Schattenwurfgutachten für die Windenergieanlage am Standort „Unterheimbach“

Neuerrichtung von 1 Windenergieanlage
(Anlagentyp: Nordex N175/6.X - 6,8 MW, Nabenhöhe: 179 m)

Standort

Bretzfeld-Unterheimbach (Baden-Württemberg)

im Auftrag der

Bürgerwindpark Hohenlohe GmbH

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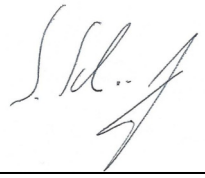
Niddatal, 13. März 2024

Das vorliegende Schattenwurfgutachten für die Windenergieanlage am Standort „Unterheimbach“ wurde im Auftrag der Bürgerwindpark Hohenlohe GmbH erstellt. Die vorgenommenen Berechnungen und Bewertungen der Schattenwurfimmissionen in der schutzbedürftigen Umgebung der geplanten Windenergieanlage basieren auf den Empfehlungen der Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz LAI („Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windkraftanlagen – WKA-Schattenwurf-Hinweise“ /1/) sowie den uns vom Auftraggeber zur Verfügung gestellten Unterlagen zur Anlagenkonzeption (Anlagentypen, -positionen u. Nabenhöhen).

Seitens der Gutachter werden keine Garantien bzw. Gewährleistungen für die Einhaltung der Prognoseergebnisse übernommen. Ein Haftungsanspruch für Irrtümer oder Abweichungen ist ausgeschlossen.

Niddatal, den 13.03.2024



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Zusammenfassung und Bewertung

In der vorliegenden Untersuchung wurden die zu erwartenden Schattenwurfimmissionen in der Umgebung der geplanten Windenergieanlage am Standort „Unterheimbach“ bestimmt. Bei dem dortigen Bauvorhaben handelt es sich um die geplante Errichtung von 1 Windenergieanlage (WEA 1) vom Typ Nordex N175/6.X - 6,8 MW (Nabenhöhe: 179 m). Als potenzielle Vorbelastung wurden insgesamt 8 bestehende bzw. genehmigte oder auch beantragte Windenergieanlagen (WEA 2-9) aus der weitläufigen Standortumgebung berücksichtigt, wobei gezeigt werden konnte, dass diese aufgrund ihrer Lage und Schattenwurfreichweite nicht auf die maßgeblichen Immissionsorte (IO A-I) einwirken können. Die Zusatzbelastung entspricht daher im vorliegenden Fall auch der Gesamtbelastung. Die Berechnungen und Bewertungen wurden auf Grundlage der Empfehlungen der Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI) /1/ durchgeführt. Die Prognoseergebnisse zeigen sowohl für das worst case-Szenario als auch für den meteorologisch wahrscheinlichen Fall (real case), dass durch den betriebsbedingten Schattenwurf ohne immissionsmindernde Maßnahmen eine nicht unerhebliche Beeinträchtigung an einzelnen schutzwürdigen Bebauungen östlich der geplanten Windenergieanlage zu erwarten wäre. Um die Sicherstellung der Einhaltung der Richtwerte zu gewährleisten, ist die Installation eines Abschaltmoduls für die geplante Windenergieanlage (WEA 1) als Auflage zu empfehlen.

Inhaltsverzeichnis

1 Sachverhalt und Gegenstand des Gutachtens

Die Bürgerwindpark Hohenlohe GmbH plant im Gemeindegebiet von Bretzfeld in der Gemarkung Unterheimbach (s. Kapitel 3.1) die Errichtung von 1 Windenergieanlage (WEA 1) vom Typ Nordex N175/6.X - 6,8 MW (Nabenhöhe: 179 m).

Das in Auftrag gegebene Gutachten dient der Prognose des periodischen Schattenwurfs in der schutzwürdigen Umgebung der Windenergieanlage.

Die Berechnung und Beurteilung der Schattenwurfimmissionen wurde auf Grundlage der Empfehlungen der Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI) /1/ durchgeführt. Dabei wurde zum einen die astronomisch maximal mögliche Beschattungsdauer (worst case, LAI-Richtwert Schattenwurfdauer: 30 h/a bzw. 30 min/d) und zum anderen anhand klimatologischer Daten (standortbezogene Wind- und Strahlungsverhältnisse, s. Kapitel 2.1) die meteorologisch wahrscheinliche Beschattungsdauer (real case, LAI-Richtwert Schattenwurfdauer: 8 h/a) für die Standortumgebung bestimmt. Topografische Effekte bzw. Höhenunterschiede zwischen den Windenergieanlagen und den Immissionsorten wurden über ein digitales Geländemodell /2/ erfasst.

2 Beurteilungs- und Bewertungsgrundlagen

2.1 Allgemeine Grundlagen und Berechnungsmethode

Der durch den umlaufenden Rotor einer Windenergieanlage verursachte periodische Schattenwurf ist im Sinne des Bundes-Immissionsschutzgesetz (BImSchG) /3/ ein umweltbelastender Eintrag (Immission).

Als Kernschatten bezeichnet man die vollständige Verdeckung der Sonne durch das Rotorblatt, während die unvollständige Abdeckung als Halbschatten bezeichnet wird. Je nach Drehzahl des Rotorblattes werden bei Sonnenschein Helligkeits- bzw. Lichtwechsel mit einer Frequenz zwischen 0,4 Hz und 3 Hz ausgelöst, die vom Menschen allgemein als störend empfunden werden.

Einwirkungen durch periodischen Schattenwurf auf Immissionsorte können nur dann sicher ausgeschlossen werden, wenn diese außerhalb des möglichen Beschattungsbereichs der jeweiligen Anlage liegen. Soweit sich zu berücksichtigende Immissionsorte innerhalb des Beschattungsbereiches der Windenergieanlagen befinden, muss mit zeitweilig auftretenden und wiederkehrenden Belästigungen gerechnet werden.

Die Grundlage zur Prognose bzw. Berechnung des von einer Windenergieanlage ausgehenden Schattenwurfs bildet der Sonnenstand, der den Einstrahlungswinkel des Sonnenlichts zur Erdoberfläche angibt. Er ist standort- und tageszeitabhängig sowie über das Jahr veränderlich. Für die vorliegende Prognose wurde der Sonnenstand nach allgemein zugängigen Methoden, wie u. a. in /4/, /5/ und /6/ beschrieben, berechnet.

Die Dauer und der geometrische Verlauf des Schattenwurfs wurde für ein Raster mit einer räumlichen Auflösung von 10 m x 10 m in einem Umkreis von 5 km um die jeweiligen Standorte für das Gesamtjahr berechnet (Simulationssoftware WindPRO – Modul Shadow

/13/, Ergebnisse s. Kapitel 4). Hierzu wurden neben den geografischen Positionen und der geometrischen Daten (Nabenhöhe, Rotordurchmesser, Blatttiefe) der Windenergieanlagen, die orografischen Verhältnisse in der weiträumigen Umgebung des Standortes berücksichtigt. Entsprechend der LAI-Hinweise /1/ wurde aufgrund des Bewuchses und der Bebauung sowie der zu durchdringenden Atmosphärenschichten potenzieller Schattenwurf für Sonnenstände unter 3° Erhöhung über Horizont vernachlässigt. Für das Rotorblatt, das mindestens 20 % der Sonnenfläche verdecken muss, wurde eine rechteckige Geometrie mit einer mittleren Blatttiefe[1] angenommen. Falls die astronomisch maximal mögliche Beschattungsdauer (worst case) am jeweiligen Immissionsort (in einer Bezugshöhe von 2 m über Grund) nicht mehr als 30 Stunden pro Kalenderjahr und darüber hinaus nicht mehr als 30 Minuten pro Kalendertag beträgt, kann eine Einwirkung durch den zu erwartenden periodischen Schattenwurf als nicht erheblich belästigend angesehen werden (/7/, /8/). Zur Prognose des „worst case“ wurde kontinuierlicher Sonnenschein bei wolkenlosem Himmel und senkrechte Sonneneinstrahlung in Bezug zur Rotorfläche sowie Dauerbetrieb der Anlage angenommen. Von Relevanz sind die an einem Immissionsort tatsächlich auftretenden bzw. wahrnehmbaren Immissionen, die nur bei bestimmten Wetterbedingungen auftreten können (meteorologisch wahrscheinliche Beschattungsdauer – „real case“). Bei der meteorologisch wahrscheinlichen Beschattungsdauer (real case) sind aufgrund des Windklimas und der Sonnenscheinhäufigkeit des Standortes deutlich geringere Schattenwurfzeiträume als im o.g. „worst case“ zu erwarten. Ein entsprechend niedrigerer Richtwert von 8 Stunden pro Kalenderjahr ist hier nach /9/ anzusetzen. Zur Prognose der meteorologisch wahrscheinlichen Beschattungsdauer (real case) wurden die Witterungsverhältnisse am Standort durch langfristige Klimazeitreihen (hier: Windstatistik des Globalen Windatlas /10/ sowie die Sonnenscheindauer/-wahrscheinlichkeit nach Angaben der Meteonorm-Datenbank /11/) berücksichtigt. Topografische Effekte, wie Höhendifferenzen

[1] Mittlere Blatttiefe = ½ (max. Blatttiefe + min. Blatttiefe bei 0,9 · Rotorradius)

im Gelände zwischen den Windenergieanlagenstandorten und den Immissionsorten wurden unter Verwendung eines digitalen Geländemodells /2/ erfasst.

2.2 Kartenmaterial und Planungsunterlagen

Als Kartenmaterial wurden verwendet:

- Standortkoordinaten nach Angaben des Planers (s. Kapitel 3.1)
- Auszüge aus den Bebauungs- und Flächennutzungsplänen der Gemeinden Bretzfeld und Wüstenrot sowie Pfedelbach (s. /17/-/20/)
- topografische Karte des Landesvermessungsamtes Baden-Württemberg /12/
- OpenStreetMap /16/
- Digitales Geländemodell SRTMGL3 /2/
- Geoportal /14/ und Energieatlas Baden-Württemberg /21/

2.3 Technische Daten der Windenergieanlagen

Bei der seitens des Auftraggebers geplanten Windenergieanlage (Zusatzbelastung: WEA 1) handelt es sich um den Anlagentyp Nordex N175/6.X - 6,8 MW (Nabenhöhe: 179 m, s. Rotorblattdaten in Mitgeltende Unterlagen /A/). Des Weiteren wurden 8 bestehende bzw. genehmigte oder auch beantragte Windenergieanlagen (WEA 2-9) aus der weitläufigen Standortumgebung (Umkreis ca. 6 km) nach Vorgabe der Genehmigungsbehörden (Landratsämter Hohenlohekreis, Heilbronn, Schwäbisch Hall u. Rems-Murr-Kreis)[2] berücksichtigt und überprüft ob eine potenzielle Vorbelastung an den maßgeblichen Immissionsorten (IO A-I, s. Kapitel 3.2) besteht. Die Tabellen 1a und 1b geben eine Zusammenstellung der technischen Daten der als Zusatz- und potenzielle Vorbelastung berücksichtigten Windenergieanlagen.

[2]In den potenziell relevanten Gebieten des angrenzenden Landkreises Schwäbisch Hall und im Rems-Murr-Kreis waren keine (Vorbelastungs-)Windenergieanlagen zu berücksichtigen.

Tabelle 1a: Technische Daten der Zusatzbelastung (WEA 1).

WEA	Anlagentyp / Nennleistung	RW[I)]	HW[I)]	NH[II)]	RD[III)]	BT[IV)]	BT90[V)]
1	Nordex N175/6.X - 6,8 MW	535.255	5.441.206	179	175	4,30	1,30

[I)] UTM-Koordinaten (Zone 32, ETRS89) Rechtswert (RW) bzw. Hochwert (HW). [II)] NH: Nabenhöhe in Metern, [III)] RD: Rotordurchmesser in Metern. [IV)] BT: max. Rotorblatttiefe in Metern. [V)] BT90: min. Blatttiefe bei 90 %-Rotorradius in Metern.

Tabelle 1b: Technische Daten der potenziellen Vorbelastung (WEA 2-9).

WEA	Anlagentyp / Nennleistung	RW[I)]	HW[I)]	NH[II)]	RD[III)]	BT[IV)]	BT90[V)]
2	Nordex N149/4.0-4.5 - 4,5 MW	531.699	5.438.916	164	149,1	4,15	1,17
3	Nordex N149/4.0-4.5 - 4,5 MW	532.215	5.439.266	164	149,1	4,15	1,17
4	GE 6.0-164 - 6,0 MW	538.696	5.441.524	167	164	4,00	1,10
5	GE 6.0-164 - 6,0 MW	539.100	5.441.837	167	164	4,00	1,10
6	Enercon E-92 - 2,3 MW	531.814	5.438.189	138,4	92	3,63	0,83
7	Enercon E-92 - 2,3 MW	531.655	5.438.523	138,4	92	3,63	0,83
8	Nordex N149/4.0-4.5 - 4,5 MW	531.447	5.439.292	164	149,1	4,15	1,17
9	Nordex N175/6.X - 6,8 MW	531.700	5.439.749	179	175	4,30	1,30

[I)] UTM-Koordinaten (Zone 32, ETRS89) Rechtswert (RW) bzw. Hochwert (HW). [II)] NH: Nabenhöhe in Metern, [III)] RD: Rotordurchmesser in Metern. [IV)] BT: max. Rotorblatttiefe in Metern. [V)] BT90: min. Blatttiefe bei 90 %-Rotorradius in Metern.

Nach den vorliegenden Prognoseergebnissen (s. Projektbericht/Schattenwurfkarte „Zusatzbelastung WEA 1 u. potenzielle Vorbelastung WEA 2-9 (worst case)“ im Anhang) ergibt sich keine Vorbelastung an den maßgeblichen Immissionsorten (IO A-I). Die Zusatzbelastung entspricht daher im vorliegenden Fall auch der Gesamtbelastung.

2.4 Sonstige Beurteilungsgrundlagen

Zur Vervollständigung der Beurteilungsgrundlagen wurde seitens des Gutachters eine Standortbesichtigung (Projektstandort u. Immissionsorte) am 11.03.2024 durchgeführt (s. Kapitel 3). Die Gebietseinstufungen nach BauNVO /15/ wurden nach Einholung der aktuell gültigen Flächennutzungspläne unter Berücksichtigung der in den Bebauungsplänen festgelegten Nutzungen vorgenommen.

3 Projektstandort und Umgebungsbedingungen

3.1 Projektstandort

Im Rahmen der Prognose der Schattenwurfimmissionen wurde eine Standortbesichtigung am 11.03.2024 durchgeführt. Die örtlichen Gegebenheiten des Projektstandortes (s. Abbildung 1) und der Immissionsorte wurden durch Fotodokumentation, geografische Positionen mittels GPS erfasst.

Abbildung 1: Projekt-Standort „Unterheimbach“ (Waldareal im Bildhintergrund) bei einer durchgeführten Besichtigung am 11.03.2024. Fotostandort[3]: ca. 250 m nördlich der geplanten Anlage WEA 1.

Der Standort der geplanten Windenergieanlage befindet sich

- im Land Baden-Württemberg,
- im Hohenlohekreis,
- im Gemeindegebiet von Bretzfeld,
- Gemarkung Unterheimbach.

Die geografische Position der geplanten Windenergieanlage geht aus den Koordinaten der Tabelle 2 hervor.

[3]Fotostandort (UTM 32, ETRS89): Rechtswert = 535.211, Hochwert = 5.441.457.

Tabelle 2: UTM-Koordinaten (Zone: 32, Datum: ETRS89) der geplanten Windenergieanlage (WEA 1).

