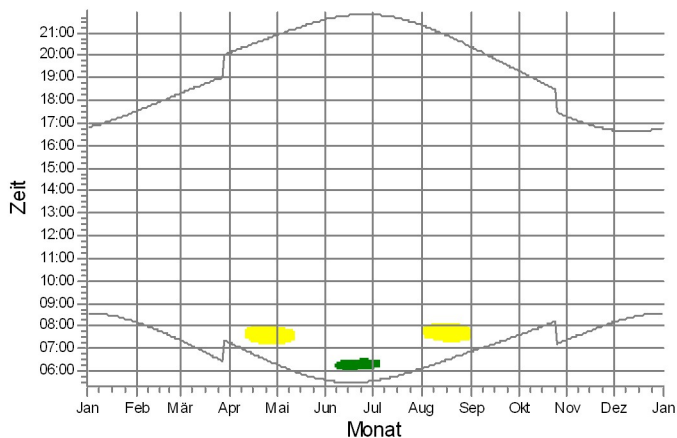
I-07: 1, Z.A. Gadderscheier, 4570 Niederkorn



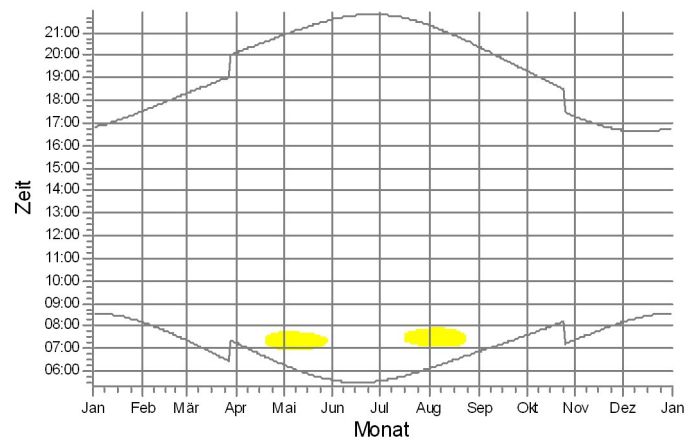
I-08: Z.I. Gadderscheier



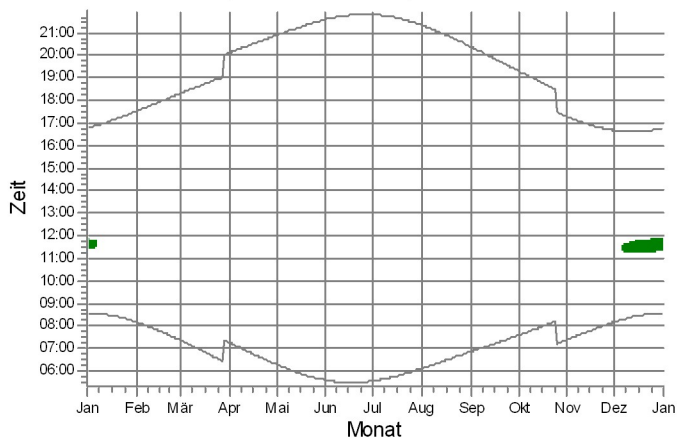
I-09: Z.I. Gadderscheier



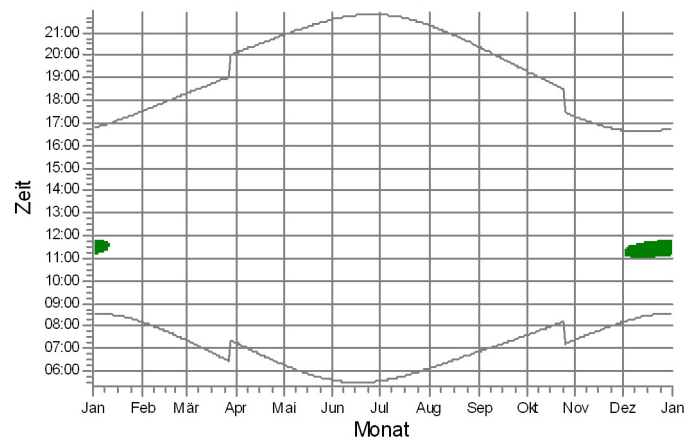
I-10: Z.I. Gadderscheier



N-01: 189, Rue de Niederkorn, 4991 Sanem



N-02: 193, Rue de Niederkorn, 4991 Sanem



WEA



WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

Beschreibung:

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 DE-34131 Kassel



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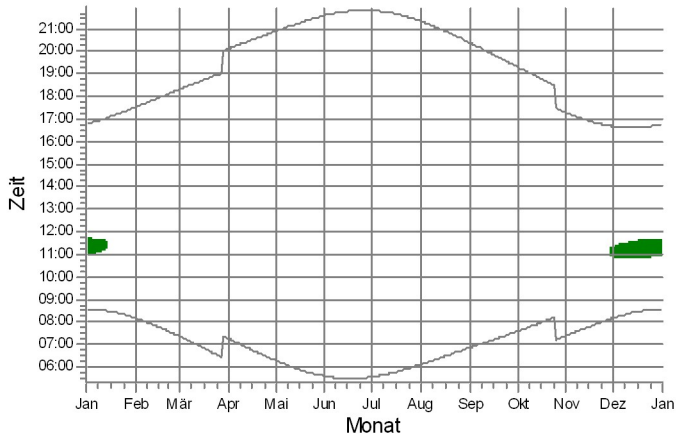
Berechnet:

08.07.2022 13:02/3.5.584

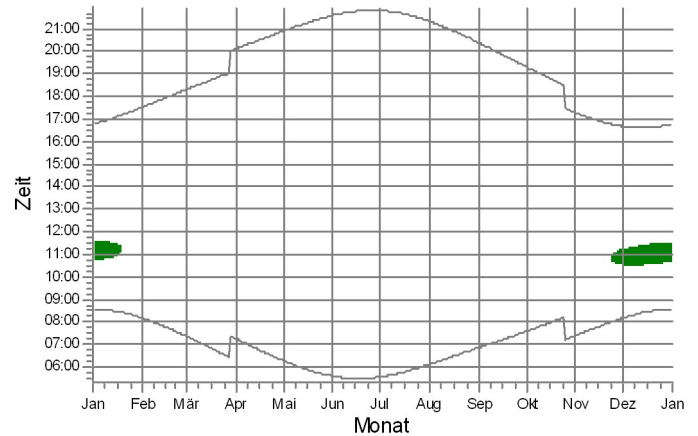
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

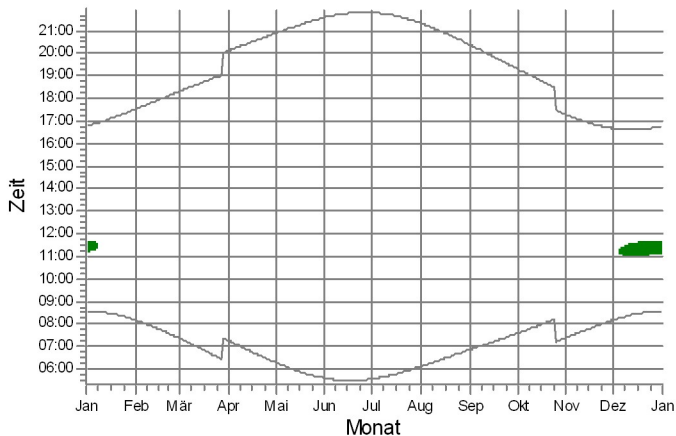
N-03: 197, Rue de Niederkorn, 4991 Sanem



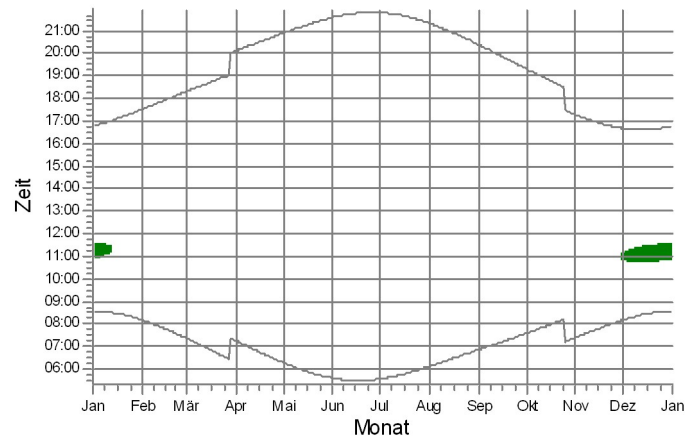
N-04: 203, Rue de Niederkorn, 4991 Sanem



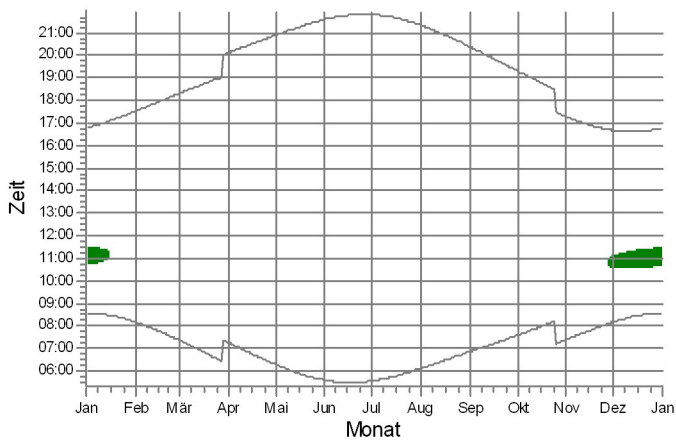
N-05: 194, Rue de Niederkorn, 4991 Sanem



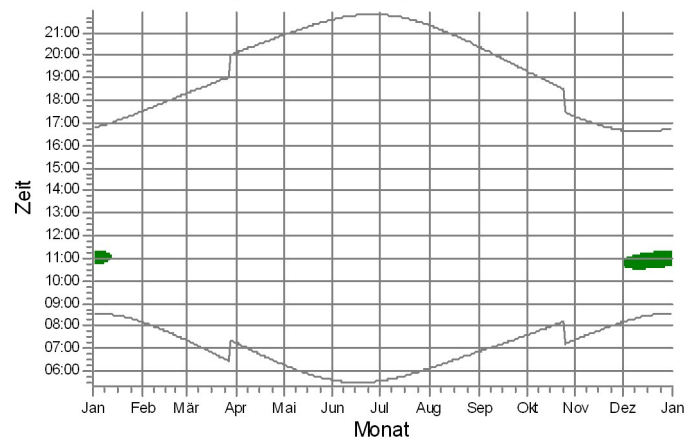
N-06: 200, Rue de Niederkorn, 4991 Sanem



N-07: 200, Rue de Niederkorn, 4991 Sanem



N-08: 36, Rue de l'Industrie, 4991 Sanem



WEA

WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)



## Projekt:

21-1-3087-000  
 ENECO Ingénieurs-Conseils S.A.  
 22, rue Edmond Reuter  
 5326 Contern

## Beschreibung:

Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

## Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

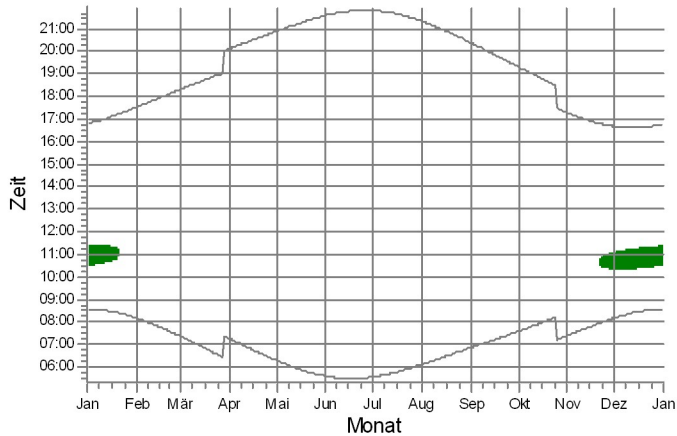
Berechnet:

08.07.2022 13:02/3.5.584

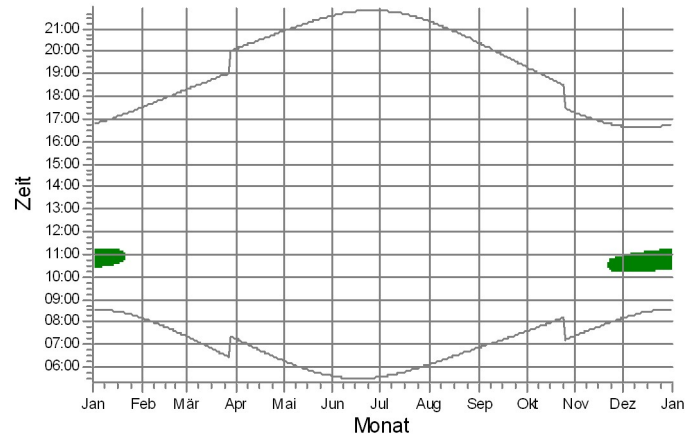
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

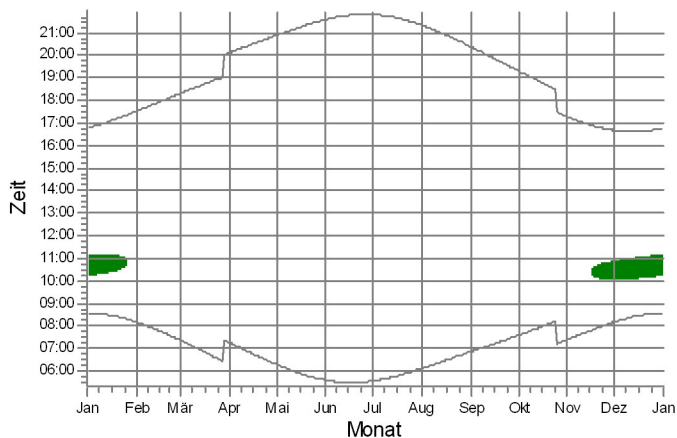
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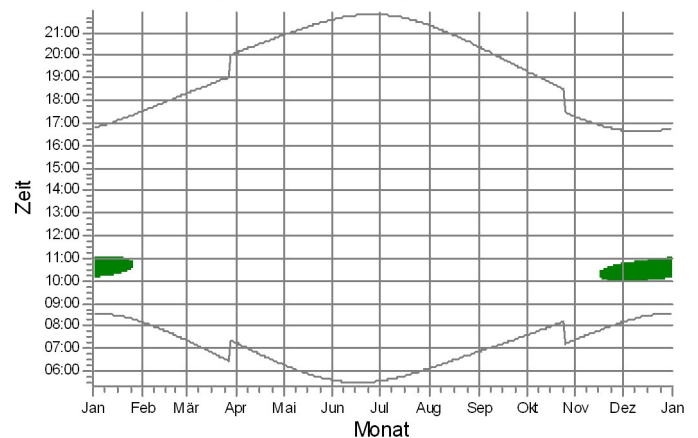
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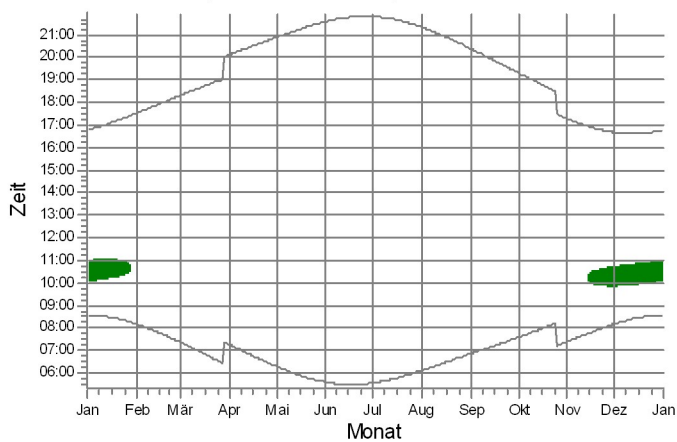
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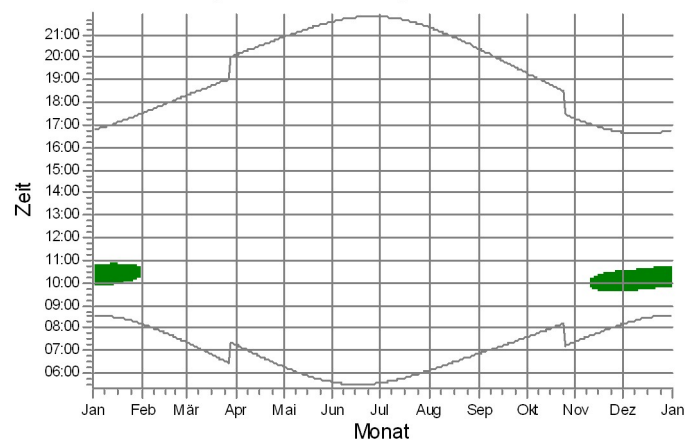
N-12: 239, Rue Pierre Gansen, 4570 Niederkorn



N-13: 228, Rue Pierre Gansen, 4570 Niederkorn



N-14: 216, Rue Pierre Gansen, 4570 Niederkorn



WEA

WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)



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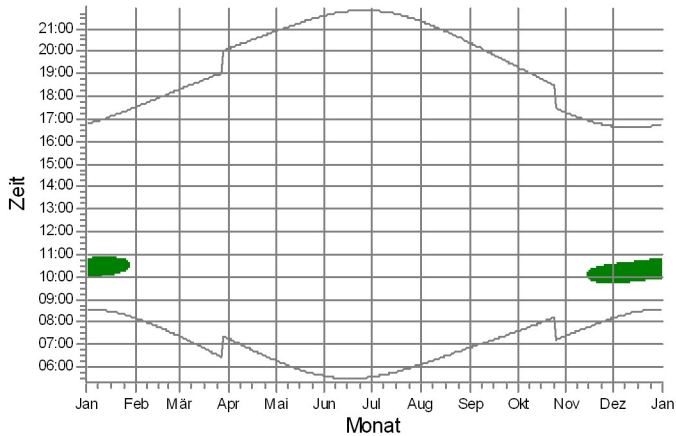
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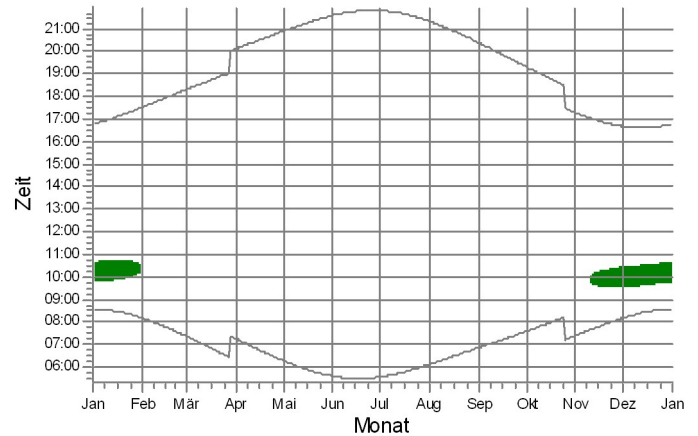
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

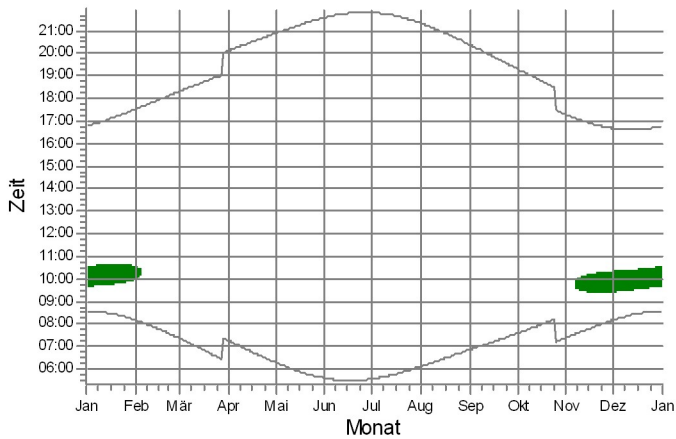
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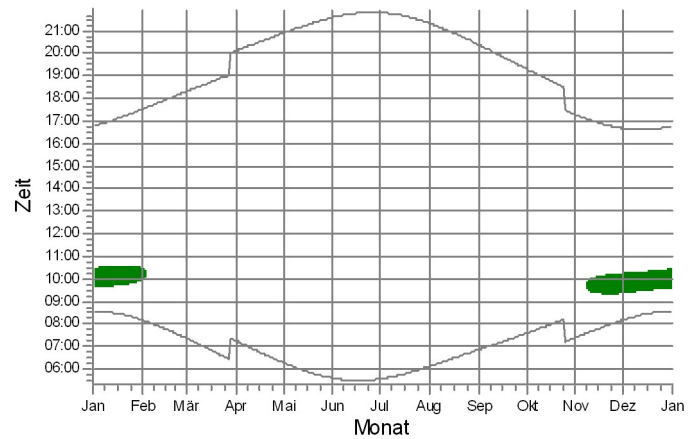
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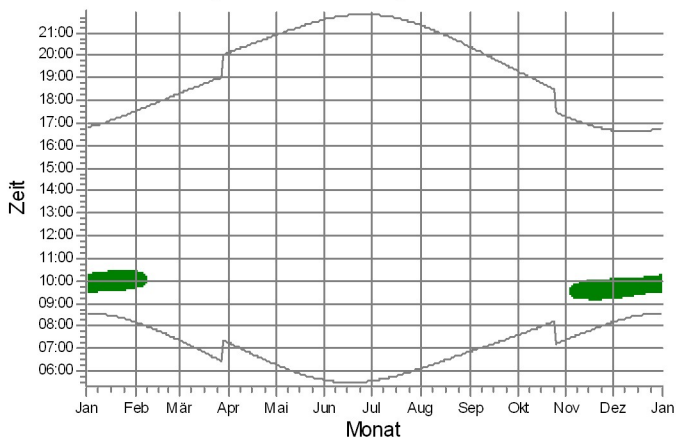
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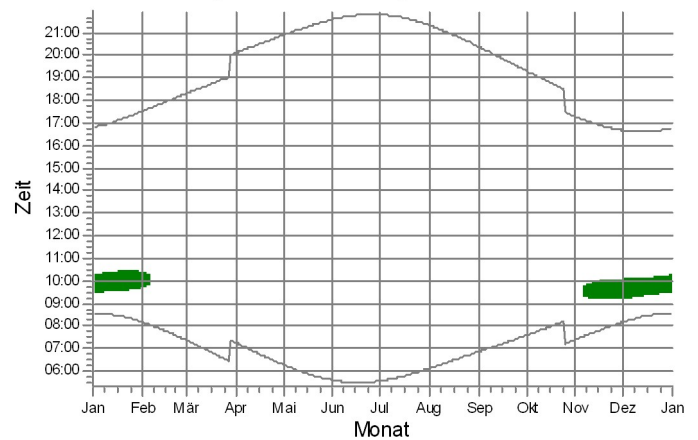
N-18: 229, Rue Pierre Gansen, 4570 Niederkorn



N-19: 198K, Rue Pierre Gansen, 4570 Niederkorn



N-20: 223, Rue Pierre Gansen, 4570 Niederkorn



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WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)



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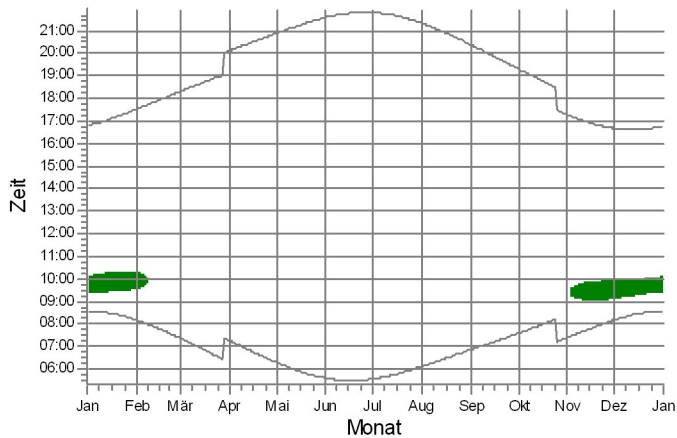
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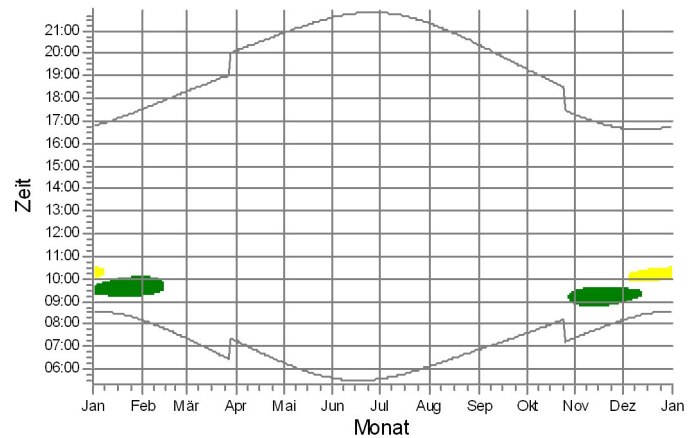
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

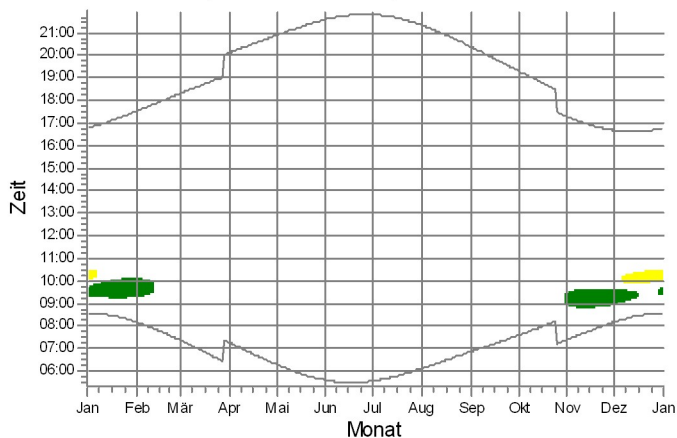
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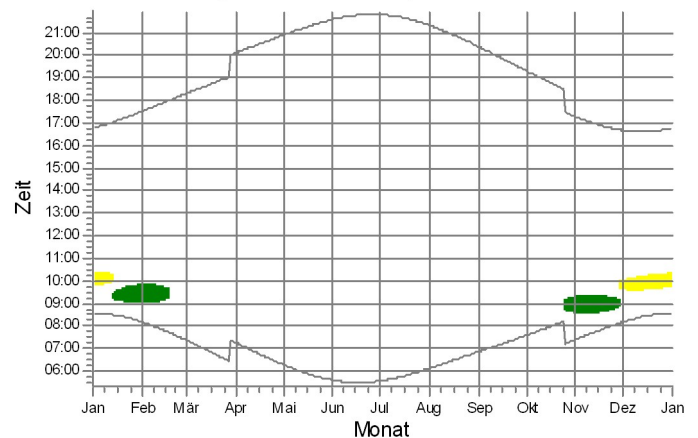
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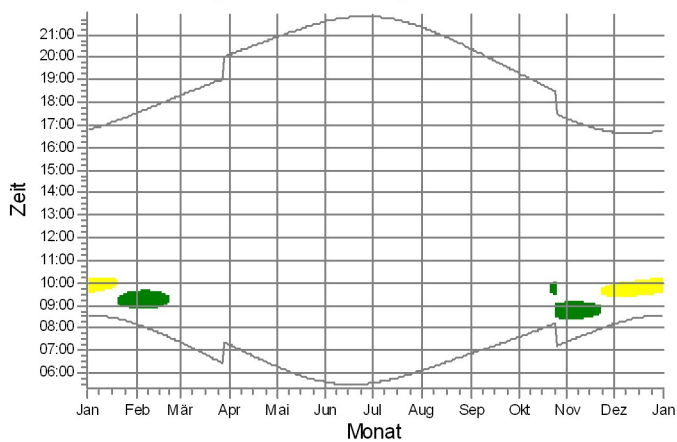
N-23: 211, Rue Pierre Gansen, 4570 Niederkorn



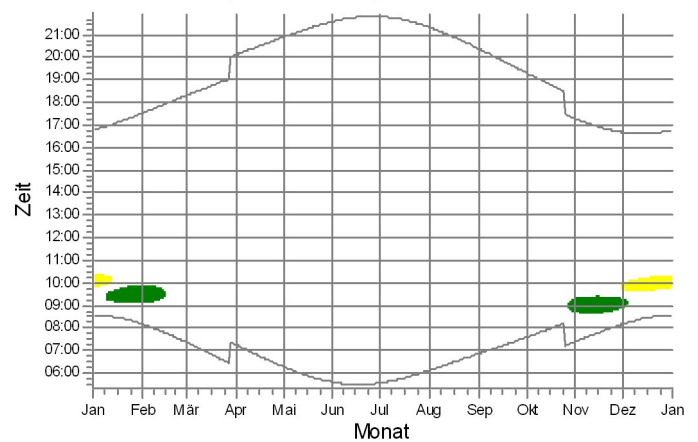
N-24: 198E, Rue Pierre Gansen, 4570 Niederkorn



N-25: 198C, Rue Pierre Gansen, 4570 Niederkorn



N-26: 89, Rue de Sanem, 4664 Niederkorn



WEA



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WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