Bezeichnung	Anlagentyp	Nabenhöhe	Rechtswert	Hochwert	Höhe ü. NN
WEA 1	Nordex N175/6.X - 6,8 MW	179 m	535.255	5.441.206	437 m

Der in einem ausgedehnten Waldgebiet gelegene Standort befindet sich mit einer Höhe von ca. 437 m über NN im Bereich der Schwäbisch-Fränkischen-Waldberge. Das Gelände in der unmittelbaren und weitläufigen Umgebung ist von hügeligem bis bergigem Charakter mit mäßiger Strukturierung. Die Besiedelungsstruktur in der weitläufigen Umgebung ist durch die Gemeindeteile von Bretzfeld (Unterheimbach) und Wüstenrot (Maienfels)[4] gekennzeichnet. Die in den vorgenannten Gemeindeteilen festgelegten Immissionsorte können Kapitel 3.2 entnommen werden.

3.2 Immissionsorte

Maßgebliche Immissionsorte müssen sich innerhalb des Beschattungsbereichs der geplanten Windenergieanlage befinden. Entsprechend der LAI-Hinweise /1/ handelt es sich dabei insbesondere um folgende schutzwürdigen Räume:

- Wohnräume, einschließlich Wohndielen
- Schlafräume, einschließlich Übernachtungsräume in Beherbergungsstätten und Bettenräume in Krankenhäusern und Sanatorien
- Unterrichtsräume in Schulen, Hochschulen und ähnlichen Einrichtungen
- Büroräume, Praxisräume, Arbeitsräume, Schulungsräume und ähnliche Arbeitsräume
- unbebaute Flächen in einer Bezugshöhe von 2 m über Grund an dem am stärksten betroffenen Rand der Flächen, auf denen nach Bau- oder Planungsrecht Gebäude mit schutzwürdigen Räumen zulässig sind.

Direkt an Gebäuden beginnende Außenflächen (z. B. Terrassen und Balkone) sind schutzwürdigen Räumen tagsüber zwischen 6.00-22.00 Uhr gleichgestellt. Für die vorliegende Untersuchung wurden die in der Abbildung 2 und der Tabelle 3 dargestellten Immissionsorte

[4]Zu Maienfels gehören die Weiler Berg, Busch, Kreuzle, Oberheimbach, Ochsenhof, Schweizerhof und Walklensweiler sowie die Höfe Blindenmannshäusle und Happbühl.

(IO A-I) unter Beachtung der obigen Kriterien exemplarisch ausgewählt. Der maximale Beschattungsbereich der Anlage kann der Schattenwurfkarte „Zusatz-/Gesamtbelastung WEA 1 (worst case)“ im Anhang entnommen werden. Eine Besichtigung der Immissionsorte erfolgte seitens des Gutachters am 11.03.2024.

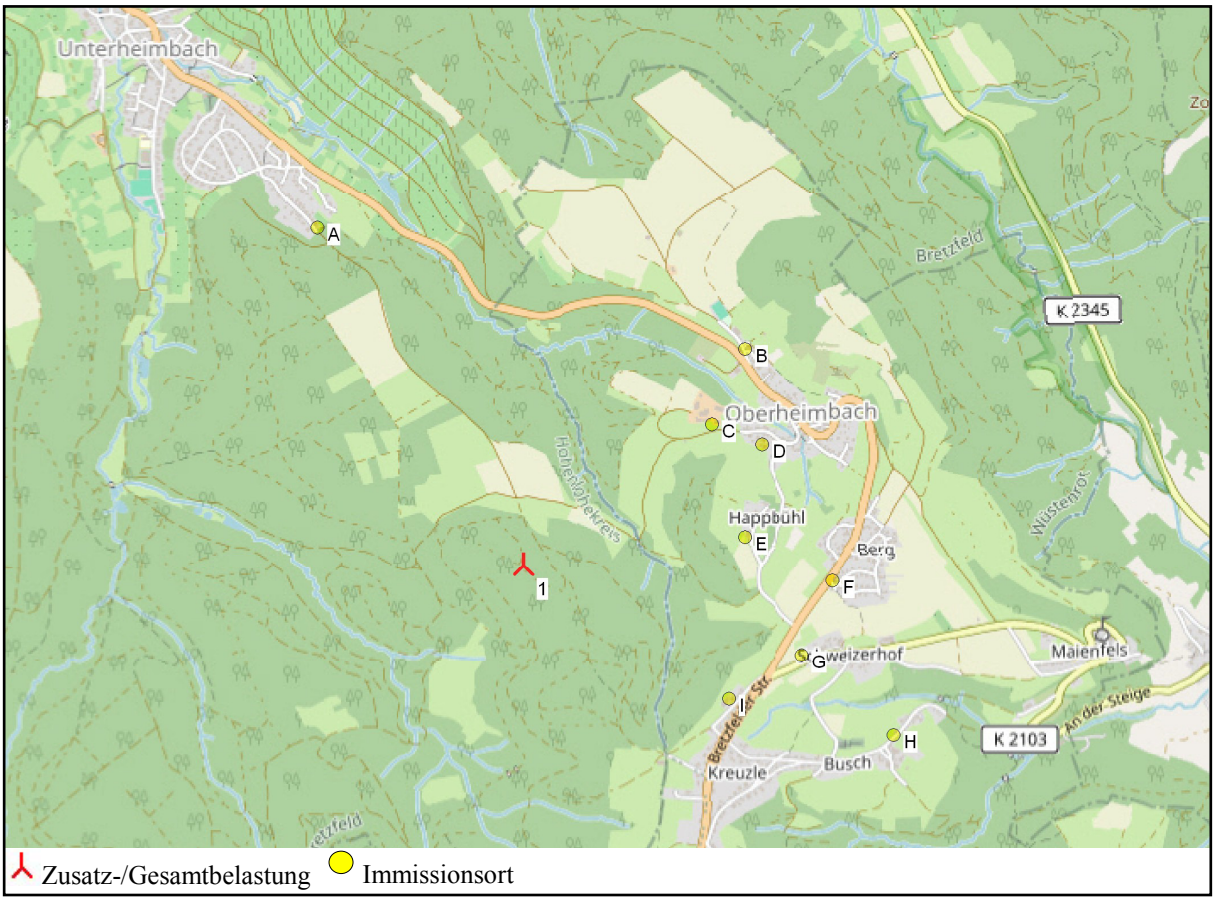

Abbildung 2: Übersichtskarte der am Standort „Unterheimbach“ geplanten Windenergieanlage (Zusatz-/Gesamtbelastung: WEA 1) sowie maßgebliche Immissionsorte (IO A-I).

Tabelle 3: Immissionsorte IO A-I (UTM-Koordinaten, Zone: 32, Datum: ETRS89).

IO	Ortsbezeichnung	Raumnutzung	Rechtswert	Hochwert	Richtwert (worst / real)
A	Oberer Wasen 29 (Unterheimbach)	Wohnraum	534.488	5.442.468	30 h/a, 30 min/d / 8 h/a
B	Im Greutle 1 (Maienfels)	Wohnraum	536.079	5.442.015	30 h/a, 30 min/d / 8 h/a
C	Hagenauer Straße 28 (Maienfels)	Wohnraum	535.957	5.441.733	30 h/a, 30 min/d / 8 h/a
D	Hagenauer Straße 25 (Maienfels)	Wohnraum	536.142	5.441.660	30 h/a, 30 min/d / 8 h/a
E	Happbühl 1 (Maienfels)	Wohnraum	536.079	5.441.311	30 h/a, 30 min/d / 8 h/a
F	Neuer Ring 1 (Maienfels)	Wohnraum	536.405	5.441.149	30 h/a, 30 min/d / 8 h/a
G	Ochsenhof 1 (Maienfels)	Wohnraum	536.289	5.440.871	30 h/a, 30 min/d / 8 h/a
H	Lange Straße 55 (Maienfels)	Wohnraum	536.631	5.440.573	30 h/a, 30 min/d / 8 h/a
I	Am Schellenbuckel 15 (Maienfels)	Wohnraum	536.020	5.440.708	30 h/a, 30 min/d / 8 h/a

4 Ergebnisse

4.1 Astronomisch maximal mögliche Beschattungsdauer

Die Simulation der astronomisch maximal möglichen Beschattungsdauer (worst case) wurde für den maximalen Beschattungsbereich der untersuchten Windenergieanlage durchgeführt. Dabei wurde eine Rasterkarte (Simulationssoftware WindPRO – Modul Shadow /13/) für die Umgebung der Windenergieanlage mit einer räumlichen Auflösung von 10 m x 10 m erzeugt. Die prognostizierte tägliche und jährliche Zusatz- bzw. Gesamtbelastung an den maßgeblichen Immissionsorten (IO A-I) kann der Tabelle 4 entnommen werden. Die grafische Darstellung für die Projektumgebung ist dem Anhang zu entnehmen.

Tabelle 4: Worst case – Zusatz-/Gesamtbelastung.

IO	Ortsbezeichnung	Beschattungs-dauer pro Jahr (h/a)	Beschattungs-dauer pro Tag (min/d)	Richtwert (h/a / min/d)
A	Oberer Wasen 29 (Unterheimbach)	22:58 (-7:02)*	29 (-1)*	30 / 30
B	Im Greutle 1 (Maienfels)	30:35 (+0:35)*	36 (+6)*	30 / 30
C	Hagenauer Straße 28 (Maienfels)	36:39 (+6:39)*	45 (+15)*	30 / 30
D	Hagenauer Straße 25 (Maienfels)	26:45 (-3:15)*	40 (+10)*	30 / 30
E	Happbühl 1 (Maienfels)	38:11 (+8:11)*	48 (+18)*	30 / 30
F	Neuer Ring 1 (Maienfels)	21:31 (-8:29)*	35 (+5)*	30 / 30
G	Ochsenhof 1 (Maienfels)	36:28 (+6:28)*	39 (+9)*	30 / 30
H	Lange Straße 55 (Maienfels)	31:38 (+1:38)*	28 (-2)*	30 / 30
I	Am Schellenbuckel 15 (Maienfels)	15:37 (-14:23)*	29 (-1)*	30 / 30

*Abstand zum Richtwert („+“: Überschreitung/Abschaltzeit, „-“: Unterschreitung).

Im Hinblick auf die Zusatz- bzw. Gesamtbelastung ist an den Immissionsorten IO B-H davon auszugehen, dass die Richtwerte für die astronomisch maximal mögliche Schattenwurfdauer

(30 h/a bzw. 30 min/d) überschritten werden. Es wäre daher ohne immissionsmindernde Maßnahmen an einzelnen schutzwürdigen Bebauungen östlich der geplanten Windenergieanlage von einer nicht unerheblichen Beeinträchtigung durch Schattenwurf auszugehen. Um die Nichtüberschreitung der Richtwerte sicherzustellen, ist die Installation eines Abschaltmoduls für die geplante Windenergieanlage (WEA 1) als Auflage zu empfehlen (s. Kapitel „Zusammenfassung und Bewertung“).

4.2 Meteorologisch wahrscheinliche Beschattungsdauer

Zur Prognose der meteorologisch wahrscheinlichen Beschattungsdauer (real case) wurden die standortspezifischen Witterungsverhältnisse (Windverteilung u. Sonnenscheindauer, vgl. Kapitel 2.1) berücksichtigt. Die Simulation wurde dabei für den maximalen Beschattungsbereich der Windenergieanlage durchgeführt, wobei eine Rasterkarte (Simulationssoftware WindPRO – Modul Shadow /13/) mit einer räumlichen Auflösung von 10 m x 10 m erzeugt wurde. Die aus der Simulation resultierende jährliche Zusatz- bzw. Gesamtbelastung durch Schattenwurf im meteorologisch wahrscheinlichen Fall (real case) ist in der Tabelle 5 dargestellt. Die grafische Darstellung für die Projektumgebung ist dem Anhang zu entnehmen.

Tabelle 5: Real case – Zusatz-/Gesamtbelastung.

IO	Ortsbezeichnung	Beschattungsdauer pro Jahr (h/a)	Richtwert (h/a)
A	Oberer Wasen 29 (Unterheimbach)	3:31 (-4:29)*	8
B	Im Greutle 1 (Maienfels)	6:26 (-1:34)*	8
C	Hagenauer Straße 28 (Maienfels)	9:07 (+1:07)*	8
D	Hagenauer Straße 25 (Maienfels)	7:05 (-0:55)*	8
E	Happbühl 1 (Maienfels)	11:46 (+3:46)*	8
F	Neuer Ring 1 (Maienfels)	6:45 (-1:15)*	8
G	Ochsenhof 1 (Maienfels)	10:49 (+2:49)*	8
H	Lange Straße 55 (Maienfels)	9:25 (+1:25)*	8
I	Am Schellenbuckel 15 (Maienfels)	4:28 (-3:32)*	8

* Abstand zum Richtwert („+“: Überschreitung/Abschaltzeit, „-“: Unterschreitung).

Unter Berücksichtigung realer Witterungsbedingungen (real case) ist im Vergleich zum worst case-Szenario (vgl. Kapitel 4.1) nur an den Immissionsorten IO C, IO E und IO G-H von einer erhöhten Beeinträchtigung durch periodischen Schattenwurf auszugehen. Zur Sicherstellung der Nichtüberschreitung des Richtwertes ist auch nach diesen Ergebnissen die

Installation eines Abschaltmoduls für die geplante Windenergieanlage (WEA 1) als Auflage zu empfehlen.

5 Literaturverzeichnis

/1/ Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz (LAI): Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windkraftanlagen – Aktualisierung 2019 (WKA-Schattenwurf-Hinweise), Stand 23.01.2020.

/2/ NASA Shuttle Radar Topography Mission Global 3 arc second (SRTMGL3 v003). https://lpdaac.usgs.gov/products/srtmgl3v003/

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/4/ DIN 5034-2: Tageslicht in Innenräumen – Grundlagen, Beuth-Verlag, Berlin 1985.

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/11/ Meteonorm Version 8.2.0 (Release 12.07.2023): Global Meteorological Database for Engineers, Planers and Education. Meteotest AG, Bern, Switzerland. Klimadaten – Standort „Unterheimbach“: 49,123°N, 9,483°E. https://meteonorm.com/

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/13/ WindPRO – Module shadow (vers. 2.7). EMD International A/S, Aalborg, Denmark. https://www.emd-international.com/windpro/windpro-modules/environment-modules/shadow/

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/18/ Geoportal Hohenlohekreis. https://www.hohenlohekreis.de/ihr-anliegen/hokis-geoportal

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/20/ Bauleitplanung Pfedelbach. https://www.pfedelbach.de

/21/ Energieatlas Baden-Württemberg. https://www.energieatlas-bw.de/

Mitgeltende Unterlagen

/A/ Nordex Energy SE & Co. KG: Allgemeine Dokumentation, Abmessungen Maschinenhaus und Rotorblätter. Anlagengeneration Delta. Produktreihe Delta 4000. Produkt N133/4.X, N149/4.X, N149/5.X, N163/5.X, N163/6.X und N175/6.X. Dokument-Nr.: E0004289528, Rev. 09, 28.04.2023.