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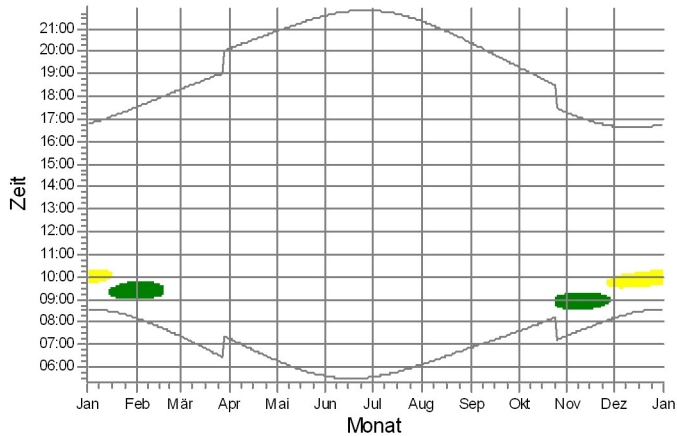
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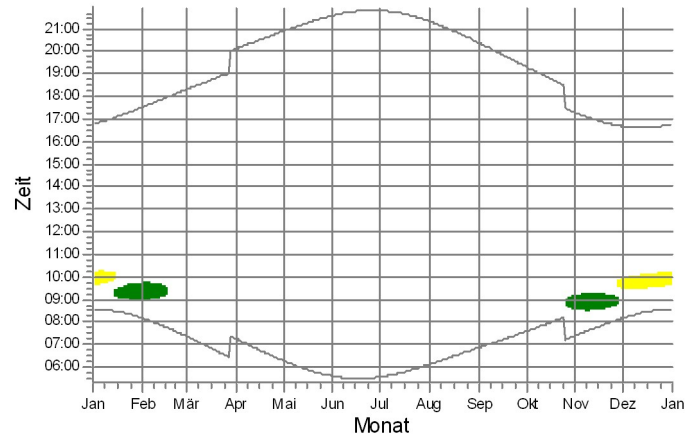
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

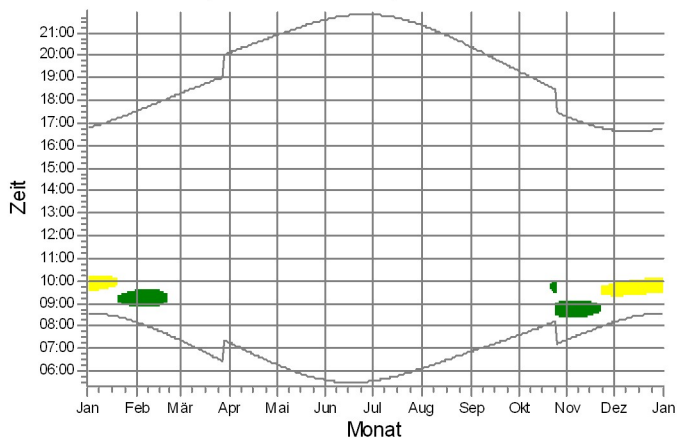
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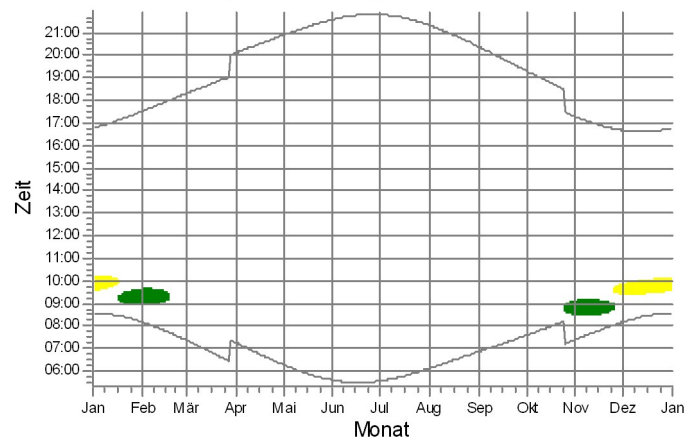
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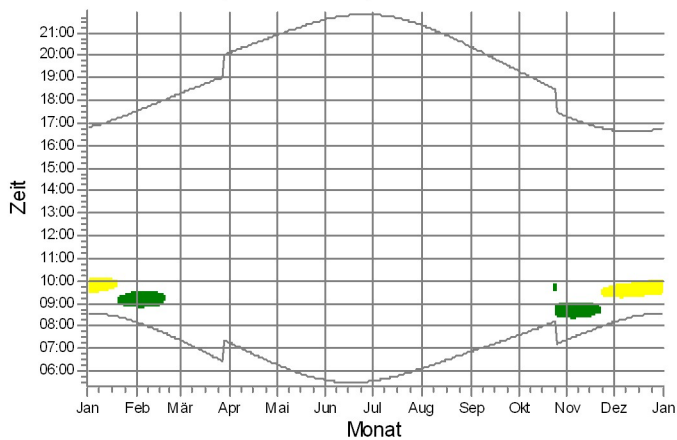
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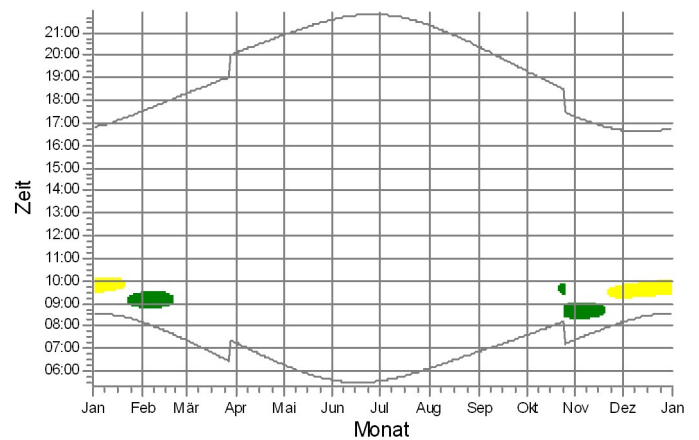
N-30: 65, Rue de Sanem, 4664 Niederkorn



N-31: 53, Rue de Sanem, 4664 Niederkorn



N-32: 38, Rue de Sanem, 4664 Niederkorn



WEA



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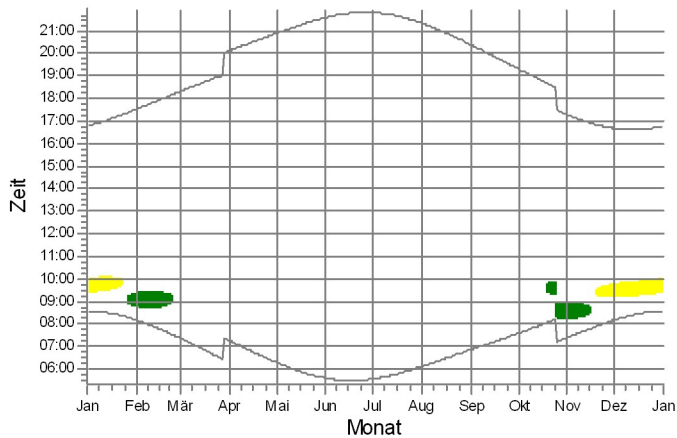
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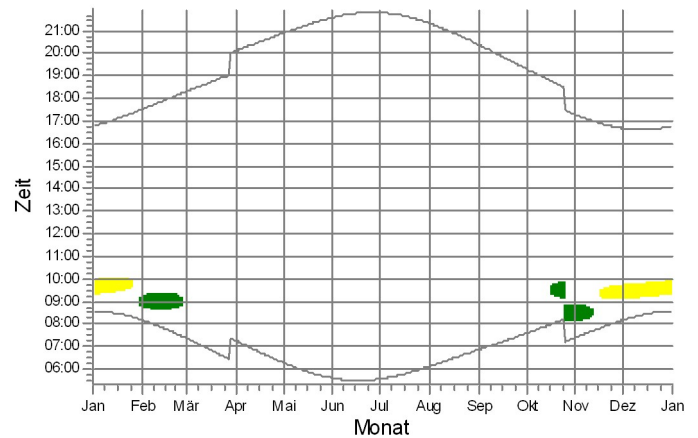
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

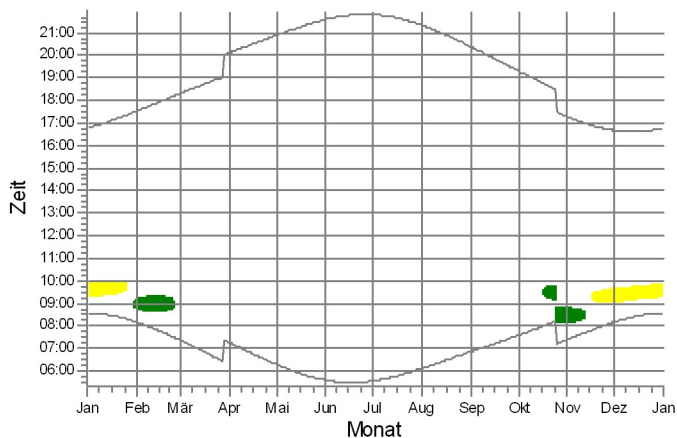
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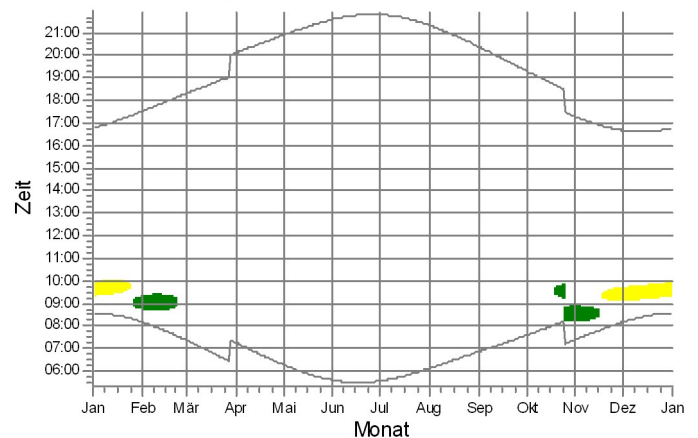
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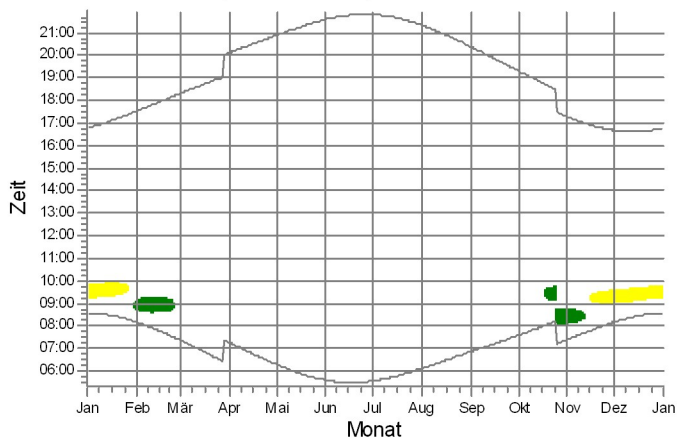
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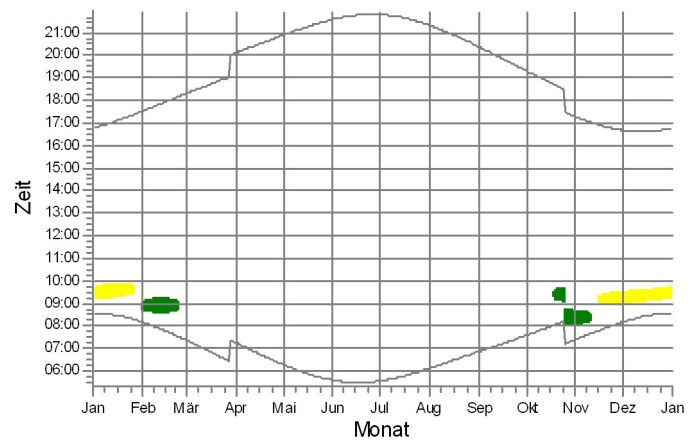
N-36: 28, Rue de Sanem, 4664 Niederkorn



N-37: 18, Rue de Sanem, 4664 Niederkorn



N-38: 18, Rue de Sanem, 4664 Niederkorn



WEA



WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)

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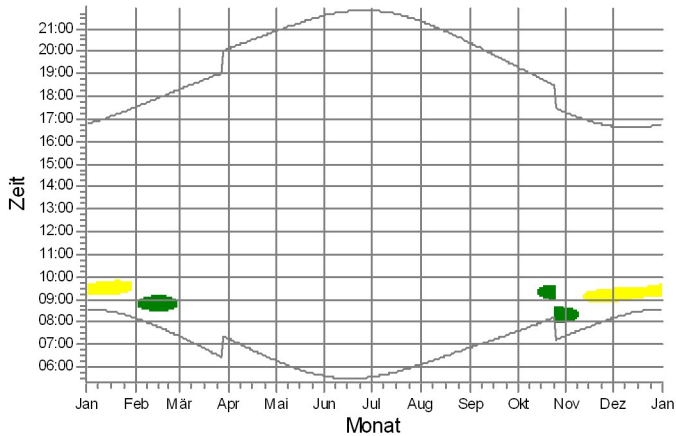
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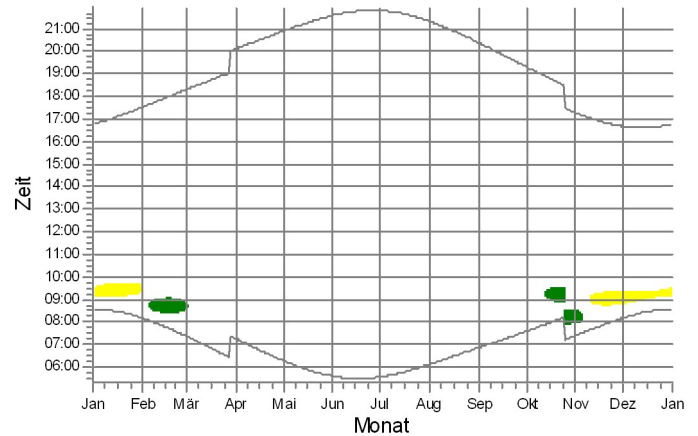
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

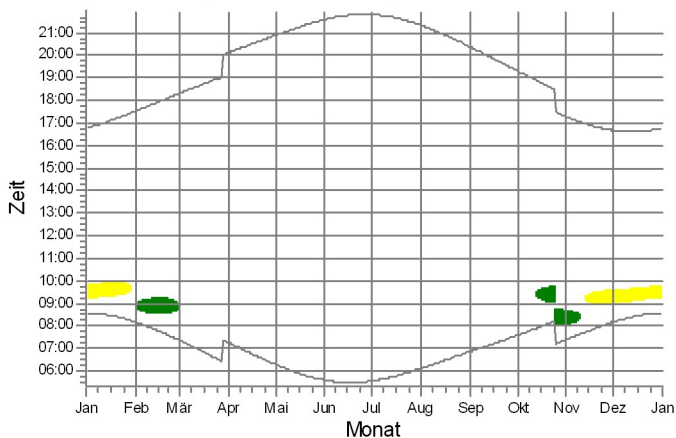
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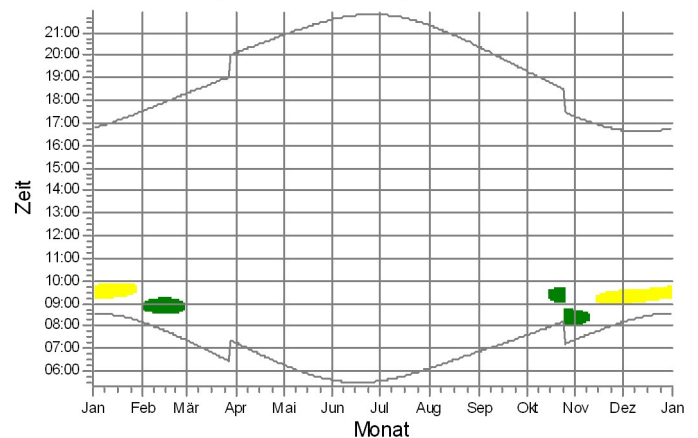
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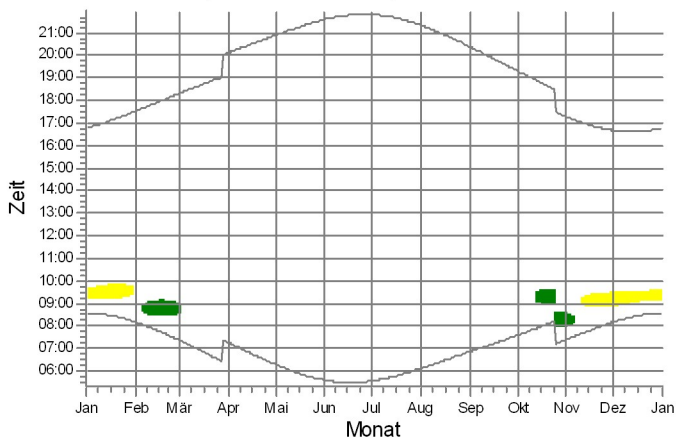
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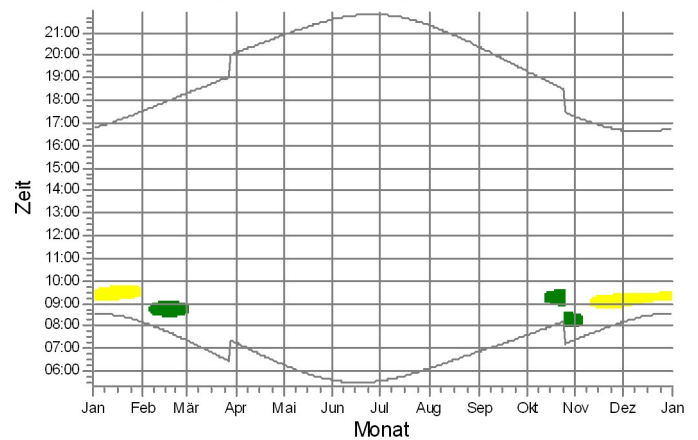
N-42: 165, Rue Pierre Gansen, 4570 Niederkorn



N-43: 174, Rue Pierre Gansen, 4570 Niederkorn



N-44: 151, Rue Pierre Gansen, 4570 Niederkorn



WEA



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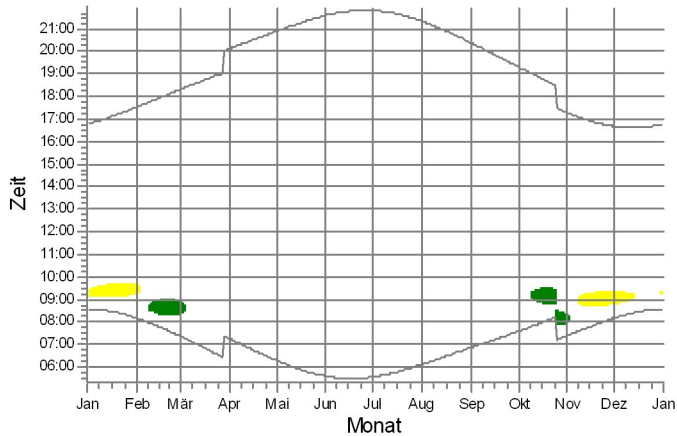
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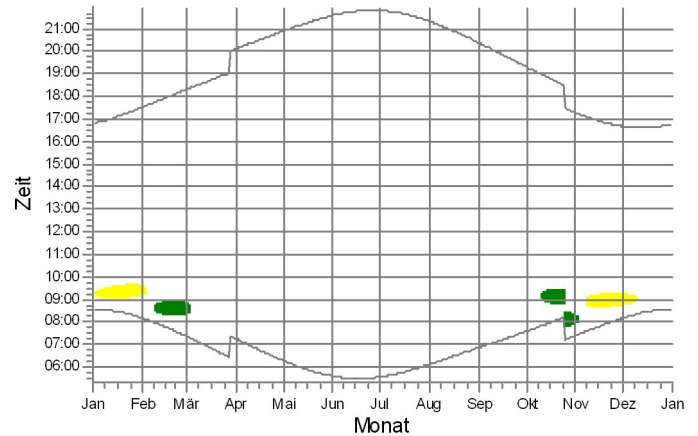
## SHADOW - Grafischer Kalender

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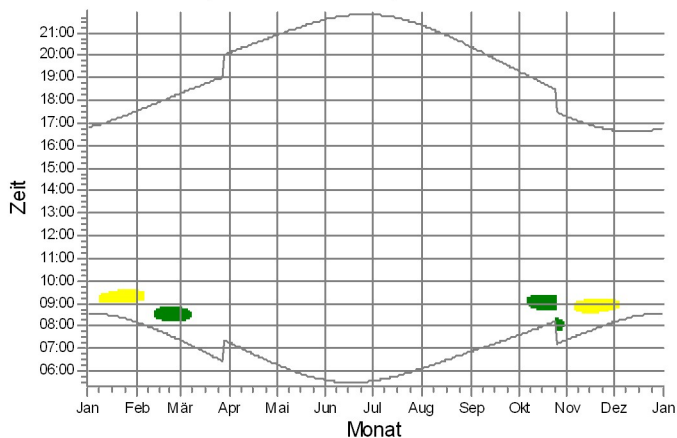
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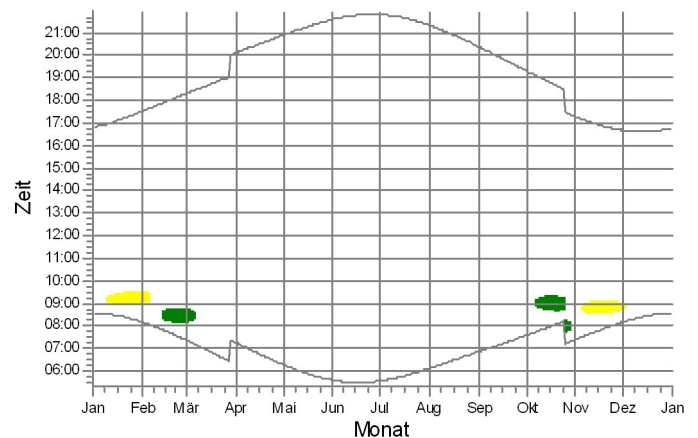
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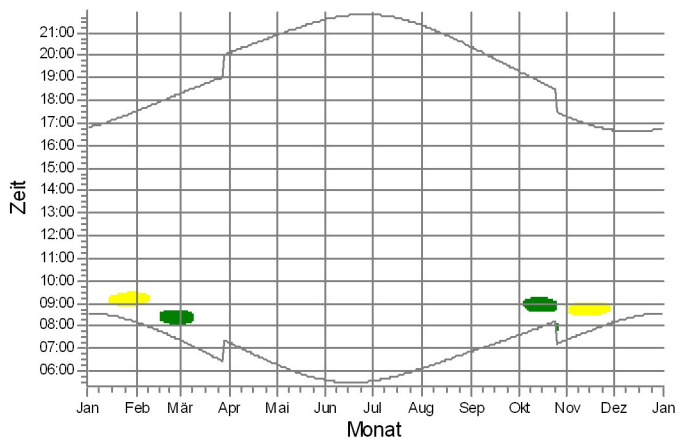
N-47: 146, Rue Pierre Gansen, 4570 Niederkorn



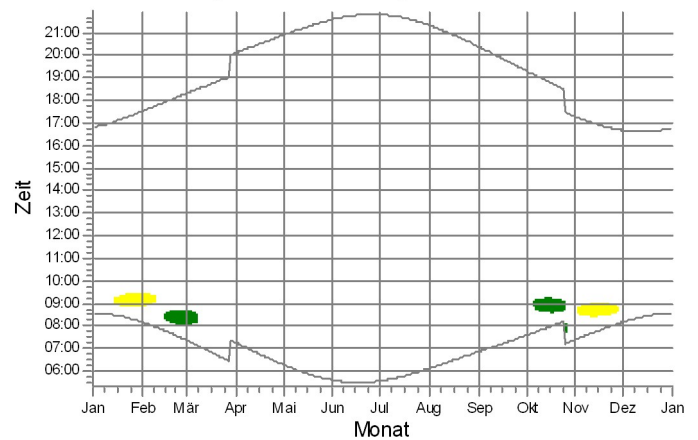
N-48: 127, Rue Pierre Gansen, 4570 Niederkorn



N-49: 134, Rue Pierre Gansen, 4570 Niederkorn



N-50: 103, Rue Pierre Gansen, 4570 Niederkorn



## WEA



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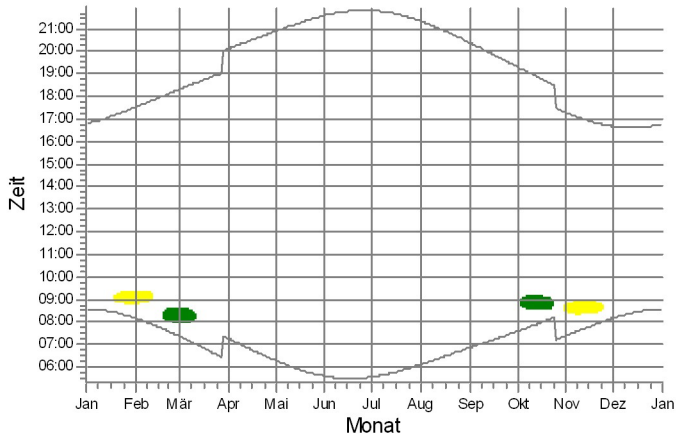
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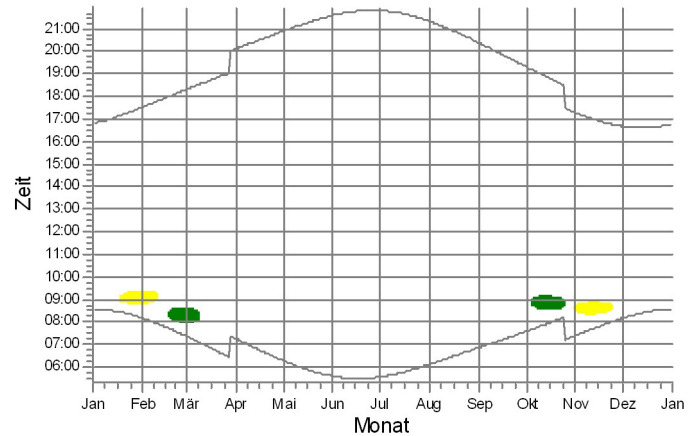
## SHADOW - Grafischer Kalender

Berechnung: Zusatzbelastung

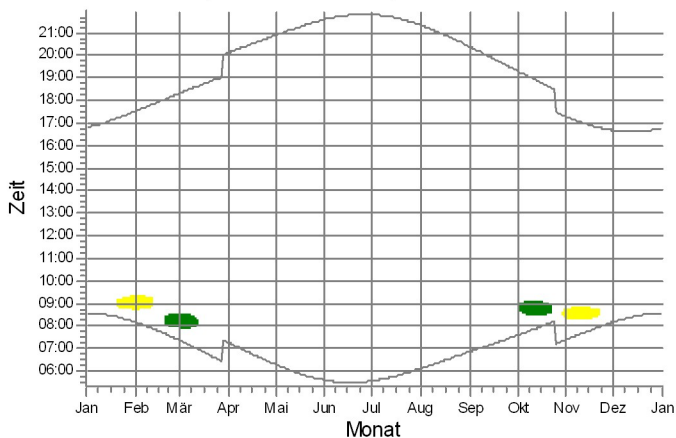
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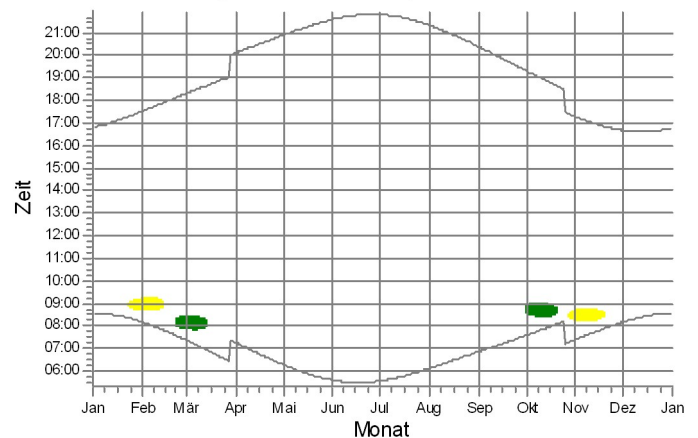
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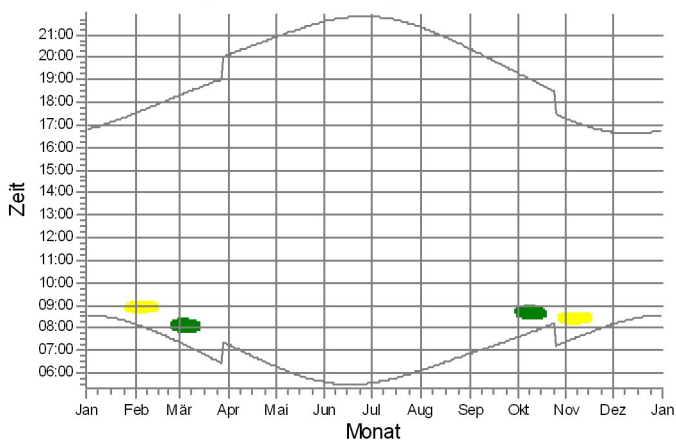
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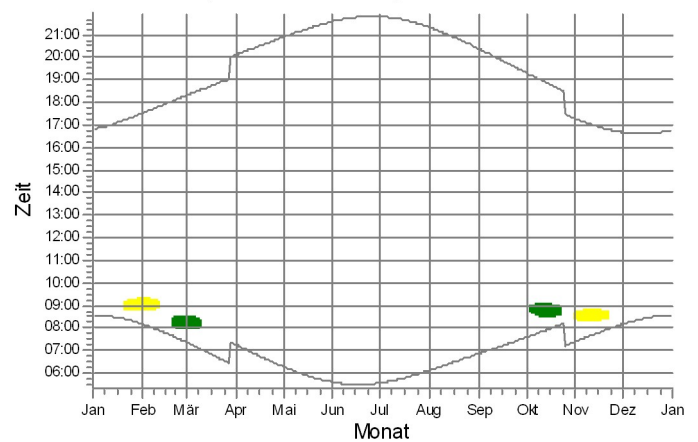
N-54: 108B, Rue Pierre Gansen, 4570 Niederkorn