• *03.2_E0004289528_R09_Abmessungen-Gondel-und-Blätter_D4k.pdf*

Anhang

- Übersicht Immissionsorte
- Zusatz-/Gesamtbelastung WEA 1 (worst case): Schattenwurfkarte, Hauptergebnis, immissionsortspezifischer Schattenwurfkalender
- Zusatz-/Gesamtbelastung WEA 1 (real case): Schattenwurfkarte, Hauptergebnis
- Zusatzbelastung WEA 1 u. potenzielle Vorbelastung WEA 2-9 (worst case): Schattenwurfkarte, Hauptergebnis

Übersicht Immissionsorte

IO A

IO B

IO C-D

IO E

IO F

IO G

IO H

IO I

WindPRO version 2.7.490 Sep 2011

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

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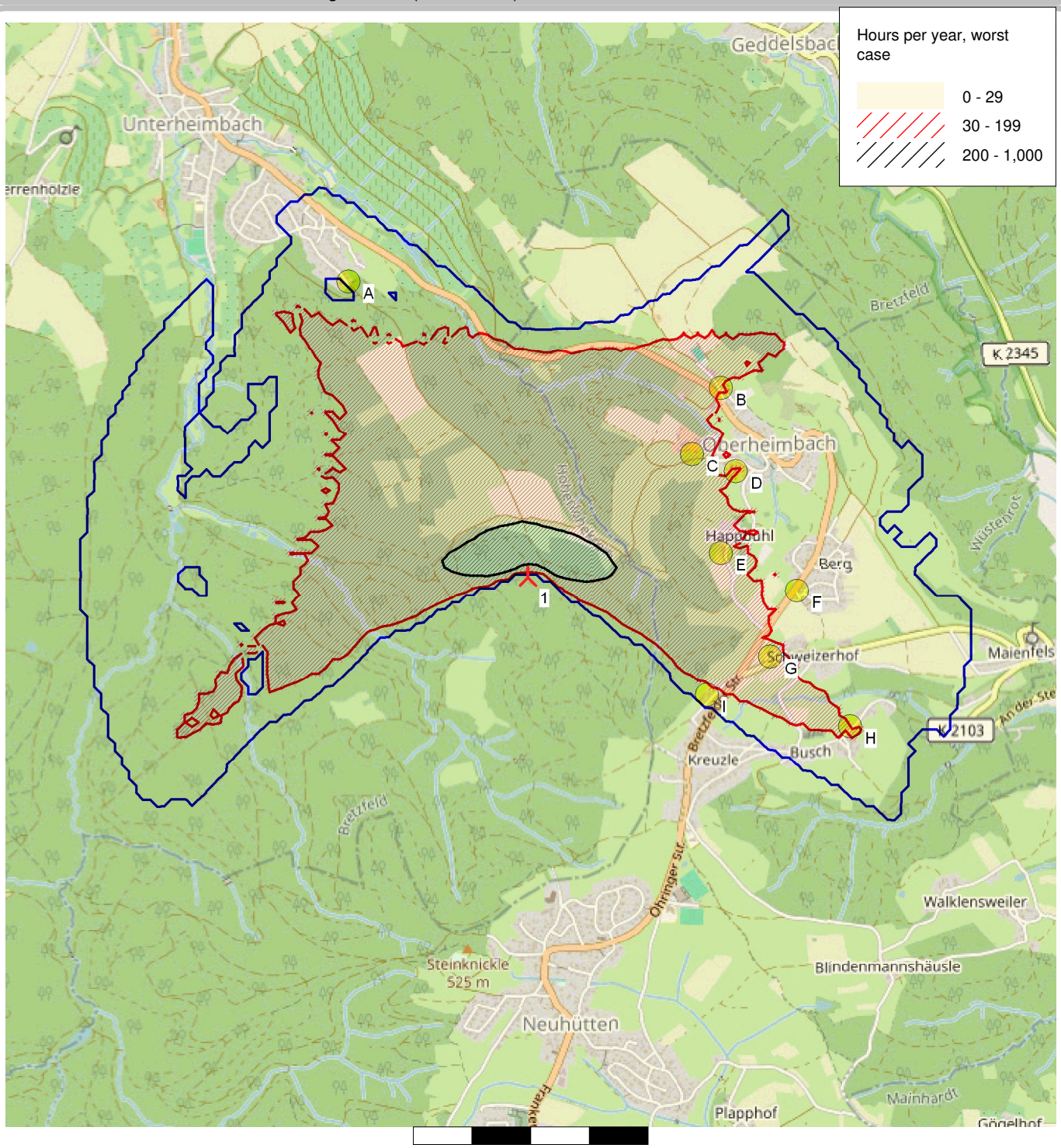
SHADOW - Map

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)



Map: , Print scale 1:25,000, Map center ETRS 89 Zone: 32 East: 535,260 North: 5,441,220

New WTG
Shadow receptor

Isolines showing shadow in Hours per year, worst case

0
30
200

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
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SHADOW - Main Result

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)

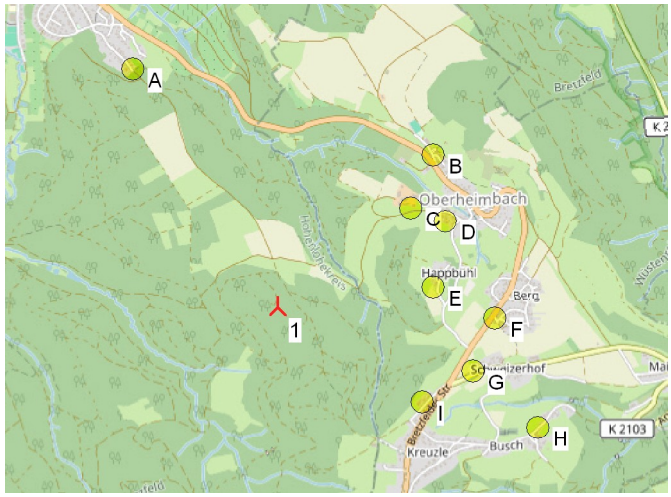
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: topo-unterheimbach.map (1)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10 m



Scale 1:40,000

New WTG Shadow receptor

WTGs

	ETRS 89 Zone: 32 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	ETRS 89 Zone: 32		[m]					[kW]	[m]	[m]	[m]	[RPM]
1	535,255	5,441,206	437.0	WEA 1	Yes	NORDEX	N175/6.X-6,800	6,800	175.0	179.0	1,899	10.8

Shadow receptor-Input

No.	Name	ETRS 89 Zone: 32 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	IO A - Oberer Wasen 29 - Unterheimbach	534,488	5,442,468	321.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
B	IO B - Im Greutle 1 - Maienfels	536,079	5,442,015	390.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
C	IO C - Hagenauer Straße 28 - Maienfels	535,957	5,441,733	392.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
D	IO D - Hagenauer Straße 25 - Maienfels	536,142	5,441,660	396.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
E	IO E - Happbühl 1 - Maienfels	536,079	5,441,311	448.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
F	IO F - Neuer Ring 1 - Maienfels	536,405	5,441,149	461.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
G	IO G - Ochsenhof 1 - Maienfels	536,289	5,440,871	477.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
H	IO H - Lange Straße 55 - Maienfels	536,631	5,440,573	456.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
I	IO I - Am Schellenbuckel 15 - Maienfels	536,020	5,440,708	489.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	IO A - Oberer Wasen 29 - Unterheimbach	22:58	56	0:29
B	IO B - Im Greutle 1 - Maienfels	30:35	67	0:36
C	IO C - Hagenauer Straße 28 - Maienfels	36:39	63	0:45
D	IO D - Hagenauer Straße 25 - Maienfels	26:45	52	0:40
E	IO E - Happbühl 1 - Maienfels	38:11	62	0:48
F	IO F - Neuer Ring 1 - Maienfels	21:31	47	0:35
G	IO G - Ochsenhof 1 - Maienfels	36:28	76	0:39
H	IO H - Lange Straße 55 - Maienfels	31:38	86	0:28
I	IO I - Am Schellenbuckel 15 - Maienfels	15:37	42	0:29

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

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SHADOW - Main Result

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	WEA 1	254:02	

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
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D-74676 Niedernhall

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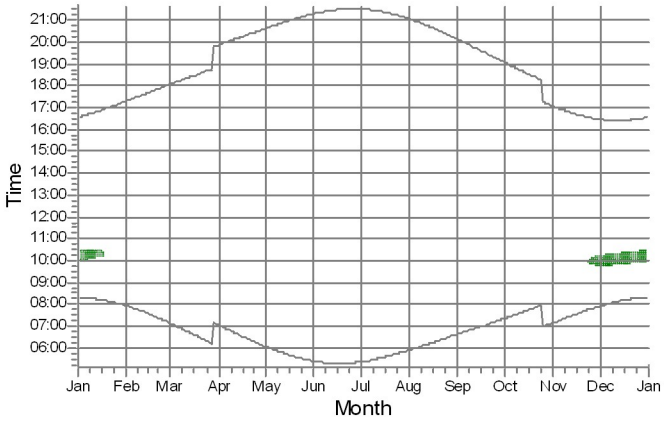
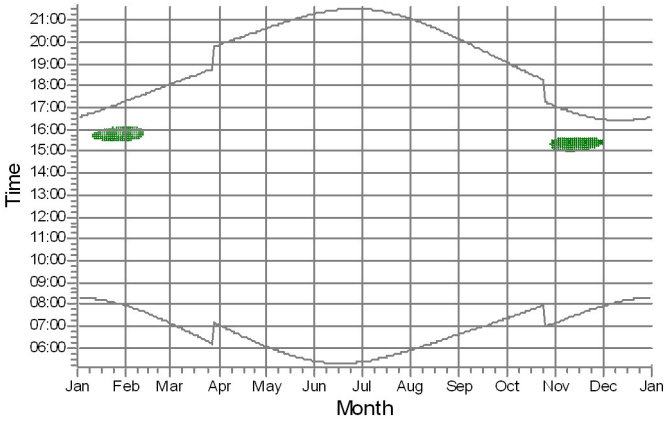
SHADOW - Calendar, graphical

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)

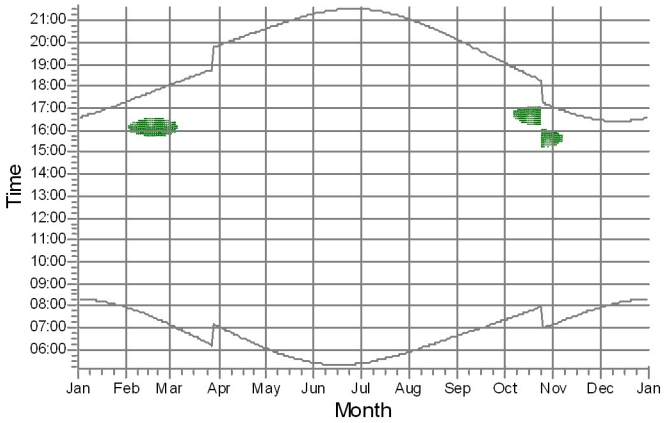
A: IO A - Oberer Wasen 29 - Unterheimbach



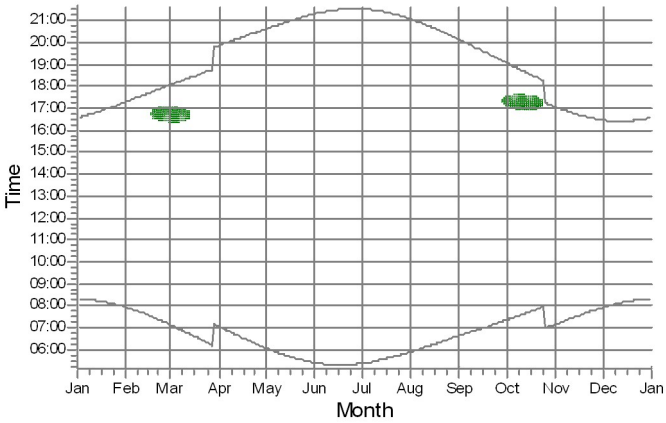
B: IO B - Im Greutle 1 - Maienfels



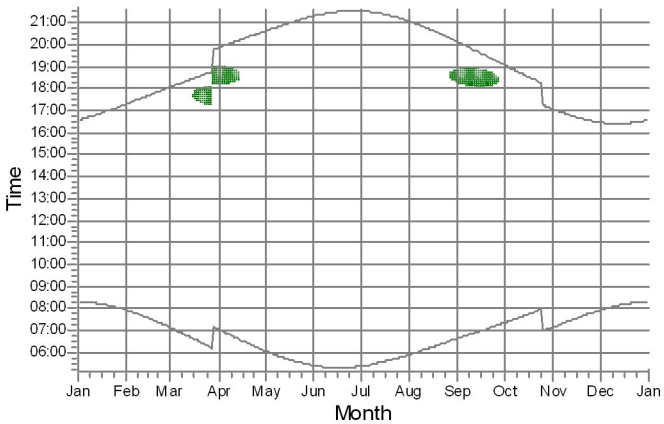
C: IO C - Hagenauer Straße 28 - Maienfels



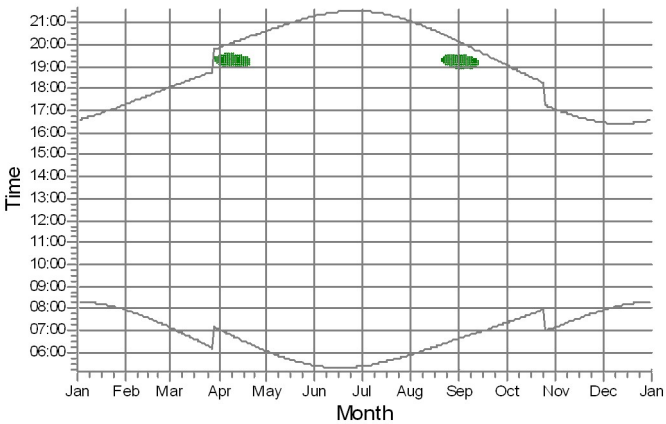
D: IO D - Hagenauer Straße 25 - Maienfels



E: IO E - Happbühl 1 - Maienfels



F: IO F - Neuer Ring 1 - Maienfels



WTGs

1: WEA 1

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
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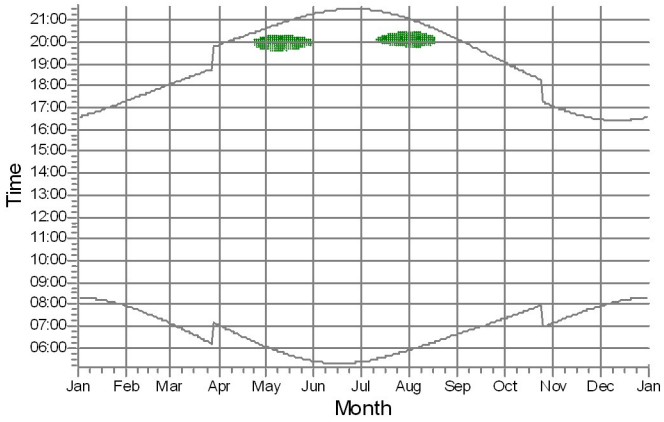
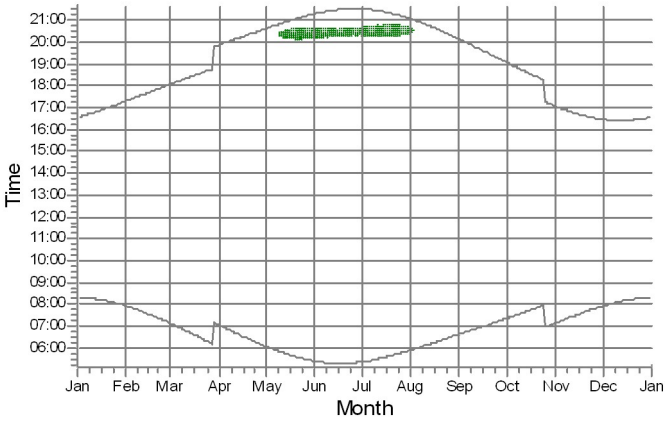
SHADOW - Calendar, graphical

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)

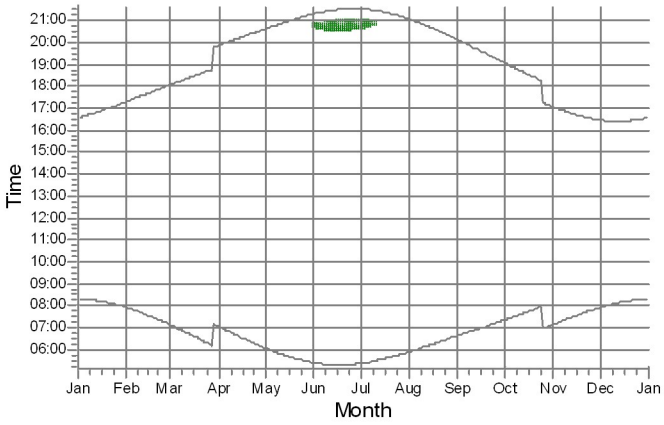
G: IO G - Ochsenhof 1 - Maienfels



H: IO H - Lange Straße 55 - Maienfels



I: IO I - Am Schellenbuckel 15 - Maienfels



WTGs

1: WEA 1

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
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Braunsbergweg 5
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Calculated:
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SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case)**Shadow receptor:** A - IO A - Oberer Wasen 29 - Unterheimbach