N-55: 108, Rue Pierre Gansen, 4570 Niederkorn



N-56: 87, Rue Pierre Gansen, 4570 Niederkorn



WEA



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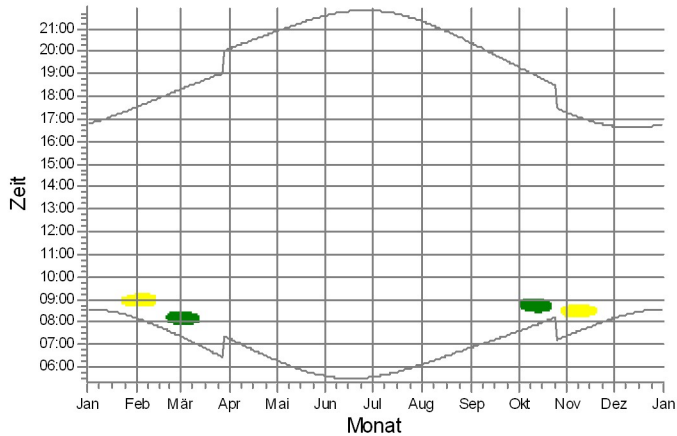
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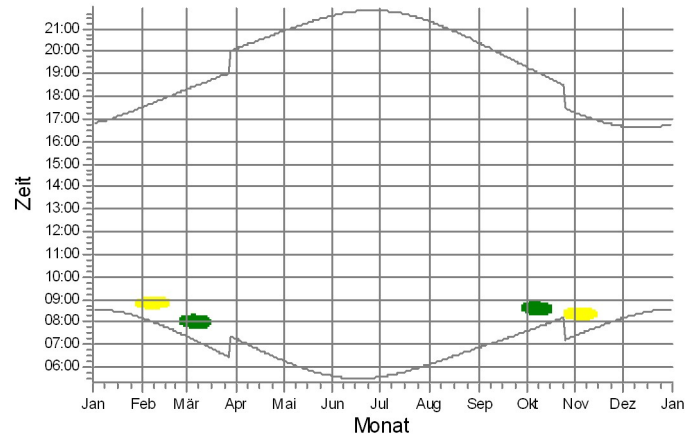
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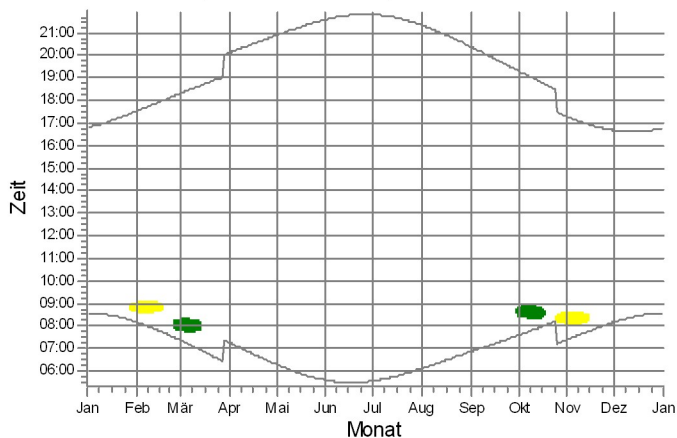
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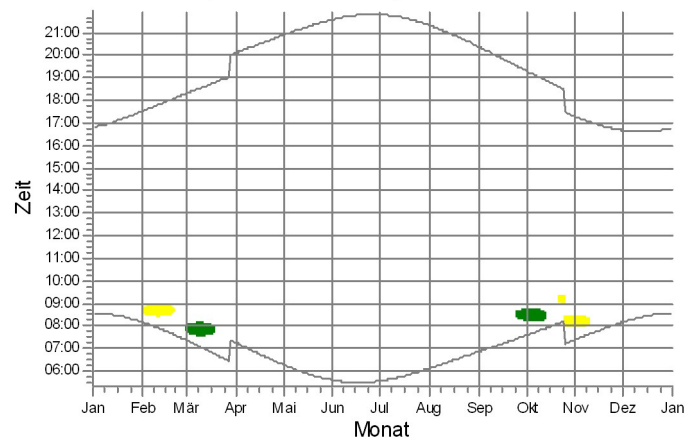
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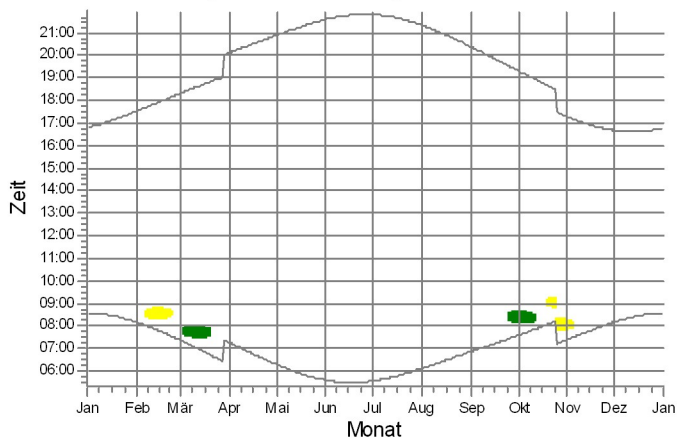
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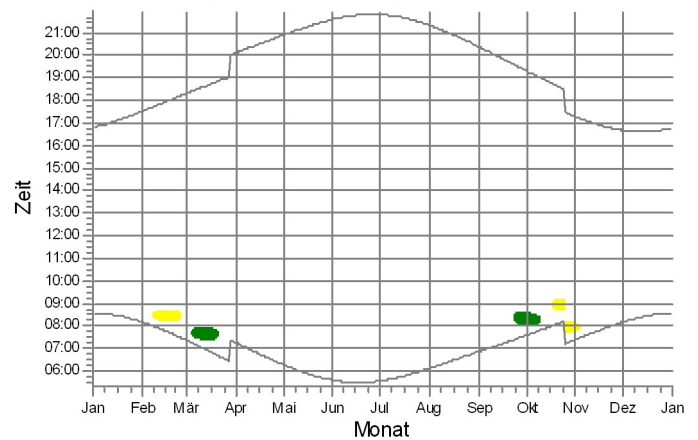
N-60: 76, Rue Pierre Gansen, 4570 Niederkorn



N-61: 52A, Rue Pierre Gansen, 4570 Niederkorn



N-62: 36, Rue Pierre Gansen, 4570 Niederkorn



WEA



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 5326 Contern

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Windpark Sanem, Gemeinde  
 Sanem, Kanton  
 Esch-sur-Alzette, Luxembourg

## Lizenzierter Anwender:

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

Robin Umminger / robin.umminger@ramboll.com

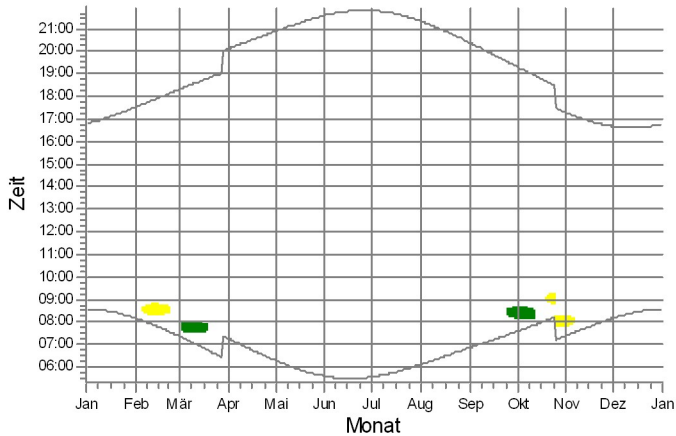
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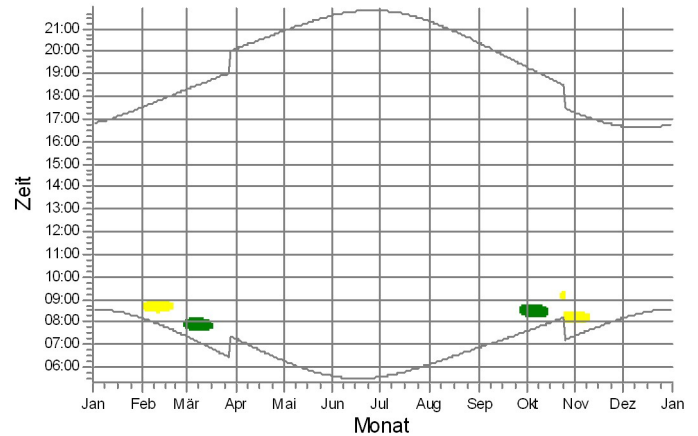
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Berechnung: Zusatzbelastung

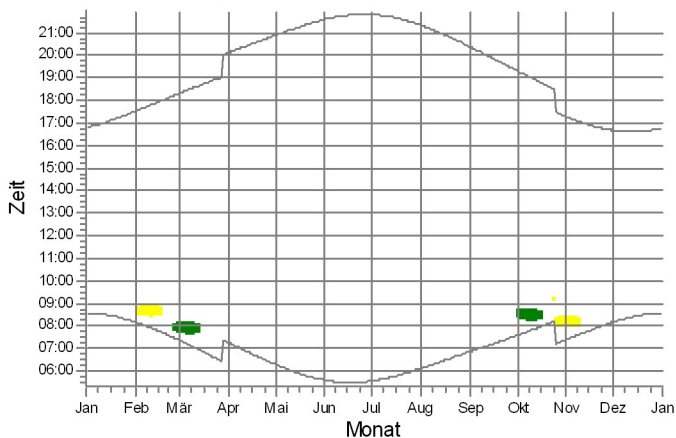
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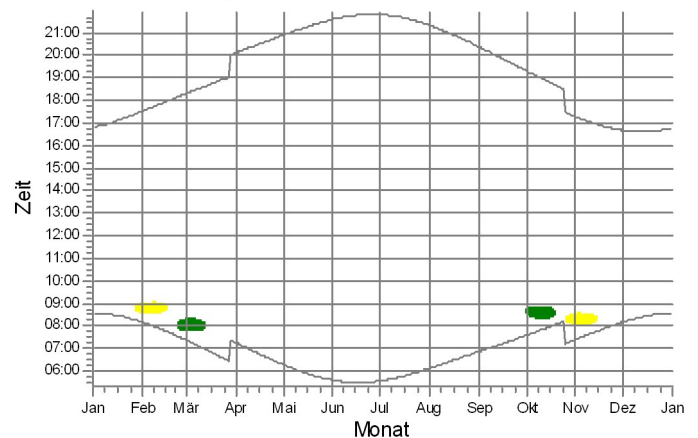
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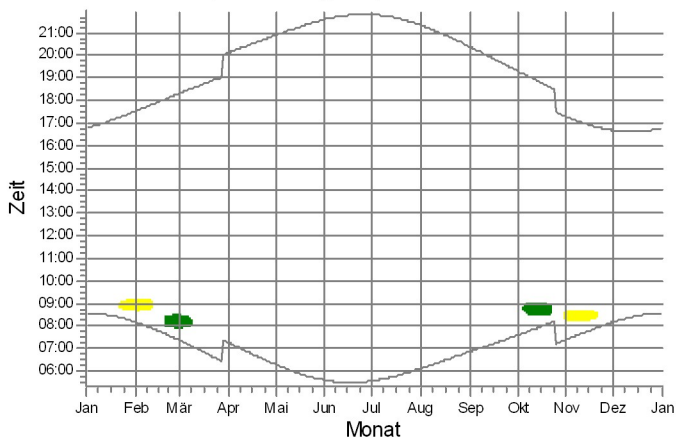
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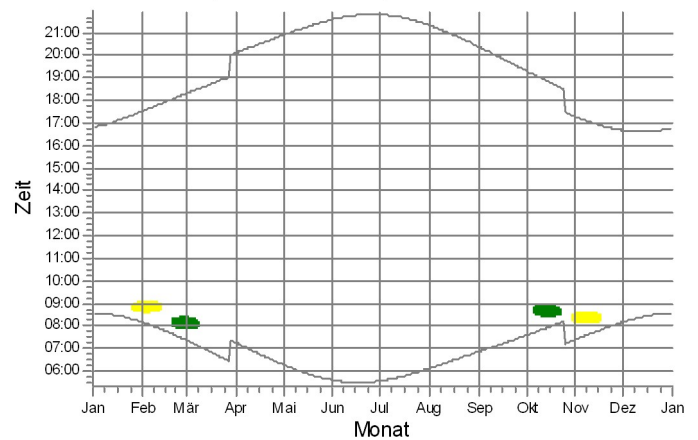
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N-67: 10, Rue des Lignes, 4609 Niederkorn



N-68: 7, Rue des Trévires, 4680 Niederkorn



WEA



WEA 1: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (39)

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



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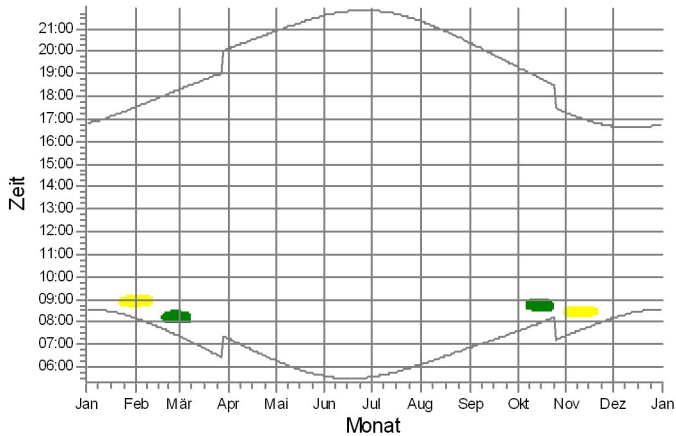
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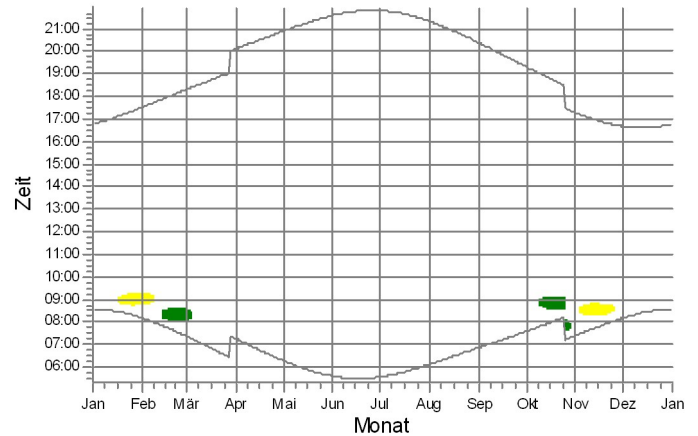
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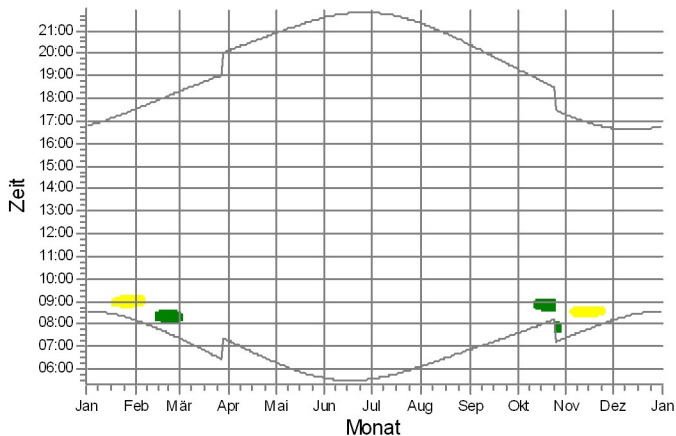
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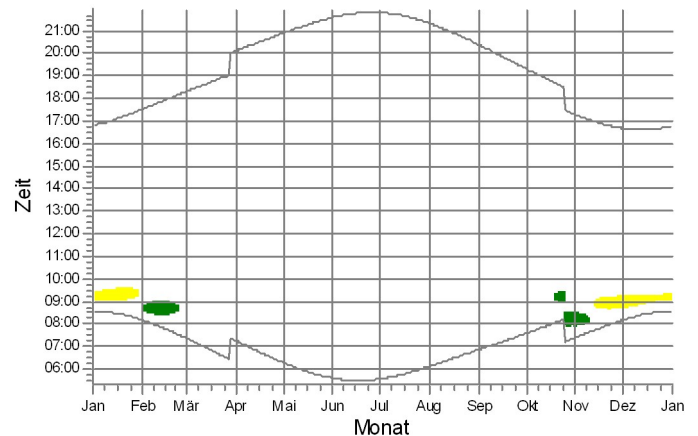
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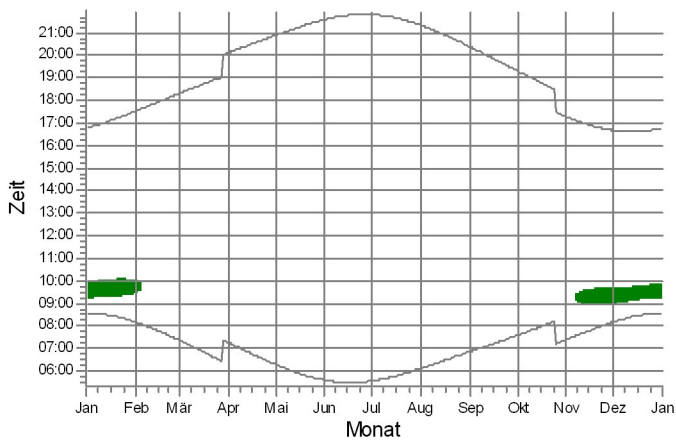
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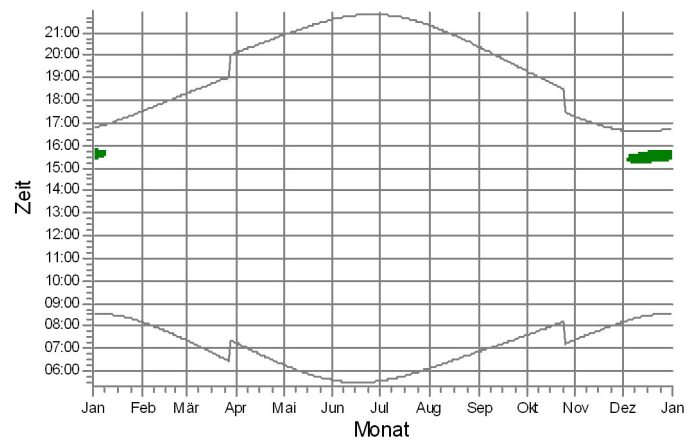
N-72: Z.I. Hahneboesch, 4562 Niederkorn



N-73: Z.I. Hahneboesch, 4562 Niederkorn



S-01: 39, Rue Ermesinde, 4992 Sanem



WEA



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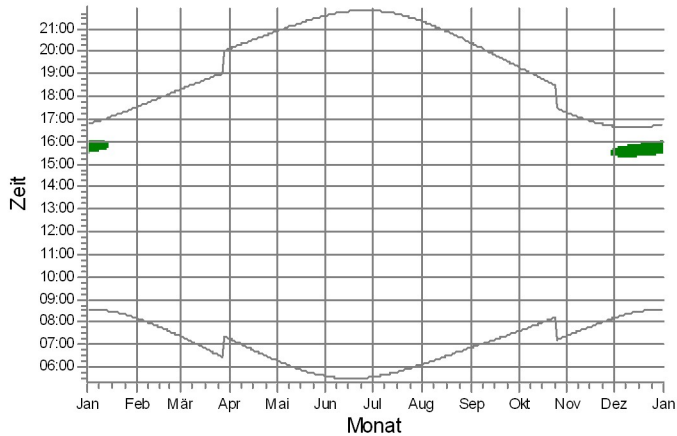
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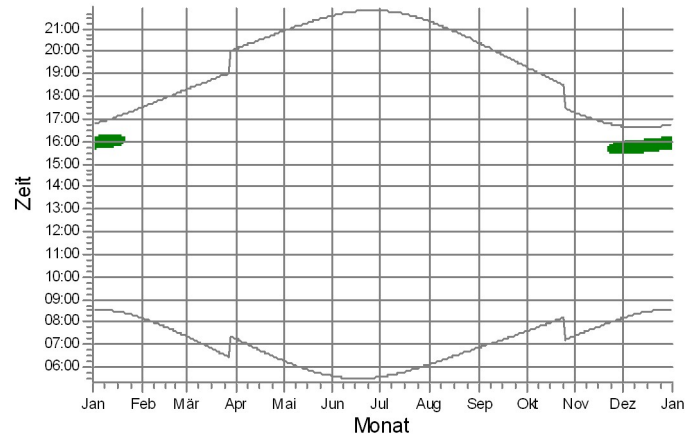
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Berechnung: Zusatzbelastung

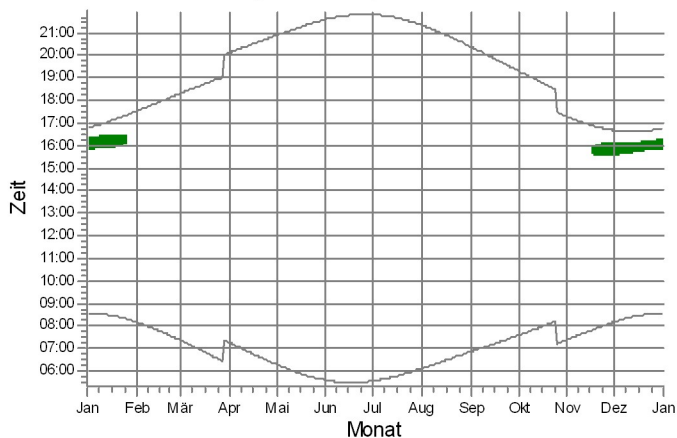
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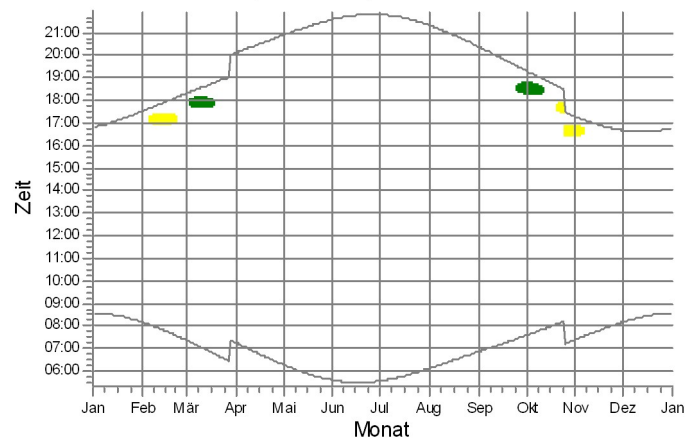
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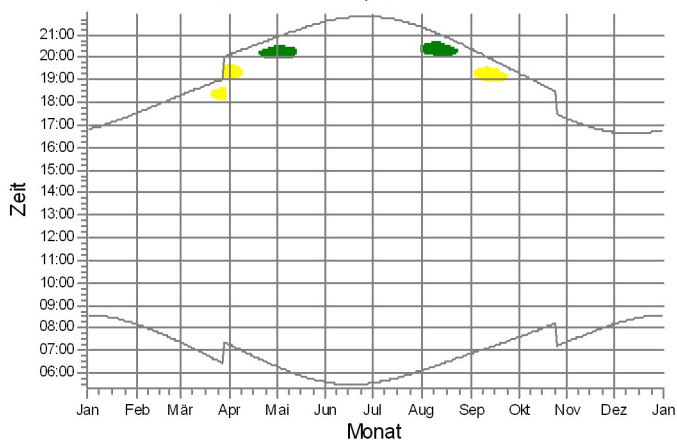
S-04: 89, Rue d'Esch, 4985 Sanem



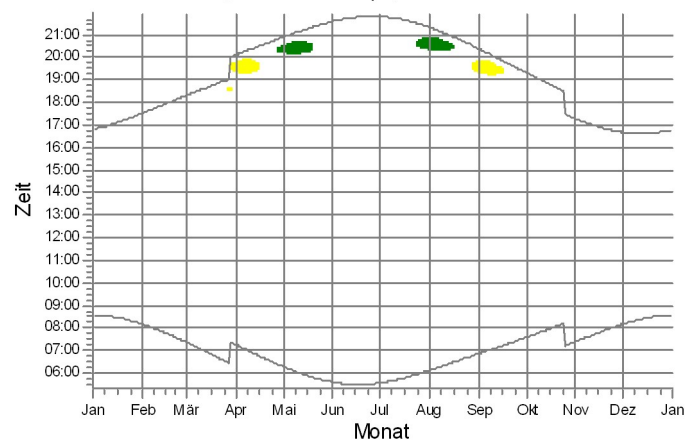
S-05: 10, Um Woeller, 4410 Soleuvre



S-06: 80, Rue des Champs, 4432 Soleuvre



S-07: 75, Rue des Champs, 4432 Soleuvre



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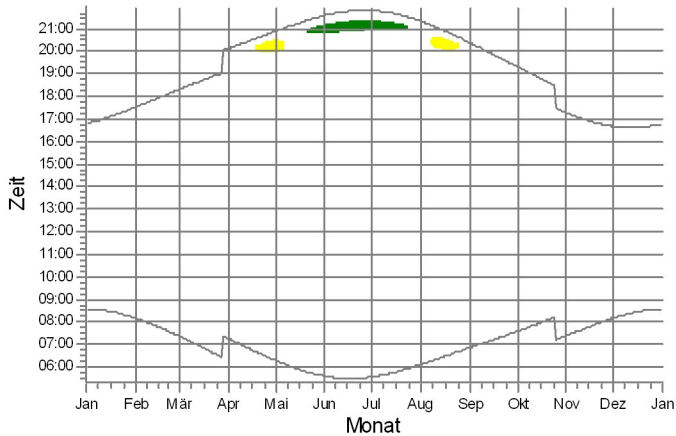
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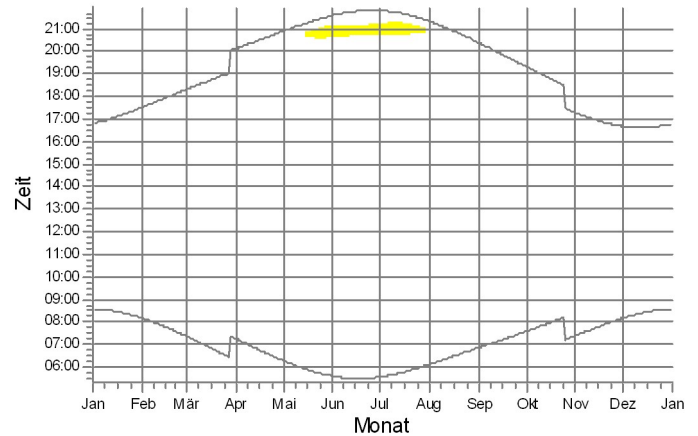
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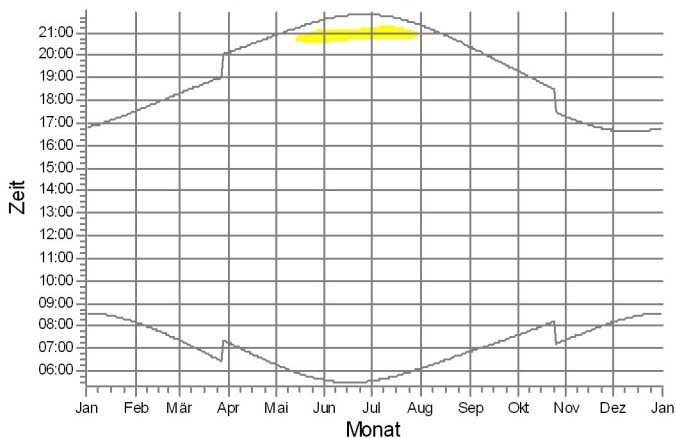
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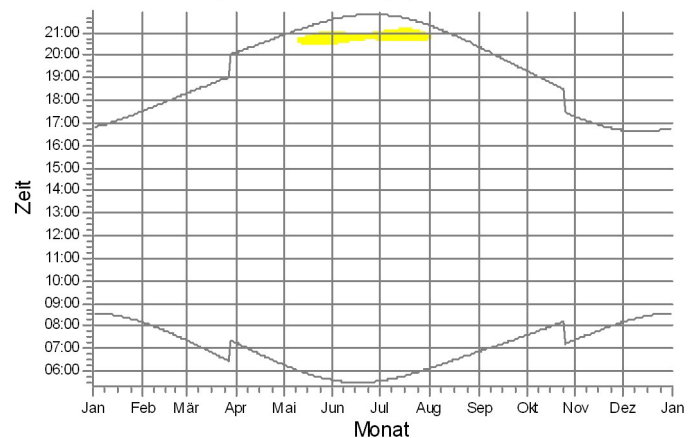
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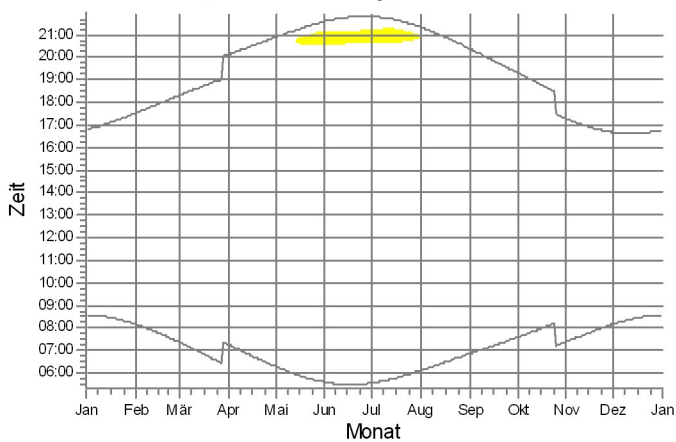
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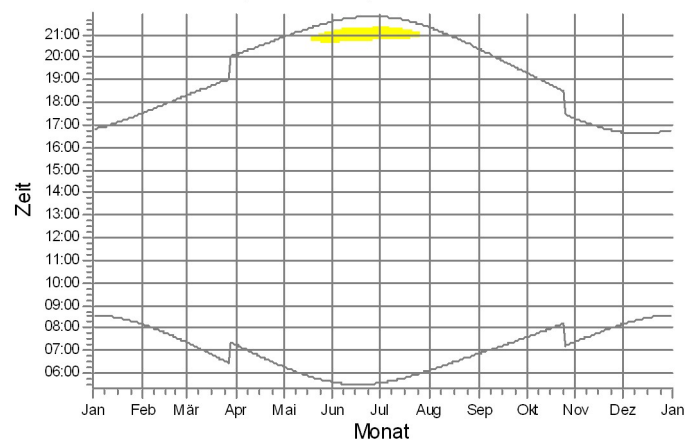
S-11: 16, Rue de Differdange, 4437 Soleuvre