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January			February	March	April	May	June	July	August	September	October	November			December		
1	08:17		09:57 (1)	07:55	07:07	07:02	06:03	05:23	05:21	05:54	06:38	07:21	07:09			07:55		09:45 (1)
	16:35	28	10:25 (1)	17:18	18:04	19:52	20:38	21:18	21:31	21:03	20:07	19:03	17:03			16:28	24	10:09 (1)
2	08:17		09:58 (1)	07:54	07:05	07:00	06:01	05:22	05:22	05:55	06:39	07:22	07:10			07:56		09:45 (1)
	16:36	28	10:26 (1)	17:20	18:06	19:54	20:39	21:19	21:31	21:02	20:05	19:01	17:02			16:27	24	10:09 (1)
3	08:17		09:57 (1)	07:52	07:03	06:58	06:00	05:22	05:22	05:56	06:40	07:24	07:12			07:57		09:46 (1)
	16:37	28	10:25 (1)	17:21	18:08	19:55	20:40	21:20	21:31	21:00	20:03	18:59	17:00			16:27	25	10:11 (1)
4	08:17		09:58 (1)	07:51	07:01	06:56	05:58	05:21	05:23	05:58	06:42	07:25	07:14			07:58		09:45 (1)
	16:38	28	10:26 (1)	17:23	18:09	19:57	20:42	21:21	21:30	20:59	20:01	18:57	16:58			16:26	26	10:11 (1)
5	08:17		09:59 (1)	07:49	06:59	06:54	05:56	05:21	05:24	05:59	06:43	07:27	07:15			08:00		09:45 (1)
	16:39	27	10:26 (1)	17:25	18:11	19:58	20:43	21:22	21:30	20:57	19:59	18:55	16:57			16:26	27	10:12 (1)
6	08:17		09:59 (1)	07:48	06:57	06:52	05:55	05:20	05:25	06:00	06:45	07:28	07:17			08:01		09:45 (1)
	16:40	27	10:26 (1)	17:26	18:12	20:00	20:45	21:23	21:29	20:56	19:57	18:53	16:55			16:26	27	10:12 (1)
7	08:17		10:00 (1)	07:46	06:55	06:50	05:53	05:19	05:25	06:02	06:46	07:30	07:18			08:02		09:46 (1)
	16:41	26	10:26 (1)	17:28	18:14	20:01	20:46	21:24	21:29	20:54	19:55	18:51	16:54			16:25	27	10:13 (1)
8	08:16		10:01 (1)	07:45	06:53	06:48	05:52	05:19	05:26	06:03	06:48	07:31	07:20			08:03		09:46 (1)
	16:42	26	10:27 (1)	17:30	18:16	20:03	20:48	21:24	21:28	20:53	19:53	18:49	16:52			16:25	28	10:14 (1)
9	08:16		10:02 (1)	07:43	06:51	06:45	05:50	05:19	05:27	06:05	06:49	07:33	07:22			08:04		09:46 (1)
	16:44	25	10:27 (1)	17:31	18:17	20:04	20:49	21:25	21:28	20:51	19:51	18:47	16:51			16:25	28	10:14 (1)
10	08:15		10:02 (1)	07:41	06:49	06:43	05:48	05:18	05:28	06:06	06:50	07:34	07:23			08:05		09:47 (1)
	16:45	24	10:26 (1)	17:33	18:19	20:06	20:51	21:26	21:27	20:49	19:48	18:45	16:49			16:25	28	10:15 (1)
11	08:15		10:03 (1)	07:40	06:47	06:41	05:47	05:18	05:29	06:07	06:52	07:36	07:25			08:06		09:47 (1)
	16:46	24	10:27 (1)	17:35	18:20	20:08	20:52	21:27	21:27	20:47	19:46	18:43	16:48			16:25	28	10:15 (1)
12	08:14		10:04 (1)	07:38	06:44	06:39	05:45	05:18	05:30	06:09	06:53	07:37	07:26			08:07		09:47 (1)
	16:47	22	10:26 (1)	17:36	18:22	20:09	20:53	21:27	21:26	20:46	19:44	18:41	16:46			16:25	29	10:16 (1)
13	08:14		10:05 (1)	07:36	06:42	06:37	05:44	05:17	05:31	06:10	06:55	07:39	07:28			08:08		09:48 (1)
	16:49	20	10:25 (1)	17:38	18:23	20:11	20:55	21:28	21:25	20:44	19:42	18:39	16:45			16:25	28	10:16 (1)
14	08:13		10:07 (1)	07:35	06:40	06:35	05:43	05:17	05:32	06:12	06:56	07:40	07:30			08:09		09:48 (1)
	16:50	19	10:26 (1)	17:40	18:25	20:12	20:56	21:28	21:24	20:42	19:40	18:37	16:44			16:25	29	10:17 (1)
15	08:13		10:08 (1)	07:33	06:38	06:33	05:41	05:17	05:33	06:13	06:58	07:42	07:31			08:10		09:49 (1)
	16:52	17	10:25 (1)	17:41	18:26	20:14	20:58	21:29	21:23	20:40	19:38	18:35	16:43			16:25	29	10:18 (1)
16	08:12		10:09 (1)	07:31	06:36	06:31	05:40	05:17	05:34	06:15	06:59	07:43	07:33			08:11		09:49 (1)
	16:53	15	10:24 (1)	17:43	18:28	20:15	20:59	21:29	21:23	20:39	19:36	18:33	16:41			16:25	28	10:17 (1)
17	08:11		10:11 (1)	07:30	06:34	06:29	05:39	05:17	05:35	06:16	07:00	07:45	07:34			08:12		09:49 (1)
	16:54	11	10:22 (1)	17:45	18:30	20:17	21:00	21:30	21:22	20:37	19:33	18:31	16:40			16:25	29	10:18 (1)
18	08:10		10:14 (1)	07:28	06:32	06:27	05:37	05:17	05:36	06:17	07:02	07:47	07:36			08:12		09:50 (1)
	16:56	5	10:19 (1)	17:46	18:31	20:18	21:02	21:30	21:21	20:35	19:31	18:29	16:39			16:25	29	10:19 (1)
19	08:10			07:26	06:30	06:25	05:36	05:17	05:37	06:19	07:03	07:48	07:37			08:13		09:50 (1)
	16:57			17:48	18:33	20:20	21:03	21:30	21:20	20:33	19:29	18:27	16:38			16:26	29	10:19 (1)
20	08:09			07:24	06:28	06:23	05:35	05:17	05:38	06:20	07:05	07:50	07:39			08:14		09:51 (1)
	16:59			17:50	18:34	20:21	21:04	21:31	21:19	20:31	19:27	18:25	16:37			16:26	29	10:20 (1)
21	08:08			07:22	06:25	06:21	05:34	05:17	05:40	06:22	07:06	07:51	07:40			08:14		09:51 (1)
	17:00			17:51	18:36	20:23	21:06	21:31	21:18	20:29	19:25	18:23	16:36			16:27	29	10:20 (1)
22	08:07			07:20	06:23	06:20	05:32	05:18	05:41	06:23	07:08	07:53	07:42			08:15		09:52 (1)
	17:02			17:53	18:37	20:24	21:07	21:31	21:16	20:27	19:23	18:21	16:35			16:27	29	10:21 (1)
23	08:06			07:18	06:21	06:18	05:31	05:18	05:42	06:25	07:09	07:54	07:43			08:15		09:52 (1)
	17:04			17:55	18:39	20:26	21:08	21:31	21:15	20:25	19:21	18:19	16:34			16:28	29	10:21 (1)
24	08:05			07:17	06:19	06:16	05:30	05:18	05:43	06:26	07:11	07:56	07:45		09:52 (1)	08:16		09:53 (1)
	17:05			17:56	18:40	20:27	21:09	21:32	21:14	20:23	19:18	18:17	16:33	4	09:56 (1)	16:28	29	10:22 (1)
25	08:04			07:15	06:17	06:14	05:29	05:18	05:44	06:27	07:12	06:58	07:46		09:49 (1)	08:16		09:53 (1)
	17:07			17:58	18:42	20:29	21:10	21:32	21:13	20:21	19:16	17:15	16:32	11	10:00 (1)	16:29	29	10:22 (1)
26	08:02			07:13	06:15	06:12	05:28	05:19	05:46	06:29	07:13	06:59	07:48		09:48 (1)	08:16		09:53 (1)
	17:08			17:59	18:43	20:30	21:12	21:32	21:12	20:19	19:14	17:14	16:31	15	10:03 (1)	16:29	29	10:22 (1)
27	08:01			07:11	06:13	06:10	05:27	05:19	05:47	06:30	07:15	07:01	07:49		09:47 (1)	08:17		09:54 (1)
	17:10			18:01	18:45	20:32	21:13	21:32	21:10	20:17	19:12	17:12	16:30	17	10:04 (1)	16:30	29	10:23 (1)
28	08:00			07:09	06:11	06:08	05:26	05:20	05:48	06:32	07:16	07:02	07:51		09:47 (1)	08:17		09:55 (1)
	17:11			18:03	18:46	20:33	21:14	21:32	21:09	20:15	19:10	17:10	16:30	19	10:06 (1)	16:31	29	10:24 (1)
29	07:59				07:08	06:07	05:25	05:20	05:50	06:33	07:18	07:04	07:52		09:46 (1)	08:17		09:55 (1)
	17:13				19:48	20:35	21:15	21:31	21:08	20:13	19:08	17:08	16:29	21	10:07 (1)	16:32	29	10:24 (1)
30	07:58				07:06	06:05	05:25	05:21	05:51	06:35	07:19	07:05	07:53		09:45 (1)	08:17		09:56 (1)
	17:15				19:49	20:36	21:16	21:31	21:06	20:11	19:06	17:07	16:28	22	10:07 (1)	16:32	28	10:24 (1)
31	07:56				07:04		05:24		05:52	06:36		07:07				08:17		09:56 (1)
	17:16				19:51		21:17		21:05	20:09		17:05				16:33	29	10:25 (1)
Potential sun hours	271			283	368	411	474	484	489	446	379	336	276			257		
Total, worst case		400												109			869	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 2
Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** B - IO B - Im Greutle 1 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January		February		March	April	May	June	July	August	September	October	November	December
1	08:17		07:55	15:28 (1)	07:07	07:02	06:03	05:23	05:21	05:54	06:37	07:21	07:09	15:04 (1) / 07:55	15:19 (1)
	16:35		17:18 35	16:03 (1)	18:04	19:52	20:37	21:18	21:31	21:03	20:07	19:03	17:03 23	15:27 (1) / 16:28 6	15:25 (1)
2	08:17		07:53	15:28 (1)	07:05	07:00	06:01	05:22	05:22	05:55	06:39	07:22	07:10	15:03 (1) / 07:56	
	16:36		17:20 35	16:03 (1)	18:06	19:54	20:39	21:19	21:31	21:02	20:05	19:01	17:01 26	15:29 (1) / 16:27	
3	08:17		07:52	15:29 (1)	07:03	06:58	06:00	05:22	05:22	05:56	06:40	07:24	07:12	15:02 (1) / 07:57	
	16:37		17:21 34	16:03 (1)	18:07	19:55	20:40	21:20	21:30	21:00	20:03	18:59	17:00 28	15:30 (1) / 16:27	
4	08:17		07:51	15:29 (1)	07:01	06:56	05:58	05:21	05:23	05:58	06:42	07:25	07:13	15:02 (1) / 07:58	
	16:38		17:23 33	16:02 (1)	18:09	19:57	20:42	21:21	21:30	20:59	20:01	18:57	16:58 30	15:32 (1) / 16:26	
5	08:17		07:49	15:30 (1)	06:59	06:54	05:56	05:20	05:24	05:59	06:43	07:27	07:15	15:00 (1) / 08:00	
	16:39		17:25 33	16:03 (1)	18:11	19:58	20:43	21:22	21:30	20:57	19:59	18:55	16:57 32	15:32 (1) / 16:26	
6	08:17		07:48	15:30 (1)	06:57	06:52	05:55	05:20	05:25	06:00	06:45	07:28	07:17	15:00 (1) / 08:01	
	16:40		17:26 32	16:02 (1)	18:12	20:00	20:45	21:23	21:29	20:56	19:57	18:53	16:55 32	15:32 (1) / 16:26	
7	08:16		07:46	15:32 (1)	06:55	06:50	05:53	05:19	05:25	06:02	06:46	07:30	07:18	15:00 (1) / 08:02	
	16:41		17:28 30	16:02 (1)	18:14	20:01	20:46	21:23	21:29	20:54	19:55	18:51	16:54 33	15:33 (1) / 16:25	
8	08:16		07:45	15:33 (1)	06:53	06:47	05:51	05:19	05:26	06:03	06:47	07:31	07:20	14:59 (1) / 08:03	
	16:42		17:30 28	16:01 (1)	18:15	20:03	20:48	21:24	21:28	20:52	19:53	18:49	16:52 35	15:34 (1) / 16:25	
9	08:16		07:43	15:34 (1)	06:51	06:45	05:50	05:19	05:27	06:05	06:49	07:33	07:21	14:58 (1) / 08:04	
	16:43		17:31 25	15:59 (1)	18:17	20:04	20:49	21:25	21:28	20:51	19:50	18:47	16:51 36	15:34 (1) / 16:25	
10	08:15		07:41	15:36 (1)	06:48	06:43	05:48	05:18	05:28	06:06	06:50	07:34	07:23	14:59 (1) / 08:05	
	16:45		17:33 22	15:58 (1)	18:19	20:06	20:51	21:26	21:27	20:49	19:48	18:45	16:49 35	15:34 (1) / 16:25	
11	08:15	15:37 (1)	07:40	15:38 (1)	06:46	06:41	05:47	05:18	05:29	06:07	06:52	07:36	07:25	14:59 (1) / 08:06	
	16:46 5	15:42 (1)	17:35 18	15:56 (1)	18:20	20:07	20:52	21:26	21:26	20:47	19:46	18:43	16:48 36	15:35 (1) / 16:25	
12	08:14	15:34 (1)	07:38	15:41 (1)	06:44	06:39	05:45	05:18	05:30	06:09	06:53	07:37	07:26	14:58 (1) / 08:07	
	16:47 11	15:45 (1)	17:36 12	15:53 (1)	18:22	20:09	20:53	21:27	21:26	20:46	19:44	18:40	16:46 36	15:34 (1) / 16:24	
13	08:14	15:32 (1)	07:36		06:42	06:37	05:44	05:17	05:31	06:10	06:55	07:39	07:28	14:59 (1) / 08:08	
	16:49 15	15:47 (1)	17:38		18:23	20:10	20:55	21:28	21:25	20:44	19:42	18:38	16:45 35	15:34 (1) / 16:25	
14	08:13	15:32 (1)	07:35		06:40	06:35	05:43	05:17	05:32	06:12	06:56	07:40	07:29	14:59 (1) / 08:09	
	16:50 18	15:50 (1)	17:40		18:25	20:12	20:56	21:28	21:24	20:42	19:40	18:36	16:44 36	15:35 (1) / 16:25	
15	08:13	15:31 (1)	07:33		06:38	06:33	05:41	05:17	05:33	06:13	06:57	07:42	07:31	15:00 (1) / 08:10	
	16:51 20	15:51 (1)	17:41		18:26	20:13	20:57	21:29	21:23	20:40	19:38	18:34	16:42 35	15:35 (1) / 16:25	
16	08:12	15:30 (1)	07:31		06:36	06:31	05:40	05:17	05:34	06:14	06:59	07:43	07:33	15:00 (1) / 08:11	
	16:53 22	15:52 (1)	17:43		18:28	20:15	20:59	21:29	21:22	20:38	19:35	18:32	16:41 34	15:34 (1) / 16:25	
17	08:11	15:29 (1)	07:29		06:34	06:29	05:38	05:17	05:35	06:16	07:00	07:45	07:34	15:00 (1) / 08:11	
	16:54 25	15:54 (1)	17:45		18:29	20:16	21:00	21:30	21:22	20:37	19:33	18:30	16:40 34	15:34 (1) / 16:25	
18	08:10	15:29 (1)	07:28		06:32	06:27	05:37	05:17	05:36	06:17	07:02	07:46	07:36	15:01 (1) / 08:12	
	16:56 26	15:55 (1)	17:46		18:31	20:18	21:02	21:30	21:21	20:35	19:31	18:29	16:39 34	15:35 (1) / 16:25	
19	08:09	15:28 (1)	07:26		06:30	06:25	05:36	05:17	05:37	06:19	07:03	07:48	07:37	15:01 (1) / 08:13	
	16:57 28	15:56 (1)	17:48		18:33	20:19	21:03	21:30	21:20	20:33	19:29	18:27	16:38 33	15:34 (1) / 16:26	
20	08:09	15:28 (1)	07:24		06:28	06:23	05:35	05:17	05:38	06:20	07:05	07:50	07:39	15:02 (1) / 08:13	
	16:59 29	15:57 (1)	17:50		18:34	20:21	21:04	21:31	21:19	20:31	19:27	18:25	16:37 32	15:34 (1) / 16:26	
21	08:08	15:27 (1)	07:22		06:25	06:21	05:34	05:17	05:40	06:22	07:06	07:51	07:40	15:03 (1) / 08:14	
	17:00 31	15:58 (1)	17:51		18:36	20:22	21:05	21:31	21:17	20:29	19:25	18:23	16:36 31	15:34 (1) / 16:26	
22	08:07	15:27 (1)	07:20		06:23	06:19	05:32	05:17	05:41	06:23	07:08	07:53	07:42	15:04 (1) / 08:15	
	17:02 32	15:59 (1)	17:53		18:37	20:24	21:07	21:31	21:16	20:27	19:23	18:21	16:35 29	15:33 (1) / 16:27	
23	08:06	15:27 (1)	07:18		06:21	06:18	05:31	05:18	05:42	06:24	07:09	07:54	07:43	15:05 (1) / 08:15	
	17:03 33	16:00 (1)	17:55		18:39	20:25	21:08	21:31	21:15	20:25	19:20	18:19	16:34 28	15:33 (1) / 16:27	
24	08:05	15:27 (1)	07:16		06:19	06:16	05:30	05:18	05:43	06:26	07:10	07:56	07:45	15:06 (1) / 08:16	
	17:05 34	16:01 (1)	17:56		18:40	20:27	21:09	21:31	21:14	20:23	19:18	18:17	16:33 26	15:32 (1) / 16:28	
25	08:03	15:26 (1)	07:15		06:17	06:14	05:29	05:18	05:44	06:27	07:12	06:57	07:46	15:07 (1) / 08:16	
	17:07 34	16:00 (1)	17:58		18:42	20:28	21:10	21:32	21:13	20:21	19:16	17:15	16:32 25	15:32 (1) / 16:29	
26	08:02	15:27 (1)	07:13		06:15	06:12	05:28	05:19	05:46	06:29	07:13	06:59	07:48	15:08 (1) / 08:16	
	17:08 34	16:01 (1)	17:59		18:43	20:30	21:11	21:32	21:12	20:19	19:14	17:14	16:31 22	15:30 (1) / 16:29	
27	08:01	15:27 (1)	07:11		06:13	06:10	05:27	05:19	05:47	06:30	07:15	07:01	07:49	15:10 (1) / 08:17	
	17:10 35	16:02 (1)	18:01		18:45	20:31	21:13	21:32	21:10	20:17	19:12	17:12	16:30 20	15:30 (1) / 16:30	
28	08:00	15:27 (1)	07:09		06:11	06:08	05:26	05:20	05:48	06:32	07:16	07:02	07:50	15:11 (1) / 08:17	
	17:11 36	16:03 (1)	18:03		18:46	20:33	21:14	21:31	21:09	20:15	19:10	17:10	16:30 18	15:29 (1) / 16:31	
29	07:59	15:27 (1)			07:08	06:07	05:25	05:20	05:50	06:33	07:18	07:04	15:15 (1) / 07:52	15:13 (1) / 08:17	
	17:13 36	16:03 (1)			19:48	20:34	21:15	21:31	21:08	20:13	19:08	17:08 3	15:18 (1) / 16:29	15:28 (1) / 16:32	
30	07:57	15:27 (1)			07:06	06:05	05:25	05:21	05:51	06:35	07:19	07:05	15:10 (1) / 07:53	15:15 (1) / 08:17	
	17:15 36	16:03 (1)			19:49	20:36	21:16	21:31	21:06	20:11	19:05	17:06 14	15:24 (1) / 16:28	15:26 (1) / 16:32	
31	07:56	15:27 (1)			07:04		05:24		05:52	06:36		07:07	15:07 (1)	08:17	
	17:16 36	16:03 (1)			19:51		21:17		21:05	20:09		17:05 19	15:26 (1)	16:33	
Potential sun hours	271		283		368	411	474	484	489	446	379	336	276	257	
Total, worst case	576		337									36	880	6	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 3

Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de

Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** C - IO C - Hagenauer Straße 28 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February		March		April	May	June	July	August	September	October		November		December
1	08:17	07:55		07:07	15:48 (1)	07:02	06:03	05:23	05:21	05:54	06:37	07:21		07:09	15:17 (1)	07:55
	16:35	17:18		18:04	35 16:23 (1)	19:52	20:37	21:18	21:31	21:03	20:07	19:03		17:03	36 15:53 (1)	16:28
2	08:17	07:53		07:05	15:50 (1)	07:00	06:01	05:22	05:22	05:55	06:39	07:22		07:10	15:18 (1)	07:56
	16:36	17:20		18:06	31 16:21 (1)	19:54	20:39	21:19	21:31	21:02	20:05	19:01		17:01	34 15:52 (1)	16:27
3	08:17	07:52	16:03 (1)	07:03	15:52 (1)	06:58	06:00	05:22	05:22	05:56	06:40	07:24		07:12	15:19 (1)	07:57
	16:37	17:21	3 16:06 (1)	18:07	27 16:19 (1)	19:55	20:40	21:20	21:30	21:00	20:03	18:59		17:00	32 15:51 (1)	16:27
4	08:17	07:51	15:57 (1)	07:01	15:54 (1)	06:56	05:58	05:21	05:23	05:58	06:42	07:25		07:13	15:21 (1)	07:58
	16:38	17:23	15 16:12 (1)	18:09	23 16:17 (1)	19:57	20:42	21:21	21:30	20:59	20:01	18:57		16:58	28 15:49 (1)	16:26
5	08:17	07:49	15:55 (1)	06:59	15:57 (1)	06:54	05:56	05:20	05:24	05:59	06:43	07:27		07:15	15:22 (1)	08:00
	16:39	17:25	21 16:16 (1)	18:11	17 16:14 (1)	19:58	20:43	21:22	21:30	20:57	19:59	18:55		16:57	25 15:47 (1)	16:26
6	08:17	07:48	15:52 (1)	06:57	16:03 (1)	06:52	05:55	05:20	05:25	06:00	06:45	07:28		07:17	15:25 (1)	08:01
	16:40	17:26	25 16:17 (1)	18:12	3 16:06 (1)	20:00	20:45	21:23	21:29	20:56	19:57	18:53		16:55	20 15:45 (1)	16:26
7	08:16	07:46	15:51 (1)	06:55		06:50	05:53	05:19	05:25	06:02	06:46	07:30		07:18	15:28 (1)	08:02
	16:41	17:28	29 16:20 (1)	18:14		20:01	20:46	21:23	21:29	20:54	19:55	18:51		16:54	14 15:42 (1)	16:25
8	08:16	07:45	15:50 (1)	06:53		06:47	05:51	05:19	05:26	06:03	06:47	07:31	16:34 (1)	07:20		08:03
	16:42	17:30	31 16:21 (1)	18:15		20:03	20:48	21:24	21:28	20:52	19:53	18:49	13 16:47 (1)	16:52		16:25
9	08:16	07:43	15:48 (1)	06:51		06:45	05:50	05:19	05:27	06:05	06:49	07:33	16:29 (1)	07:21		08:04
	16:43	17:31	34 16:22 (1)	18:17		20:04	20:49	21:25	21:28	20:51	19:50	18:47	20 16:49 (1)	16:51		16:25
10	08:15	07:41	15:48 (1)	06:49		06:43	05:48	05:18	05:28	06:06	06:50	07:34	16:27 (1)	07:23		08:05
	16:45	17:33	36 16:24 (1)	18:19		20:06	20:51	21:26	21:27	20:49	19:48	18:45	25 16:52 (1)	16:49		16:25
11	08:15	07:40	15:47 (1)	06:46		06:41	05:47	05:18	05:29	06:07	06:52	07:36	16:25 (1)	07:25		08:06
	16:46	17:35	38 16:25 (1)	18:20		20:07	20:52	21:26	21:26	20:47	19:46	18:43	29 16:54 (1)	16:48		16:25
12	08:14	07:38	15:46 (1)	06:44		06:39	05:45	05:18	05:30	06:09	06:53	07:37	16:22 (1)	07:26		08:07
	16:47	17:36	39 16:25 (1)	18:22		20:09	20:53	21:27	21:26	20:46	19:44	18:40	33 16:55 (1)	16:46		16:25
13	08:14	07:36	15:45 (1)	06:42		06:37	05:44	05:17	05:31	06:10	06:55	07:39	16:21 (1)	07:28		08:08
	16:49	17:38	41 16:26 (1)	18:23		20:10	20:55	21:28	21:25	20:44	19:42	18:38	35 16:56 (1)	16:45		16:25
14	08:13	07:35	15:45 (1)	06:40		06:35	05:43	05:17	05:32	06:12	06:56	07:40	16:19 (1)	07:29		08:09
	16:50	17:40	42 16:27 (1)	18:25		20:12	20:56	21:28	21:24	20:42	19:40	18:36	37 16:56 (1)	16:44		16:25
15	08:13	07:33	15:44 (1)	06:38		06:33	05:41	05:17	05:33	06:13	06:58	07:42	16:18 (1)	07:31		08:10
	16:51	17:41	44 16:28 (1)	18:26		20:13	20:57	21:29	21:23	20:40	19:38	18:34	39 16:57 (1)	16:43		16:25
16	08:12	07:31	15:44 (1)	06:36		06:31	05:40	05:17	05:34	06:14	06:59	07:43	16:17 (1)	07:33		08:11
	16:53	17:43	44 16:28 (1)	18:28		20:15	20:59	21:29	21:22	20:38	19:35	18:32	41 16:58 (1)	16:41		16:25
17	08:11	07:29	15:43 (1)	06:34		06:29	05:38	05:17	05:35	06:16	07:00	07:45	16:16 (1)	07:34		08:11
	16:54	17:45	45 16:28 (1)	18:29		20:16	21:00	21:30	21:22	20:37	19:33	18:31	42 16:58 (1)	16:40		16:25
18	08:10	07:28	15:43 (1)	06:32		06:27	05:37	05:17	05:36	06:17	07:02	07:46	16:16 (1)	07:36		08:12
	16:56	17:46	45 16:28 (1)	18:31		20:18	21:02	21:30	21:21	20:35	19:31	18:29	43 16:59 (1)	16:39		16:25
19	08:09	07:26	15:43 (1)	06:30		06:25	05:36	05:17	05:37	06:19	07:03	07:48	16:14 (1)	07:37		08:13
	16:57	17:48	45 16:28 (1)	18:33		20:19	21:03	21:30	21:20	20:33	19:29	18:27	44 16:58 (1)	16:38		16:26
20	08:09	07:24	15:44 (1)	06:28		06:23	05:35	05:17	05:38	06:20	07:05	07:50	16:14 (1)	07:39		08:13
	16:59	17:50	45 16:29 (1)	18:34		20:21	21:04	21:31	21:19	20:31	19:27	18:25	45 16:59 (1)	16:37		16:26
21	08:08	07:22	15:44 (1)	06:25		06:21	05:34	05:17	05:40	06:22	07:06	07:51	16:14 (1)	07:40		08:14
	17:00	17:51	44 16:28 (1)	18:36		20:22	21:05	21:31	21:17	20:29	19:25	18:23	45 16:59 (1)	16:36		16:26
22	08:07	07:20	15:44 (1)	06:23		06:19	05:32	05:18	05:41	06:23	07:08	07:53	16:13 (1)	07:42		08:15
	17:02	17:53	44 16:28 (1)	18:37		20:24	21:07	21:31	21:16	20:27	19:23	18:21	45 16:58 (1)	16:35		16:27
23	08:06	07:18	15:44 (1)	06:21		06:18	05:31	05:18	05:42	06:25	07:09	07:54	16:13 (1)	07:43		08:15
	17:03	17:55	44 16:28 (1)	18:39		20:25	21:08	21:31	21:15	20:25	19:20	18:19	45 16:58 (1)	16:34		16:27
24	08:05	07:16	15:44 (1)	06:19		06:16	05:30	05:18	05:43	06:26	07:10	07:56	16:13 (1)	07:45		08:16
	17:05	17:56	43 16:27 (1)	18:40		20:27	21:09	21:31	21:14	20:23	19:18	18:17	45 16:58 (1)	16:33		16:28
25	08:03	07:15	15:45 (1)	06:17		06:14	05:29	05:18	05:44	06:27	07:12	06:57	15:13 (1)	07:46		08:16
	17:07	17:58	42 16:27 (1)	18:42		20:28	21:10	21:32	21:13	20:21	19:16	17:15	44 15:57 (1)	16:32		16:29
26	08:02	07:13	15:45 (1)	06:15		06:12	05:28	05:19	05:46	06:29	07:13	06:59	15:13 (1)	07:48		08:16
	17:08	17:59	41 16:26 (1)	18:43		20:30	21:11	21:32	21:12	20:19	19:14	17:14	44 15:57 (1)	16:31		16:29
27	08:01	07:11	15:46 (1)	06:13		06:10	05:27	05:19	05:47	06:30	07:15	07:01	15:14 (1)	07:49		08:17
	17:10	18:01	39 16:25 (1)	18:45		20:31	21:13	21:32	21:10	20:17	19:12	17:12	43 15:57 (1)	16:30		16:30
28	08:00	07:09	15:47 (1)	06:11		06:08	05:26	05:20	05:48	06:32	07:16	07:02	15:15 (1)	07:50		08:17
	17:11	18:03	37 16:24 (1)	18:46		20:33	21:14	21:31	21:09	20:15	19:10	17:10	42 15:57 (1)	16:30		16:31
29	07:59			07:08		06:07	05:25	05:20	05:50	06:33	07:18	07:04	15:14 (1)	07:52		08:17
	17:13			19:48		20:34	21:15	21:31	21:08	20:13	19:08	17:08	41 15:55 (1)	16:29		16:32
30	07:57			07:06		06:05	05:25	05:21	05:51	06:35	07:19	07:05	15:15 (1)	07:53		08:17
	17:15			19:49		20:36	21:16	21:31	21:06	20:11	19:05	17:06	40 15:55 (1)	16:28		16:32
31	07:56			07:04			05:24		05:52	06:36		07:07	15:16 (1)			08:17
	17:16			19:51			21:17		21:05	20:09		17:05	38 15:54 (1)			16:33
Potential sun hours	271	283		368		411	474	484	489	446	379	336		276		257
Total, worst case			956		136								918		189	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 4

Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de

Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** D - IO D - Hagenauer Straße 25 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February		March		April	May	June	July	August	September		October		November	December
1	08:17	07:55		07:07	16:21 (1)	07:02	06:03	05:23	05:21	05:54	06:37		07:21	17:07 (1)	07:09	07:55
	16:35	17:18		18:04	40 17:01 (1)	19:52	20:37	21:18	21:31	21:03	20:07		19:03	22 17:29 (1)	17:03	16:28
2	08:17	07:53		07:05	16:21 (1)	07:00	06:01	05:22	05:22	05:55	06:39		07:22	17:05 (1)	07:10	07:56
	16:36	17:20		18:06	40 17:01 (1)	19:54	20:39	21:19	21:31	21:02	20:05		19:01	26 17:31 (1)	17:01	16:27
3	08:17	07:52		07:03	16:21 (1)	06:58	06:00	05:22	05:22	05:56	06:40		07:24	17:03 (1)	07:12	07:57
	16:37	17:21		18:07	39 17:00 (1)	19:55	20:40	21:20	21:30	21:00	20:03		18:59	29 17:32 (1)	17:00	16:27
4	08:17	07:51		07:01	16:21 (1)	06:56	05:58	05:21	05:23	05:58	06:42		07:25	17:01 (1)	07:13	07:58
	16:38	17:23		18:09	39 17:00 (1)	19:57	20:42	21:21	21:30	20:59	20:01		18:57	32 17:33 (1)	16:58	16:26
5	08:17	07:49		06:59	16:21 (1)	06:54	05:56	05:20	05:24	05:59	06:43		07:27	16:59 (1)	07:15	08:00
	16:39	17:25		18:11	39 17:00 (1)	19:58	20:43	21:22	21:30	20:57	19:59		18:55	34 17:33 (1)	16:57	16:26
6	08:17	07:48		06:57	16:21 (1)	06:52	05:55	05:20	05:25	06:00	06:45		07:28	16:59 (1)	07:17	08:01
	16:40	17:26		18:12	37 16:58 (1)	20:00	20:45	21:23	21:29	20:56	19:57		18:53	35 17:34 (1)	16:55	16:26
7	08:16	07:46		06:55	16:21 (1)	06:50	05:53	05:19	05:25	06:02	06:46		07:30	16:57 (1)	07:18	08:02
	16:41	17:28		18:14	36 16:57 (1)	20:01	20:46	21:23	21:29	20:54	19:55		18:51	37 17:34 (1)	16:54	16:25
8	08:16	07:45		06:53	16:22 (1)	06:47	05:51	05:19	05:26	06:03	06:47		07:31	16:57 (1)	07:20	08:03
	16:42	17:30		18:15	35 16:57 (1)	20:03	20:48	21:24	21:28	20:52	19:53		18:49	37 17:34 (1)	16:52	16:25
9	08:16	07:43		06:51	16:23 (1)	06:45	05:50	05:19	05:27	06:05	06:49		07:33	16:55 (1)	07:21	08:04
	16:43	17:31		18:17	33 16:56 (1)	20:04	20:49	21:25	21:28	20:51	19:50		18:47	39 17:34 (1)	16:51	16:25
10	08:15	07:41		06:48	16:24 (1)	06:43	05:48	05:18	05:28	06:06	06:50		07:34	16:55 (1)	07:23	08:05
	16:45	17:33		18:19	30 16:54 (1)	20:06	20:51	21:26	21:27	20:49	19:48		18:45	39 17:34 (1)	16:49	16:25
11	08:15	07:40		06:46	16:26 (1)	06:41	05:47	05:18	05:29	06:07	06:52		07:36	16:55 (1)	07:25	08:06
	16:46	17:35		18:20	27 16:53 (1)	20:07	20:52	21:26	21:26	20:47	19:46		18:43	40 17:35 (1)	16:48	16:25
12	08:14	07:38		06:44	16:27 (1)	06:39	05:45	05:18	05:30	06:09	06:53		07:37	16:54 (1)	07:26	08:07
	16:47	17:36		18:22	24 16:51 (1)	20:09	20:53	21:27	21:26	20:46	19:44		18:40	40 17:34 (1)	16:46	16:25
13	08:14	07:36		06:42	16:30 (1)	06:37	05:44	05:17	05:31	06:10	06:55		07:39	16:55 (1)	07:28	08:08
	16:49	17:38		18:23	18 16:48 (1)	20:10	20:55	21:28	21:25	20:44	19:42		18:38	39 17:34 (1)	16:45	16:25
14	08:13	07:35		06:40	16:34 (1)	06:35	05:43	05:17	05:32	06:12	06:56		07:40	16:54 (1)	07:29	08:09
	16:50	17:40		18:25	10 16:44 (1)	20:12	20:56	21:28	21:24	20:42	19:40		18:36	39 17:33 (1)	16:44	16:25
15	08:12	07:33		06:38		06:33	05:41	05:17	05:33	06:13	06:57		07:42	16:54 (1)	07:31	08:10
	16:51	17:41		18:26		20:13	20:57	21:29	21:23	20:40	19:38		18:34	39 17:33 (1)	16:43	16:25
16	08:12	07:31		06:36		06:31	05:40	05:17	05:34	06:14	06:59		07:43	16:55 (1)	07:33	08:11
	16:53	17:43		18:28		20:15	20:59	21:29	21:22	20:38	19:35		18:32	37 17:32 (1)	16:41	16:25
17	08:11	07:29	16:38 (1)	06:34		06:29	05:38	05:17	05:35	06:16	07:00		07:45	16:55 (1)	07:34	08:11
	16:54	17:45	7 16:45 (1)	18:29		20:16	21:00	21:30	21:22	20:37	19:33		18:30	36 17:31 (1)	16:40	16:25
18	08:10	07:28	16:33 (1)	06:32		06:27	05:37	05:17	05:36	06:17	07:02		07:46	16:56 (1)	07:36	08:12
	16:56	17:46	17 16:50 (1)	18:31		20:18	21:02	21:30	21:21	20:35	19:31		18:29	34 17:30 (1)	16:39	16:25
19	08:09	07:26	16:30 (1)	06:30		06:25	05:36	05:17	05:37	06:19	07:03		07:48	16:56 (1)	07:37	08:13
	16:57	17:48	22 16:52 (1)	18:33		20:19	21:03	21:30	21:20	20:33	19:29		18:27	33 17:29 (1)	16:38	16:26
20	08:09	07:24	16:28 (1)	06:28		06:23	05:35	05:17	05:38	06:20	07:05		07:50	16:57 (1)	07:39	08:13
	16:59	17:50	26 16:54 (1)	18:34		20:21	21:04	21:31	21:19	20:31	19:27		18:25	31 17:28 (1)	16:37	16:26
21	08:08	07:22	16:28 (1)	06:25		06:21	05:34	05:17	05:40	06:22	07:06		07:51	16:58 (1)	07:40	08:14
	17:00	17:51	28 16:56 (1)	18:36		20:22	21:05	21:31	21:17	20:29	19:25		18:23	28 17:26 (1)	16:36	16:26
22	08:07	07:20	16:26 (1)	06:23		06:19	05:32	05:18	05:41	06:23	07:08		07:53	16:59 (1)	07:42	08:15
	17:02	17:53	32 16:58 (1)	18:37		20:24	21:07	21:31	21:16	20:27	19:23		18:21	25 17:24 (1)	16:35	16:27
23	08:06	07:18	16:25 (1)	06:21		06:18	05:31	05:18	05:42	06:25	07:09		07:54	17:02 (1)	07:43	08:15
	17:03	17:55	33 16:58 (1)	18:39		20:25	21:08	21:31	21:15	20:25	19:20		18:19	20 17:22 (1)	16:34	16:27
24	08:05	07:16	16:24 (1)	06:19		06:16	05:30	05:18	05:43	06:26	07:10		07:56	17:05 (1)	07:45	08:16
	17:05	17:56	35 16:59 (1)	18:40		20:27	21:09	21:31	21:14	20:23	19:18		18:17	14 17:19 (1)	16:33	16:28
25	08:03	07:15	16:23 (1)	06:17		06:14	05:29	05:18	05:44	06:27	07:12		06:57		07:46	08:16
	17:07	17:58	37 17:00 (1)	18:42		20:28	21:10	21:31	21:13	20:21	19:16		17:15		16:32	16:29
26	08:02	07:13	16:22 (1)	06:15		06:12	05:28	05:19	05:46	06:29	07:13		06:59		07:48	08:16
	17:08	17:59	38 17:00 (1)	18:43		20:30	21:11	21:32	21:12	20:19	19:14		17:14		16:31	16:29
27	08:01	07:11	16:22 (1)	06:13		06:10	05:27	05:19	05:47	06:30	07:15		07:01		07:49	08:17
	17:10	18:01	38 17:00 (1)	18:45		20:31	21:13	21:32	21:10	20:17	19:12		17:12		16:30	16:30
28	08:00	07:09	16:22 (1)	06:11		06:08	05:26	05:20	05:48	06:32	07:16		07:02		07:50	08:17
	17:11	18:03	39 17:01 (1)	18:46		20:33	21:14	21:31	21:09	20:15	19:10		17:10		16:30	16:31
29	07:59			07:08		06:07	05:25	05:20	05:50	06:33	07:18	17:16 (1)	07:04		07:52	08:17
	17:13			19:48		20:34	21:15	21:31	21:08	20:13	19:08	5 17:21 (1)	17:08		16:29	16:32
30	07:57			07:06		06:05	05:25	05:21	05:51	06:35	07:19	17:11 (1)	07:05		07:53	08:17
	17:15			19:49		20:36	21:16	21:31	21:06	20:11	19:05	16 17:27 (1)	17:06		16:28	16:32
31	07:56			07:04			05:24		05:52	06:36			07:07			08:17
	17:16			19:51			21:17		21:05	20:09			17:05			16:33
Potential sun hours	271	283		368		411	474	484	489	446	379		336		276	257
Total, worst case			352		447							21		785		

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

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12/03/2024 15:18 / 5

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Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** E - IO E - Happbühl 1 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March		April		May	June	July	August		September		October	November	December
1	08:17	07:55	07:07		07:02	18:12 (1)	06:03	05:23	05:21	05:54		06:37	18:16 (1)	07:21	07:09	07:55
	16:35	17:18	18:04		19:52	47 18:59 (1)	20:37	21:18	21:31	21:03		20:07	33 18:49 (1)	19:03	17:03	16:28
2	08:17	07:53	07:05		07:00	18:12 (1)	06:01	05:22	05:22	05:55		06:39	18:14 (1)	07:22	07:10	07:56
	16:36	17:20	18:06		19:54	47 18:59 (1)	20:39	21:19	21:31	21:02		20:05	35 18:49 (1)	19:01	17:01	16:27
3	08:17	07:52	07:03		06:58	18:12 (1)	06:00	05:22	05:22	05:56		06:40	18:13 (1)	07:24	07:12	07:57
	16:37	17:21	18:07		19:55	46 18:58 (1)	20:40	21:20	21:30	21:00		20:03	38 18:51 (1)	18:59	17:00	16:27
4	08:17	07:51	07:01		06:56	18:12 (1)	05:58	05:21	05:23	05:58		06:42	18:11 (1)	07:25	07:13	07:58
	16:38	17:23	18:09		19:57	45 18:57 (1)	20:42	21:21	21:30	20:59		20:01	40 18:51 (1)	18:57	16:58	16:26
5	08:17	07:49	06:59		06:54	18:12 (1)	05:56	05:20	05:24	05:59		06:43	18:09 (1)	07:27	07:15	08:00
	16:39	17:25	18:11		19:58	45 18:57 (1)	20:43	21:22	21:30	20:57		19:59	42 18:51 (1)	18:55	16:57	16:26
6	08:17	07:48	06:57		06:52	18:13 (1)	05:55	05:20	05:25	06:00		06:45	18:09 (1)	07:28	07:17	08:01
	16:40	17:26	18:12		20:00	43 18:56 (1)	20:45	21:23	21:29	20:56		19:57	43 18:52 (1)	18:53	16:55	16:26
7	08:16	07:46	06:55		06:50	18:13 (1)	05:53	05:19	05:25	06:02		06:46	18:08 (1)	07:30	07:18	08:02
	16:41	17:28	18:14		20:01	42 18:55 (1)	20:46	21:23	21:29	20:54		19:55	44 18:52 (1)	18:51	16:54	16:25
8	08:16	07:45	06:53		06:47	18:14 (1)	05:51	05:19	05:26	06:03		06:47	18:06 (1)	07:31	07:20	08:03
	16:42	17:30	18:15		20:03	40 18:54 (1)	20:48	21:24	21:28	20:52		19:53	46 18:52 (1)	18:49	16:52	16:25
9	08:16	07:43	06:51		06:45	18:15 (1)	05:50	05:19	05:27	06:05		06:49	18:06 (1)	07:33	07:21	08:04
	16:43	17:31	18:17		20:04	38 18:53 (1)	20:49	21:25	21:28	20:51		19:50	46 18:52 (1)	18:47	16:51	16:25
10	08:15	07:41	06:48		06:43	18:16 (1)	05:48	05:18	05:28	06:06		06:50	18:05 (1)	07:34	07:23	08:05
	16:45	17:33	18:19		20:06	35 18:51 (1)	20:51	21:26	21:27	20:49		19:48	47 18:52 (1)	18:45	16:49	16:25
11	08:15	07:40	06:46		06:41	18:17 (1)	05:47	05:18	05:29	06:07		06:52	18:05 (1)	07:36	07:25	08:06
	16:46	17:35	18:20		20:07	33 18:50 (1)	20:52	21:26	21:26	20:47		19:46	47 18:52 (1)	18:43	16:48	16:25
12	08:14	07:38	06:44		06:39	18:19 (1)	05:45	05:18	05:30	06:09		06:53	18:04 (1)	07:37	07:26	08:07
	16:47	17:36	18:22		20:09	29 18:48 (1)	20:53	21:27	21:26	20:46		19:44	47 18:51 (1)	18:40	16:46	16:25
13	08:14	07:36	06:42		06:37	18:20 (1)	05:44	05:17	05:31	06:10		06:55	18:03 (1)	07:39	07:28	08:08
	16:49	17:38	18:23		20:10	26 18:46 (1)	20:55	21:28	21:25	20:44		19:42	48 18:51 (1)	18:38	16:45	16:25
14	08:13	07:35	06:40		06:35	18:23 (1)	05:43	05:17	05:32	06:12		06:56	18:04 (1)	07:40	07:29	08:09
	16:50	17:40	18:25		20:12	20 18:43 (1)	20:56	21:28	21:24	20:42		19:40	47 18:51 (1)	18:36	16:44	16:25
15	08:12	07:33	06:38		06:33	18:26 (1)	05:41	05:17	05:33	06:13		06:58	18:03 (1)	07:42	07:31	08:10
	16:51	17:41	18:26		20:13	13 18:39 (1)	20:57	21:29	21:23	20:40		19:38	47 18:50 (1)	18:34	16:43	16:25
16	08:12	07:31	06:36	17:37 (1)	06:31		05:40	05:17	05:34	06:14		06:59	18:03 (1)	07:43	07:33	08:11
	16:53	17:43	18:28	6 17:43 (1)	20:15		20:59	21:29	21:22	20:38		19:35	46 18:49 (1)	18:32	16:41	16:25
17	08:11	07:29	06:34	17:31 (1)	06:29		05:38	05:17	05:35	06:16		07:00	18:03 (1)	07:45	07:34	08:11
	16:54	17:45	18:29	18 17:49 (1)	20:16		21:00	21:30	21:22	20:37		19:33	45 18:48 (1)	18:31	16:40	16:25
18	08:10	07:28	06:32	17:27 (1)	06:27		05:37	05:17	05:36	06:17		07:02	18:03 (1)	07:46	07:36	08:12
	16:56	17:46	18:31	25 17:52 (1)	20:18		21:01	21:30	21:21	20:35		19:31	44 18:47 (1)	18:29	16:39	16:25
19	08:09	07:26	06:30	17:25 (1)	06:25		05:36	05:17	05:37	06:19		07:03	18:04 (1)	07:48	07:37	08:13
	16:57	17:48	18:33	29 17:54 (1)	20:19		21:03	21:30	21:20	20:33		19:29	42 18:46 (1)	18:27	16:38	16:26
20	08:08	07:24	06:28	17:23 (1)	06:23		05:35	05:17	05:38	06:20		07:05	18:04 (1)	07:50	07:39	08:13
	16:59	17:50	18:34	33 17:56 (1)	20:21		21:04	21:31	21:19	20:31		19:27	41 18:45 (1)	18:25	16:37	16:26
21	08:08	07:22	06:25	17:21 (1)	06:21		05:34	05:17	05:40	06:22		07:06	18:05 (1)	07:51	07:40	08:14
	17:00	17:51	18:36	36 17:57 (1)	20:22		21:05	21:31	21:17	20:29		19:25	39 18:44 (1)	18:23	16:36	16:26
22	08:07	07:20	06:23	17:20 (1)	06:19		05:32	05:18	05:41	06:23		07:08	18:05 (1)	07:53	07:42	08:15
	17:02	17:53	18:37	38 17:58 (1)	20:24		21:07	21:31	21:16	20:27		19:23	37 18:42 (1)	18:21	16:35	16:27
23	08:06	07:18	06:21	17:18 (1)	06:18		05:31	05:18	05:42	06:25		07:09	18:07 (1)	07:54	07:43	08:15
	17:03	17:55	18:39	40 17:58 (1)	20:25		21:08	21:31	21:15	20:25		19:20	34 18:41 (1)	18:19	16:34	16:27
24	08:05	07:16	06:19	17:16 (1)	06:16		05:30	05:18	05:43	06:26		07:10	18:08 (1)	07:56	07:45	08:15
	17:05	17:56	18:40	43 17:59 (1)	20:27		21:09	21:31	21:14	20:23		19:18	30 18:38 (1)	18:17	16:33	16:28
25	08:03	07:15	06:17	17:16 (1)	06:14		05:29	05:18	05:44	06:27		07:12	18:09 (1)	06:57	07:46	08:16
	17:07	17:58	18:42	43 17:59 (1)	20:28		21:10	21:31	21:13	20:21		19:16	26 18:35 (1)	17:15	16:32	16:29
26	08:02	07:13	06:15	17:15 (1)	06:12		05:28	05:19	05:46	06:29		07:13	18:12 (1)	06:59	07:48	08:16
	17:08	17:59	18:43	45 18:00 (1)	20:30		21:11	21:32	21:12	20:19		19:14	20 18:32 (1)	17:14	16:31	16:29
27	08:01	07:11	06:13	17:14 (1)	06:10		05:27	05:19	05:47	06:30		07:15	18:16 (1)	07:01	07:49	08:17
	17:10	18:01	18:45	46 18:00 (1)	20:31		21:13	21:31	21:10	20:17		19:12	11 18:27 (1)	17:12	16:30	16:30
28	08:00	07:09	06:11	17:14 (1)	06:08		05:26	05:20	05:48	06:32	18:27 (1)	07:16		07:02	07:50	08:17
	17:11	18:03	18:46	46 18:00 (1)	20:33		21:14	21:31	21:09	20:15	13 18:40 (1)	19:10		17:10	16:30	16:31
29	07:59		07:08	18:13 (1)	06:07		05:25	05:20	05:50	06:33	18:24 (1)	07:18		07:04	07:52	08:17
	17:13		19:48	47 19:00 (1)	20:34		21:15	21:31	21:08	20:13	20 18:44 (1)	19:08		17:08	16:29	16:32
30	07:57		07:06	18:13 (1)	06:05		05:25	05:21	05:51	06:35	18:20 (1)	07:19		07:05	07:53	08:17
	17:15		19:49	47 19:00 (1)	20:36		21:16	21:31	21:06	20:11	26 18:46 (1)	19:05		17:06	16:28	16:32
31	07:56		07:04	18:12 (1)			05:24		05:52	06:36	18:18 (1)			07:07		08:17
	17:16		19:51	47 18:59 (1)			21:17		21:05	20:09	29 18:47 (1)			17:05		16:33
Potential sun hours	271	283	368		411		474	484	489	446		379		336	276	257
Total, worst case				589		549					88		1065			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
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MeteoServ GbR / info@meteoserv.de

Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** F - IO F - Neuer Ring 1 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March		April		May	June	July	August		September		October	November	December
1	08:17	07:55	07:07		07:02	19:04 (1)	06:03	05:23	05:21	05:54		06:37	18:54 (1)	07:21	07:09	07:54
	16:35	17:18	18:04		19:52	22 19:26 (1)	20:37	21:18	21:31	21:03		20:07	35 19:29 (1)	19:03	17:03	16:28
2	08:17	07:53	07:05		07:00	19:02 (1)	06:01	05:22	05:22	05:55		06:39	18:54 (1)	07:22	07:10	07:56
	16:36	17:20	18:06		19:54	26 19:28 (1)	20:39	21:19	21:31	21:02		20:05	35 19:29 (1)	19:01	17:01	16:27
3	08:17	07:52	07:03		06:58	19:01 (1)	06:00	05:22	05:22	05:56		06:40	18:54 (1)	07:24	07:12	07:57
	16:37	17:21	18:07		19:55	28 19:29 (1)	20:40	21:20	21:30	21:00		20:03	35 19:29 (1)	18:59	17:00	16:27
4	08:17	07:51	07:01		06:56	18:59 (1)	05:58	05:21	05:23	05:58		06:42	18:53 (1)	07:25	07:13	07:58
	16:38	17:23	18:09		19:57	31 19:30 (1)	20:42	21:21	21:30	20:59		20:01	35 19:28 (1)	18:57	16:58	16:26
5	08:17	07:49	06:59		06:54	18:58 (1)	05:56	05:20	05:24	05:59		06:43	18:53 (1)	07:27	07:15	08:00
	16:39	17:25	18:11		19:58	32 19:30 (1)	20:43	21:22	21:30	20:57		19:59	34 19:27 (1)	18:55	16:57	16:26
6	08:17	07:48	06:57		06:52	18:58 (1)	05:55	05:20	05:25	06:00		06:45	18:54 (1)	07:28	07:17	08:01
	16:40	17:26	18:12		20:00	33 19:31 (1)	20:45	21:23	21:29	20:56		19:57	33 19:27 (1)	18:53	16:55	16:26
7	08:16	07:46	06:55		06:49	18:57 (1)	05:53	05:19	05:25	06:02		06:46	18:53 (1)	07:30	07:18	08:02
	16:41	17:28	18:14		20:01	34 19:31 (1)	20:46	21:23	21:29	20:54		19:55	32 19:25 (1)	18:51	16:54	16:25
8	08:16	07:45	06:53		06:47	18:56 (1)	05:51	05:19	05:26	06:03		06:47	18:53 (1)	07:31	07:20	08:03
	16:42	17:30	18:15		20:03	35 19:31 (1)	20:48	21:24	21:28	20:52		19:53	31 19:24 (1)	18:49	16:52	16:25
9	08:16	07:43	06:51		06:45	18:56 (1)	05:50	05:19	05:27	06:05		06:49	18:55 (1)	07:33	07:21	08:04
	16:43	17:31	18:17		20:04	35 19:31 (1)	20:49	21:25	21:28	20:51		19:50	28 19:23 (1)	18:47	16:51	16:25
10	08:15	07:41	06:48		06:43	18:56 (1)	05:48	05:18	05:28	06:06		06:50	18:55 (1)	07:34	07:23	08:05
	16:45	17:33	18:19		20:06	35 19:31 (1)	20:50	21:26	21:27	20:49		19:48	26 19:21 (1)	18:45	16:49	16:25
11	08:15	07:40	06:46		06:41	18:56 (1)	05:47	05:18	05:29	06:07		06:52	18:57 (1)	07:36	07:25	08:06
	16:46	17:35	18:20		20:07	34 19:30 (1)	20:52	21:26	21:26	20:47		19:46	23 19:20 (1)	18:43	16:48	16:25
12	08:14	07:38	06:44		06:39	18:56 (1)	05:45	05:18	05:30	06:09		06:53	18:58 (1)	07:37	07:26	08:07
	16:47	17:36	18:22		20:09	34 19:30 (1)	20:53	21:27	21:26	20:46		19:44	19 19:17 (1)	18:40	16:46	16:25
13	08:14	07:36	06:42		06:37	18:56 (1)	05:44	05:17	05:31	06:10		06:55	19:01 (1)	07:39	07:28	08:08
	16:49	17:38	18:23		20:10	33 19:29 (1)	20:55	21:28	21:25	20:44		19:42	12 19:13 (1)	18:38	16:45	16:25
14	08:13	07:35	06:40		06:35	18:56 (1)	05:43	05:17	05:32	06:12		06:56		07:40	07:29	08:09
	16:50	17:40	18:25		20:12	32 19:28 (1)	20:56	21:28	21:24	20:42		19:40		18:36	16:44	16:25
15	08:12	07:33	06:38		06:33	18:56 (1)	05:41	05:17	05:33	06:13		06:57		07:42	07:31	08:10
	16:51	17:41	18:26		20:13	31 19:27 (1)	20:57	21:29	21:23	20:40		19:38		18:34	16:43	16:25
16	08:12	07:31	06:36		06:31	18:57 (1)	05:40	05:17	05:34	06:14		06:59		07:43	07:33	08:11
	16:53	17:43	18:28		20:15	29 19:26 (1)	20:59	21:29	21:22	20:38		19:35		18:32	16:41	16:25
17	08:11	07:29	06:34		06:29	18:57 (1)	05:38	05:17	05:35	06:16		07:00		07:45	07:34	08:11
	16:54	17:45	18:29		20:16	28 19:25 (1)	21:00	21:30	21:21	20:37		19:33		18:30	16:40	16:25
18	08:10	07:28	06:32		06:27	18:58 (1)	05:37	05:17	05:36	06:17		07:02		07:46	07:36	08:12
	16:56	17:46	18:31		20:18	26 19:24 (1)	21:01	21:30	21:21	20:35		19:31		18:29	16:39	16:25
19	08:09	07:26	06:30		06:25	19:00 (1)	05:36	05:17	05:37	06:19		07:03		07:48	07:37	08:13
	16:57	17:48	18:33		20:19	22 19:22 (1)	21:03	21:30	21:20	20:33		19:29		18:27	16:38	16:26
20	08:08	07:24	06:27		06:23	19:01 (1)	05:35	05:17	05:38	06:20		07:05		07:50	07:39	08:13
	16:59	17:50	18:34		20:21	18 19:19 (1)	21:04	21:31	21:19	20:31		19:27		18:25	16:37	16:26
21	08:08	07:22	06:25		06:21	19:04 (1)	05:34	05:17	05:40	06:22	19:14 (1)	07:06		07:51	07:40	08:14
	17:00	17:51	18:36		20:22	12 19:16 (1)	21:05	21:31	21:17	20:29	3 19:17 (1)	19:25		18:23	16:36	16:26
22	08:07	07:20	06:23		06:19		05:32	05:18	05:41	06:23	19:08 (1)	07:08		07:53	07:42	08:15
	17:02	17:53	18:37		20:24		21:07	21:31	21:16	20:27	14 19:22 (1)	19:23		18:21	16:35	16:27
23	08:06	07:18	06:21		06:18		05:31	05:18	05:42	06:24	19:06 (1)	07:09		07:54	07:43	08:15
	17:03	17:55	18:39		20:25		21:08	21:31	21:15	20:25	19 19:25 (1)	19:20		18:19	16:34	16:27
24	08:05	07:16	06:19		06:16		05:30	05:18	05:43	06:26	19:03 (1)	07:10		07:56	07:45	08:15
	17:05	17:56	18:40		20:27		21:09	21:31	21:14	20:23	23 19:26 (1)	19:18		18:17	16:33	16:28
25	08:03	07:15	06:17		06:14		05:29	05:18	05:44	06:27	19:01 (1)	07:12		06:57	07:46	08:16
	17:07	17:58	18:42		20:28		21:10	21:31	21:13	20:21	26 19:27 (1)	19:16		17:15	16:32	16:29
26	08:02	07:13	06:15		06:12		05:28	05:19	05:46	06:29	19:00 (1)	07:13		06:59	07:48	08:16
	17:08	17:59	18:43		20:30		21:11	21:31	21:12	20:19	28 19:28 (1)	19:14		17:14	16:31	16:29
27	08:01	07:11	06:13		06:10		05:27	05:19	05:47	06:30	18:59 (1)	07:15		07:01	07:49	08:17
	17:10	18:01	18:45		20:31		21:13	21:31	21:10	20:17	29 19:28 (1)	19:12		17:12	16:30	16:30
28	08:00	07:09	06:11		06:08		05:26	05:20	05:48	06:32	18:57 (1)	07:16		07:02	07:50	08:17
	17:11	18:03	18:46		20:33		21:14	21:31	21:09	20:15	31 19:28 (1)	19:10		17:10	16:30	16:31
29	07:59		07:08		06:07		05:25	05:20	05:50	06:33	18:57 (1)	07:18		07:04	07:52	08:17
	17:13		19:48		20:34		21:15	21:31	21:08	20:13	32 19:29 (1)	19:08		17:08	16:29	16:32
30	07:57		07:06	19:11 (1)	06:05		05:25	05:21	05:51	06:35	18:55 (1)	07:19		07:05	07:53	08:17
	17:15		19:49	11 19:22 (1)	20:36		21:16	21:31	21:06	20:11	34 19:29 (1)	19:05		17:06	16:28	16:32
31	07:56		07:04	19:06 (1)			05:24		05:52	06:36	18:54 (1)			07:07		08:17
	17:16		19:51	18 19:24 (1)			21:17		21:05	20:09	35 19:29 (1)			17:05		16:33
Potential sun hours	271	283	368		411		474	484	489	446		379		336	276	257
Total, worst case				29		610					274		378			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 7
Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** G - IO G - Ochsenhof 1 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April		May		June	July		August		September	October	November	December
1	08:17	07:55	07:07	07:02		06:03	19:39 (1)	05:23	05:21		05:54	19:46 (1)	06:37	07:21	07:09	07:54
	16:35	17:18	18:04	19:52		20:37 32	20:11 (1)	21:18	21:31		21:03 38	20:24 (1)	20:07	19:03	17:03	16:28
2	08:17	07:53	07:05	07:00		06:01	19:38 (1)	05:22	05:22		05:55	19:45 (1)	06:39	07:22	07:10	07:56
	16:36	17:20	18:06	19:54		20:39 34	20:12 (1)	21:19	21:31		21:02 39	20:24 (1)	20:05	19:01	17:01	16:27
3	08:17	07:52	07:03	06:58		06:00	19:37 (1)	05:22	05:22		05:56	19:46 (1)	06:40	07:24	07:12	07:57
	16:37	17:21	18:07	19:55		20:40 35	20:12 (1)	21:20	21:30		21:00 39	20:25 (1)	20:03	18:59	17:00	16:27
4	08:17	07:51	07:01	06:56		05:58	19:37 (1)	05:21	05:23		05:58	19:46 (1)	06:42	07:25	07:13	07:58
	16:38	17:23	18:09	19:57		20:42 36	20:13 (1)	21:21	21:30		20:59 38	20:24 (1)	20:01	18:57	16:58	16:26
5	08:17	07:49	06:59	06:54		05:56	19:36 (1)	05:20	05:24		05:59	19:45 (1)	06:43	07:27	07:15	08:00
	16:39	17:25	18:11	19:58		20:43 37	20:13 (1)	21:22	21:30		20:57 39	20:24 (1)	19:59	18:55	16:57	16:26
6	08:17	07:48	06:57	06:52		05:55	19:36 (1)	05:20	05:25		06:00	19:46 (1)	06:45	07:28	07:17	08:01
	16:40	17:26	18:12	20:00		20:45 38	20:14 (1)	21:23	21:29		20:56 38	20:24 (1)	19:57	18:53	16:55	16:26
7	08:16	07:46	06:55	06:50		05:53	19:36 (1)	05:19	05:25		06:02	19:46 (1)	06:46	07:30	07:18	08:02
	16:41	17:28	18:14	20:01		20:46 38	20:14 (1)	21:23	21:29		20:54 37	20:23 (1)	19:55	18:51	16:54	16:25
8	08:16	07:45	06:53	06:47		05:51	19:36 (1)	05:19	05:26		06:03	19:46 (1)	06:47	07:31	07:20	08:03
	16:42	17:30	18:15	20:03		20:48 38	20:14 (1)	21:24	21:28		20:52 37	20:23 (1)	19:53	18:49	16:52	16:25
9	08:16	07:43	06:51	06:45		05:50	19:35 (1)	05:19	05:27		06:05	19:47 (1)	06:49	07:33	07:21	08:04
	16:43	17:31	18:17	20:04		20:49 39	20:14 (1)	21:25	21:28		20:51 36	20:23 (1)	19:50	18:47	16:51	16:25
10	08:15	07:41	06:48	06:43		05:48	19:36 (1)	05:18	05:28		06:06	19:47 (1)	06:50	07:34	07:23	08:05
	16:45	17:33	18:19	20:06		20:50 38	20:14 (1)	21:26	21:27		20:49 35	20:22 (1)	19:48	18:45	16:49	16:25
11	08:15	07:40	06:46	06:41		05:47	19:36 (1)	05:18	05:29		06:07	19:47 (1)	06:52	07:36	07:25	08:06
	16:46	17:35	18:20	20:07		20:52 38	20:14 (1)	21:26	21:26		20:47 33	20:20 (1)	19:46	18:43	16:48	16:25