S-12: 31, Rue de Differdange, 4437 Soleuvre



S-13: 6, Rue du Bois, 4421 Soleuvre



### WEA



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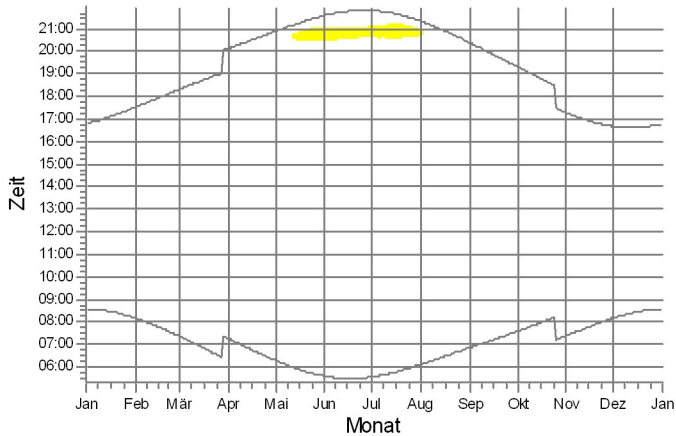
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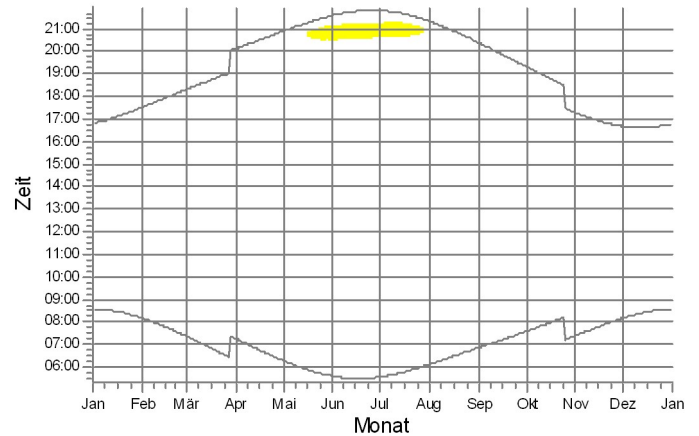
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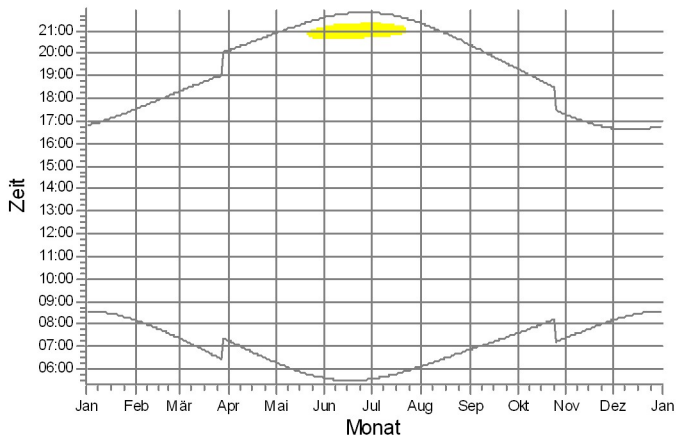
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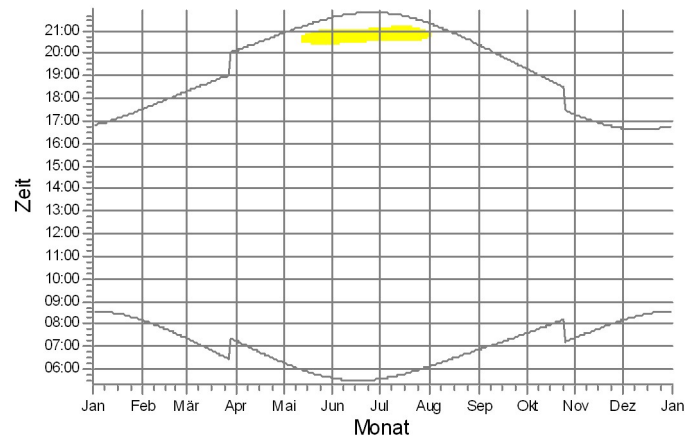
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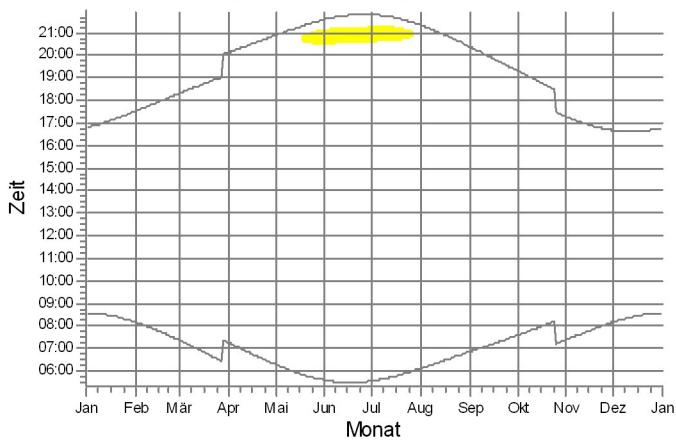
S-16: 4, Rue Emile Mayrisch, 4470 Soleuvre



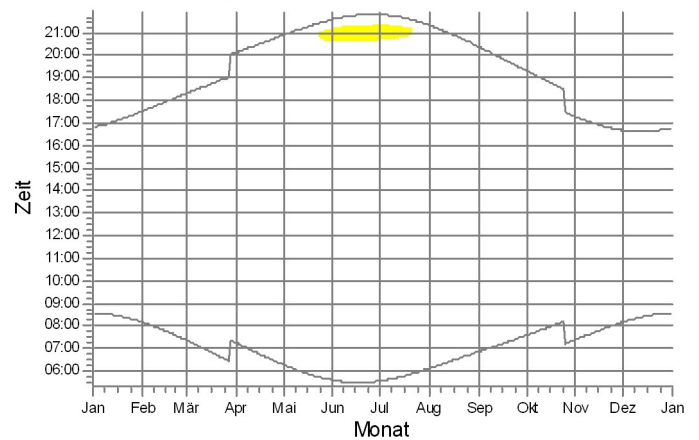
S-17: 62, Rue de Differdange, Soleuvre



S-18: 69, Rue de Differdange, Soleuvre



S-19: 35, Rue des Erables, 4423 Soleuvre



WEA

WEA 2: NORDEX N163/6.8 6800 163.0 !O! NH: 164,0 m (Ges:245,5 m) (40)



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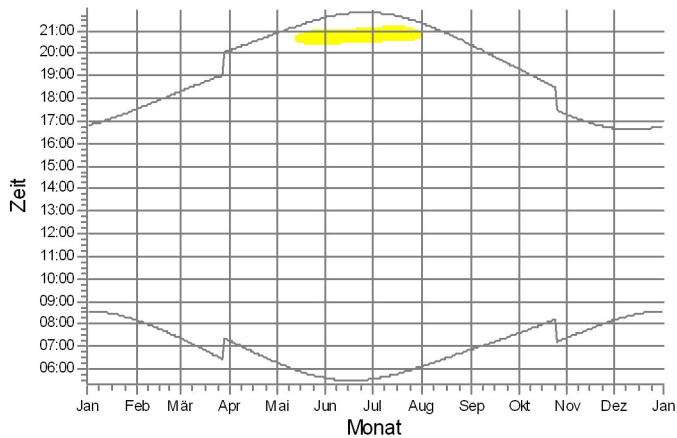
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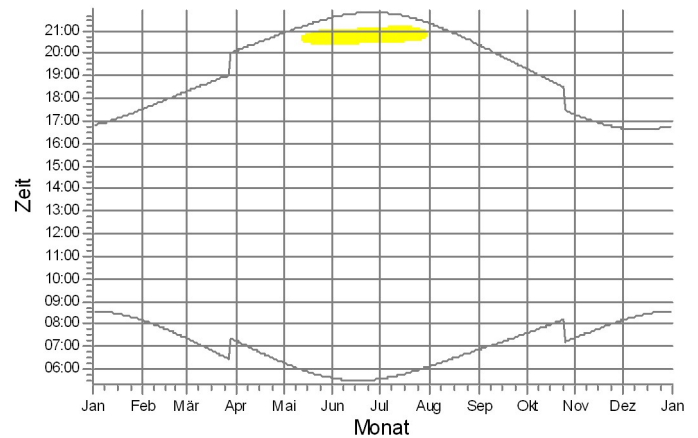
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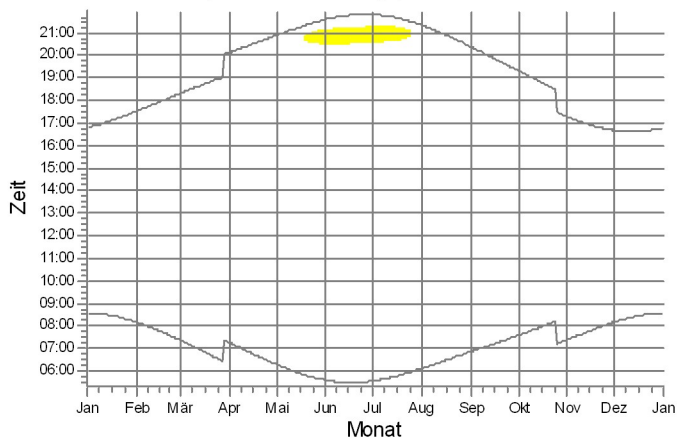
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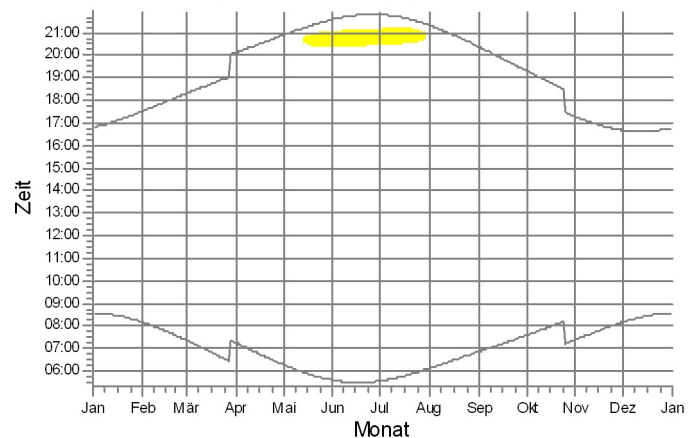
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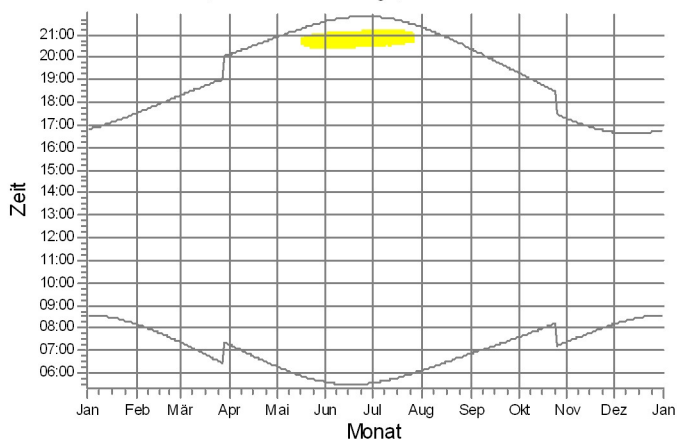
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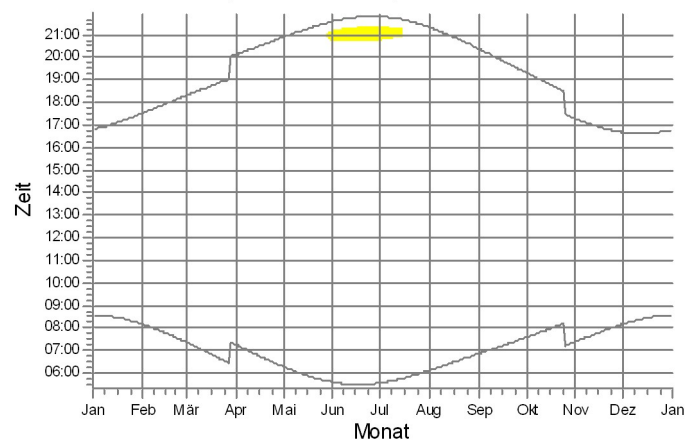
S-23: 80, Rue de Differdange, 4437 Soleuvre



S-24: 90, Rue de Differdange, 4437 Soleuvre



S-25: 25, Rue des Erables, 4423 Soleuvre



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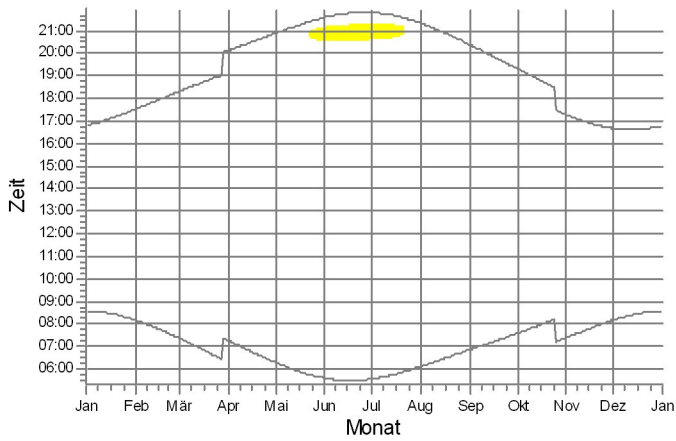
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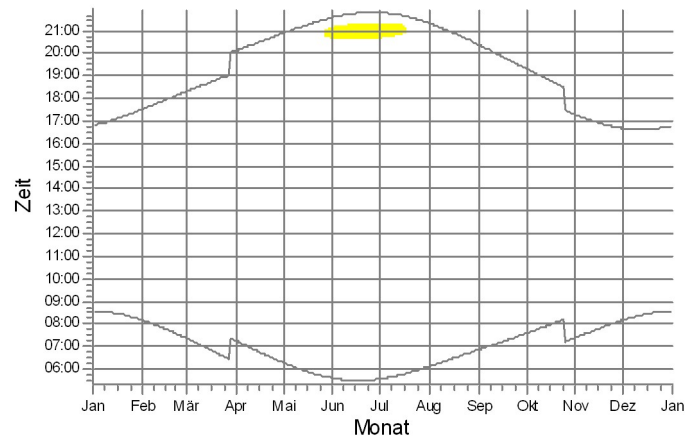
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Berechnung: Zusatzbelastung

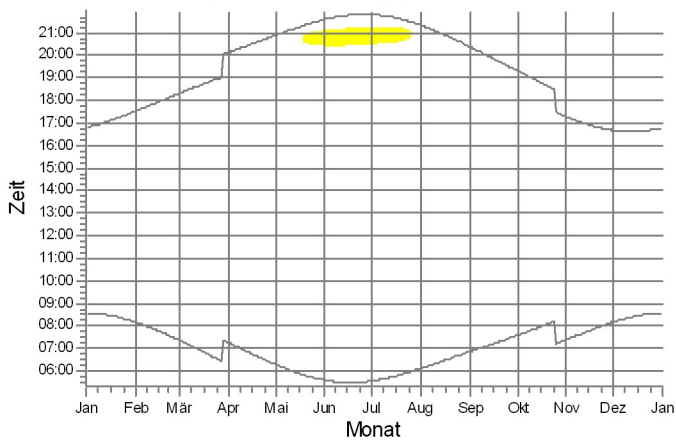
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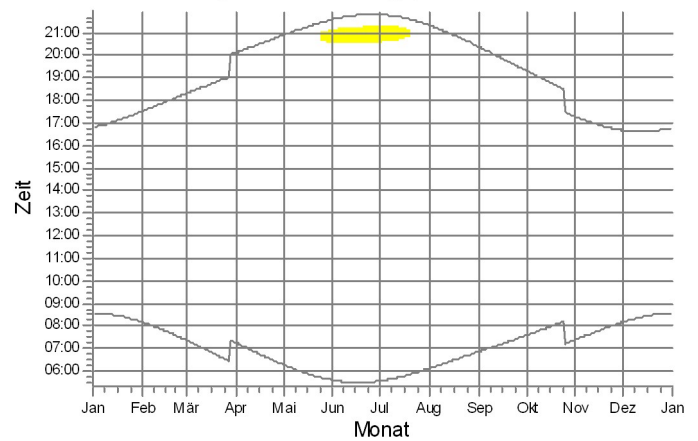
S-27: 95, Rue de Differdange, 4437 Soleuvre



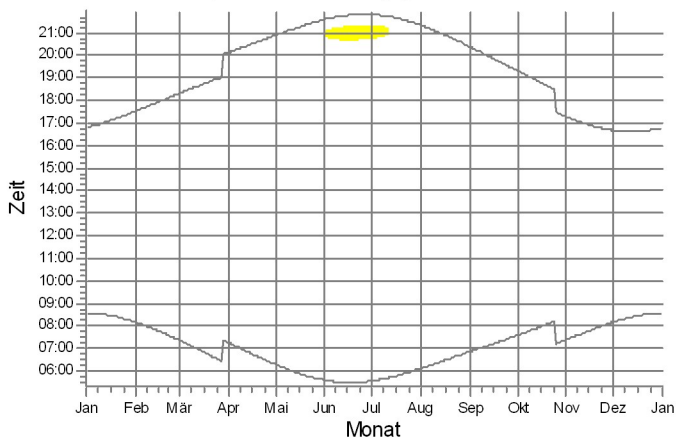
S-28: 100, Rue de Differdange, 4437 Soleuvre



S-29: 106, Rue de Differdange, 4437 Soleuvre



S-30: 112, Rue de Differdange, 4437 Soleuvre



WEA

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## **Anhang: Akkreditierung und Theoretische Grundlagen**





## Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV  
Unterzeichnerin der Multilateralen Abkommen  
von EA, ILAC und IAF zur gegenseitigen Anerkennung

## Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

**Ramboll Deutschland GmbH**

mit den Standorten

**Elisabeth-Consbruch-Straße 3, 34131 Kassel**  
**Andreaestraße 3, 30159 Hannover**

die Kompetenz nach DIN EN ISO/IEC 17025:2018 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

**Bestimmung von Windpotenzial und Energieerträgen von Windenergieanlagen (WEA) einschließlich Prüfung windklimatologischer Eingangsdaten; Bestimmung des Referenzertrages; Bestimmung der Standortgüte; Durchführung und Auswertung von Windmessungen zur Bestimmung des Windpotenzials; Erstellung von Schallimmissionsprognosen für Windenergieanlagen; Erstellung von Schattenwurfprognosen für Windenergieanlagen; Erstellung von Gutachten zur natürlichen Umgebungsturbulenz von Windenergieanlagenstandorten auf der Grundlage der Berechnung von Turbulenzintensitäten**

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 24.01.2022 mit der Akkreditierungsnummer D-PL-21488-01. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 3 Seiten.

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

Berlin, 24.01.2022

Im Auftrag Dr. Heike Manke  
Abteilungsleiterin

*Die Urkunde samt Urkundenanlage gibt den Stand zum Zeitpunkt des Ausstellungsdatums wieder. Der jeweils aktuelle Stand des Geltungsbereiches der Akkreditierung ist der Datenbank akkreditierter Stellen der Deutschen Akkreditierungsstelle GmbH (DAKkS) zu entnehmen. <https://www.dakks.de/content/datenbank-akkreditierter-stellen>*

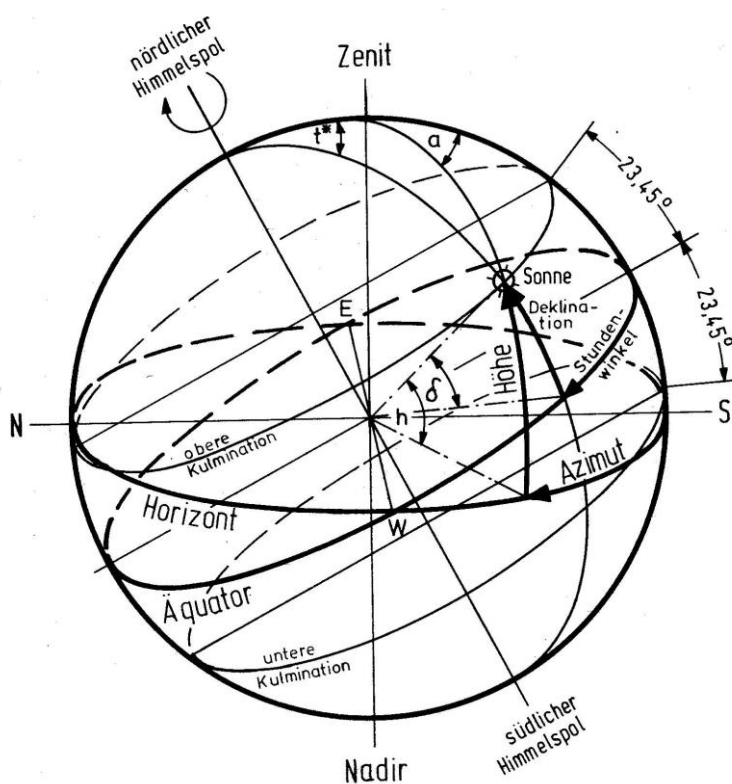
Siehe Hinweise auf der Rückseite



# 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**

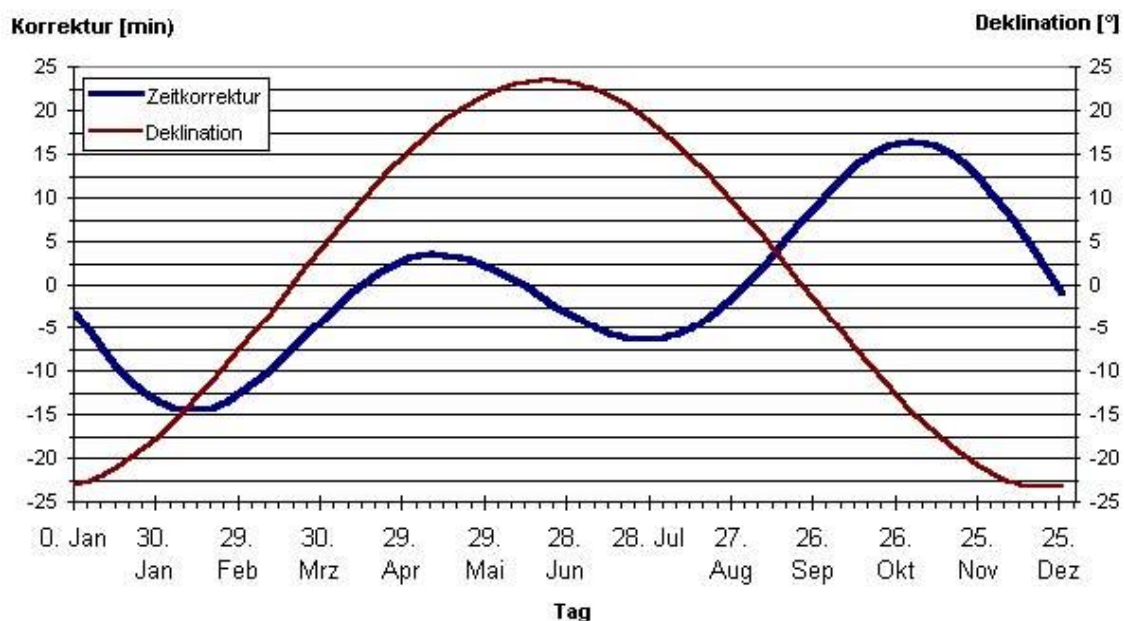
Mit diesen Daten werden die Deklination  $\delta$ , der Stundenwinkel  $\omega$ , die Sonnenhöhe  $h$ , der Azimut  $\gamma$  sowie der Sonnenauf- und -untergang  $t_a$  und  $t_u$  berechnet. Die Begriffe bedeuten:

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



- **Stundenwinkel  $\omega$ :** Winkel zwischen dem Sonnenhöchststand und der aktuellen Sonneneinstrahlung.
- **Azimut  $\gamma$ :** 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 Blattiefe 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.

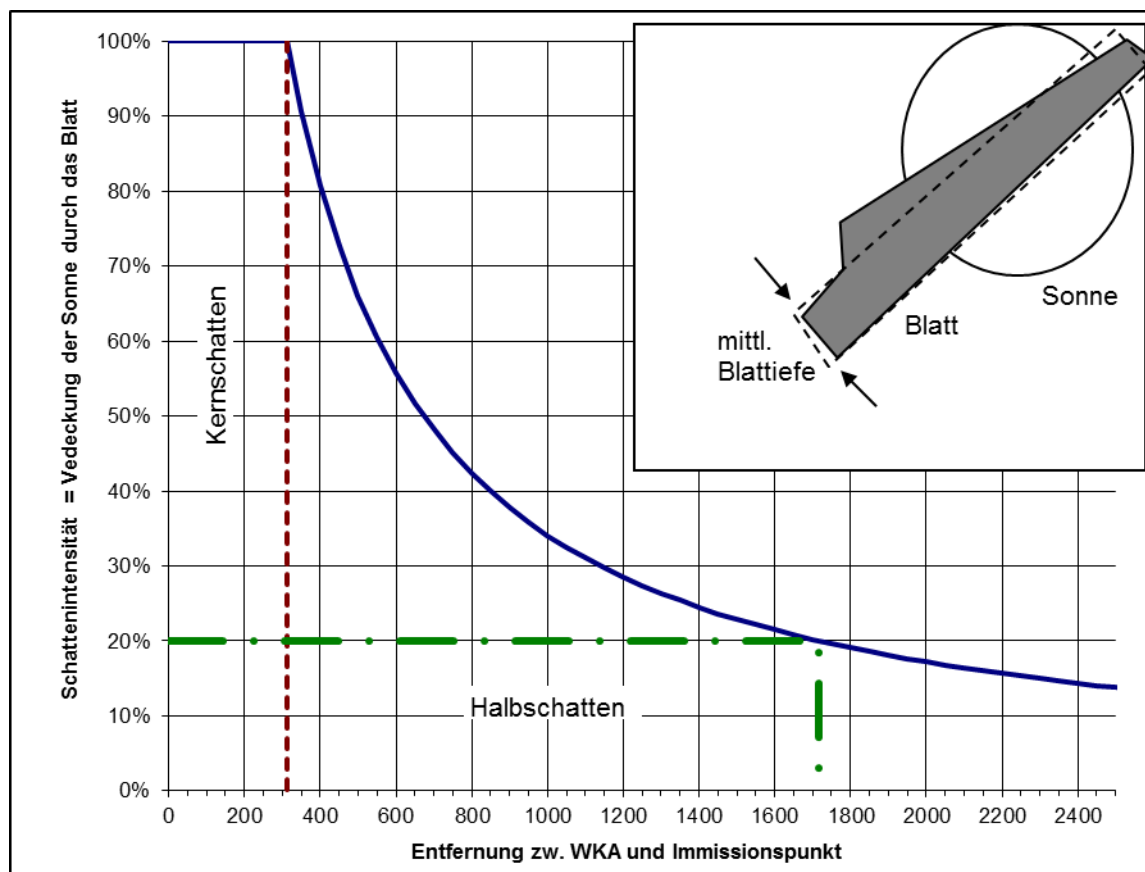


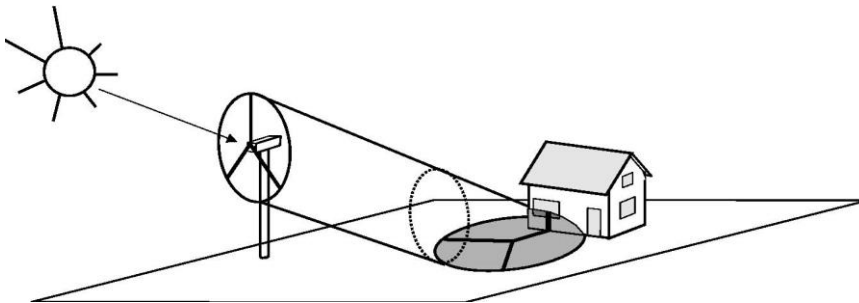
Abbildung 3: Schattenintensität in Abhängigkeit von Rotorblatttiefe und Entfernung



## 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)



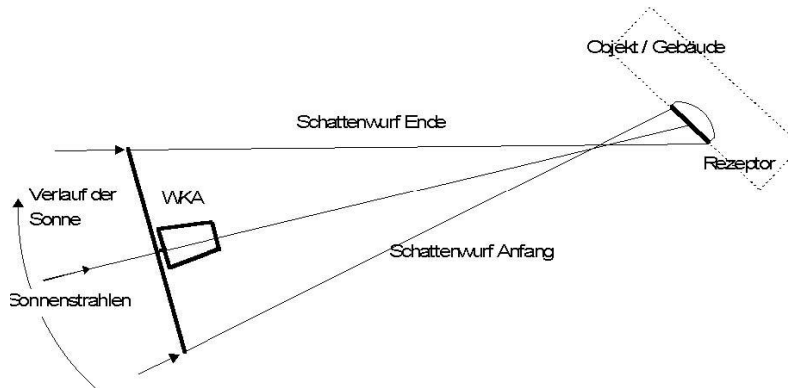
**Abbildung 4: Schattenwurf des Rotors**

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  $3^\circ$  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).



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