12	08:14	07:38	06:44	06:39		05:45	19:36 (1)	05:18	05:30	20:04 (1)	06:09	19:48 (1)	06:53	07:37	07:26	08:07
	16:47	17:36	18:22	20:09		20:53 38	20:14 (1)	21:27	21:26	2 20:06 (1)	20:46 31	20:19 (1)	19:44	18:40	16:46	16:25
13	08:14	07:36	06:42	06:37		05:44	19:36 (1)	05:17	05:31	19:59 (1)	06:10	19:48 (1)	06:55	07:39	07:28	08:08
	16:49	17:38	18:23	20:10		20:55 38	20:14 (1)	21:28	21:25	10 20:09 (1)	20:44 29	20:17 (1)	19:42	18:38	16:45	16:25
14	08:13	07:35	06:40	06:35		05:43	19:37 (1)	05:17	05:32	19:57 (1)	06:12	19:49 (1)	06:56	07:40	07:29	08:09
	16:50	17:40	18:25	20:12		20:56 37	20:14 (1)	21:28	21:24	14 20:11 (1)	20:42 26	20:15 (1)	19:40	18:36	16:44	16:25
15	08:12	07:33	06:38	06:33		05:41	19:36 (1)	05:17	05:33	19:56 (1)	06:13	19:51 (1)	06:57	07:42	07:31	08:10
	16:51	17:41	18:26	20:13		20:57 37	20:13 (1)	21:29	21:23	17 20:13 (1)	20:40 23	20:14 (1)	19:38	18:34	16:43	16:25
16	08:12	07:31	06:36	06:31		05:40	19:37 (1)	05:17	05:34	19:55 (1)	06:14	19:52 (1)	06:59	07:43	07:33	08:11
	16:53	17:43	18:28	20:15		20:59 36	20:13 (1)	21:29	21:22	19 20:14 (1)	20:38 20	20:12 (1)	19:35	18:32	16:41	16:25
17	08:11	07:29	06:34	06:29		05:38	19:37 (1)	05:17	05:35	19:55 (1)	06:16	19:53 (1)	07:00	07:45	07:34	08:11
	16:54	17:45	18:29	20:16		21:00 35	20:12 (1)	21:30	21:21	21 20:16 (1)	20:37 17	20:10 (1)	19:33	18:31	16:40	16:25
18	08:10	07:28	06:32	06:27		05:37	19:38 (1)	05:17	05:36	19:54 (1)	06:17	19:56 (1)	07:02	07:46	07:36	08:12
	16:56	17:46	18:31	20:18		21:01 34	20:12 (1)	21:30	21:21	23 20:17 (1)	20:35 13	20:09 (1)	19:31	18:29	16:39	16:25
19	08:09	07:26	06:30	06:25		05:36	19:39 (1)	05:17	05:37	19:53 (1)	06:19		07:03	07:48	07:37	08:13
	16:57	17:48	18:33	20:19		21:03 33	20:12 (1)	21:30	21:20	25 20:18 (1)	20:33		19:29	18:27	16:38	16:26
20	08:08	07:24	06:27	06:23		05:35	19:39 (1)	05:17	05:38	19:52 (1)	06:20		07:05	07:50	07:39	08:13
	16:59	17:50	18:34	20:21		21:04 31	20:10 (1)	21:31	21:19	27 20:19 (1)	20:31		19:27	18:25	16:37	16:26
21	08:08	07:22	06:25	06:21		05:34	19:39 (1)	05:17	05:40	19:51 (1)	06:22		07:06	07:51	07:40	08:14
	17:00	17:51	18:36	20:22		21:05 31	20:10 (1)	21:31	21:17	29 20:20 (1)	20:29		19:25	18:23	16:36	16:26
22	08:07	07:20	06:23	06:19		05:32	19:40 (1)	05:18	05:41	19:50 (1)	06:23		07:08	07:53	07:42	08:15
	17:02	17:53	18:37	20:24		21:07 29	20:09 (1)	21:31	21:16	30 20:20 (1)	20:27		19:23	18:21	16:35	16:27
23	08:06	07:18	06:21	06:18		05:31	19:41 (1)	05:18	05:42	19:50 (1)	06:25		07:09	07:54	07:43	08:15
	17:03	17:55	18:39	20:25		21:08 28	20:09 (1)	21:31	21:15	31 20:21 (1)	20:25		19:20	18:19	16:34	16:27
24	08:05	07:16	06:19	06:16	19:55 (1)	05:30	19:42 (1)	05:18	05:43	19:49 (1)	06:26		07:10	07:56	07:45	08:15
	17:05	17:56	18:40	20:27 4	19:59 (1)	21:09 26	20:08 (1)	21:31	21:14	32 20:21 (1)	20:23		19:18	18:17	16:33	16:28
25	08:03	07:15	06:17	06:14	19:49 (1)	05:29	19:44 (1)	05:18	05:44	19:48 (1)	06:27		07:12	06:57	07:46	08:16
	17:07	17:58	18:42	20:28 13	20:02 (1)	21:10 24	20:08 (1)	21:31	21:13	34 20:22 (1)	20:21		19:16	17:15	16:32	16:29
26	08:02	07:13	06:15	06:12	19:46 (1)	05:28	19:45 (1)	05:19	05:46	19:48 (1)	06:29		07:13	06:59	07:48	08:16
	17:08	17:59	18:43	20:30 18	20:04 (1)	21:11 22	20:07 (1)	21:31	21:12	35 20:23 (1)	20:19		19:14	17:14	16:31	16:29
27	08:01	07:11	06:13	06:10	19:45 (1)	05:27	19:46 (1)	05:19	05:47	19:48 (1)	06:30		07:15	07:01	07:49	08:17
	17:10	18:01	18:45	20:31 21	20:06 (1)	21:13 20	20:06 (1)	21:31	21:10	35 20:23 (1)	20:17		19:12	17:12	16:30	16:30
28	08:00	07:09	06:11	06:08	19:43 (1)	05:26	19:47 (1)	05:20	05:48	19:47 (1)	06:32		07:16	07:02	07:50	08:17
	17:11	18:03	18:46	20:33 24	20:07 (1)	21:14 18	20:05 (1)	21:31	21:09	36 20:23 (1)	20:15		19:10	17:10	16:30	16:31
29	07:59		07:08	06:07	19:41 (1)	05:25	19:48 (1)	05:20	05:50	19:47 (1)	06:33		07:18	07:04	07:52	08:17
	17:13		19:48	20:34 27	20:08 (1)	21:15 15	20:03 (1)	21:31	21:08	36 20:23 (1)	20:13		19:08	17:08	16:29	16:32
30	07:57		07:06	06:05	19:40 (1)	05:25	19:51 (1)	05:21	05:51	19:47 (1)	06:35		07:19	07:05	07:53	08:17
	17:15		19:49	20:36 29	20:09 (1)	21:16 11	20:02 (1)	21:31	21:06	37 20:24 (1)	20:11		19:05	17:06	16:28	16:32
31	07:56		07:04			05:24	19:53 (1)		05:52	19:46 (1)	06:36			07:07		08:17
	17:16		19:51			21:17 7	20:00 (1)		21:05	38 20:24 (1)	20:09			17:05		16:33
Potential sun hours	271	283	368	411		474		484	489		446		379	336	276	257
Total, worst case					136		953			531		568				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 8
Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** H - IO H - Lange Straße 55 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April	May		June		July		August		September	October	November	December
1	08:17	07:55	07:07	07:02	06:03		05:23	20:08 (1)	05:21	20:17 (1)	05:54	20:22 (1)	06:37	07:21	07:09	07:54
	16:35	17:18	18:04	19:52	20:37		21:18	26 20:34 (1)	21:31	20 20:37 (1)	21:03	13 20:35 (1)	20:07	19:03	17:03	16:28
2	08:17	07:53	07:05	07:00	06:01		05:22	20:09 (1)	05:22	20:17 (1)	05:55	20:24 (1)	06:39	07:22	07:10	07:56
	16:36	17:20	18:06	19:54	20:39		21:19	25 20:34 (1)	21:31	21 20:38 (1)	21:02	10 20:34 (1)	20:05	19:01	17:01	16:27
3	08:17	07:52	07:03	06:58	06:00		05:22	20:09 (1)	05:22	20:17 (1)	05:56	20:28 (1)	06:40	07:24	07:12	07:57
	16:37	17:21	18:07	19:55	20:40		21:20	25 20:34 (1)	21:30	21 20:38 (1)	21:00	4 20:32 (1)	20:03	18:59	17:00	16:27
4	08:17	07:51	07:01	06:56	05:58		05:21	20:09 (1)	05:23	20:17 (1)	05:58		06:42	07:25	07:13	07:58
	16:38	17:23	18:09	19:57	20:42		21:21	24 20:33 (1)	21:30	22 20:39 (1)	20:59		20:01	18:57	16:58	16:26
5	08:17	07:49	06:59	06:54	05:56		05:20	20:10 (1)	05:24	20:17 (1)	05:59		06:43	07:27	07:15	07:59
	16:39	17:25	18:11	19:58	20:43		21:22	24 20:34 (1)	21:30	22 20:39 (1)	20:57		19:59	18:55	16:57	16:26
6	08:17	07:48	06:57	06:52	05:55		05:20	20:11 (1)	05:25	20:16 (1)	06:00		06:45	07:28	07:17	08:01
	16:40	17:26	18:12	20:00	20:45		21:23	23 20:34 (1)	21:29	23 20:39 (1)	20:56		19:57	18:53	16:55	16:26
7	08:16	07:46	06:55	06:49	05:53		05:19	20:11 (1)	05:25	20:16 (1)	06:02		06:46	07:30	07:18	08:02
	16:41	17:28	18:14	20:01	20:46		21:23	22 20:33 (1)	21:29	24 20:40 (1)	20:54		19:55	18:51	16:54	16:25
8	08:16	07:44	06:53	06:47	05:51		05:19	20:12 (1)	05:26	20:16 (1)	06:03		06:47	07:31	07:20	08:03
	16:42	17:30	18:15	20:03	20:48		21:24	22 20:34 (1)	21:28	25 20:41 (1)	20:52		19:53	18:49	16:52	16:25
9	08:16	07:43	06:51	06:45	05:50		05:19	20:11 (1)	05:27	20:16 (1)	06:05		06:49	07:33	07:21	08:04
	16:43	17:31	18:17	20:04	20:49		21:25	22 20:33 (1)	21:28	25 20:41 (1)	20:51		19:50	18:47	16:51	16:25
10	08:15	07:41	06:48	06:43	05:48	20:16 (1)	05:18	20:12 (1)	05:28	20:16 (1)	06:06		06:50	07:34	07:23	08:05
	16:45	17:33	18:19	20:06	20:50	7 20:23 (1)	21:26	21 20:33 (1)	21:27	26 20:42 (1)	20:49		19:48	18:45	16:49	16:25
11	08:15	07:40	06:46	06:41	05:47	20:13 (1)	05:18	20:13 (1)	05:29	20:16 (1)	06:07		06:52	07:36	07:25	08:06
	16:46	17:35	18:20	20:07	20:52	12 20:25 (1)	21:26	20 20:33 (1)	21:26	26 20:42 (1)	20:47		19:46	18:42	16:48	16:25
12	08:14	07:38	06:44	06:39	05:45	20:11 (1)	05:18	20:14 (1)	05:30	20:16 (1)	06:09		06:53	07:37	07:26	08:07
	16:47	17:36	18:22	20:09	20:53	14 20:25 (1)	21:27	19 20:33 (1)	21:26	27 20:43 (1)	20:46		19:44	18:40	16:46	16:25
13	08:14	07:36	06:42	06:37	05:44	20:10 (1)	05:17	20:14 (1)	05:31	20:15 (1)	06:10		06:55	07:39	07:28	08:08
	16:49	17:38	18:23	20:10	20:55	17 20:27 (1)	21:28	19 20:33 (1)	21:25	27 20:42 (1)	20:44		19:42	18:38	16:45	16:25
14	08:13	07:35	06:40	06:35	05:43	20:09 (1)	05:17	20:15 (1)	05:32	20:15 (1)	06:12		06:56	07:40	07:29	08:09
	16:50	17:40	18:25	20:12	20:56	19 20:28 (1)	21:28	18 20:33 (1)	21:24	27 20:42 (1)	20:42		19:40	18:36	16:44	16:25
15	08:12	07:33	06:38	06:33	05:41	20:08 (1)	05:17	20:15 (1)	05:33	20:15 (1)	06:13		06:57	07:42	07:31	08:10
	16:51	17:41	18:26	20:13	20:57	21 20:29 (1)	21:29	18 20:33 (1)	21:23	28 20:43 (1)	20:40		19:38	18:34	16:43	16:25
16	08:12	07:31	06:36	06:31	05:40	20:07 (1)	05:17	20:15 (1)	05:34	20:15 (1)	06:14		06:59	07:43	07:33	08:11
	16:53	17:43	18:28	20:15	20:59	23 20:30 (1)	21:29	17 20:32 (1)	21:22	28 20:43 (1)	20:38		19:35	18:32	16:41	16:25
17	08:11	07:29	06:34	06:29	05:38	20:07 (1)	05:17	20:16 (1)	05:35	20:15 (1)	06:16		07:00	07:45	07:34	08:11
	16:54	17:45	18:29	20:16	21:00	25 20:32 (1)	21:30	17 20:33 (1)	21:21	28 20:43 (1)	20:37		19:33	18:30	16:40	16:25
18	08:10	07:28	06:32	06:27	05:37	20:07 (1)	05:17	20:16 (1)	05:36	20:16 (1)	06:17		07:02	07:46	07:36	08:12
	16:56	17:46	18:31	20:18	21:01	26 20:33 (1)	21:30	17 20:33 (1)	21:21	28 20:44 (1)	20:35		19:31	18:29	16:39	16:25
19	08:09	07:26	06:30	06:25	05:36	20:07 (1)	05:17	20:17 (1)	05:37	20:16 (1)	06:19		07:03	07:48	07:37	08:13
	16:57	17:48	18:32	20:19	21:03	27 20:34 (1)	21:30	16 20:33 (1)	21:20	28 20:44 (1)	20:33		19:29	18:27	16:38	16:26
20	08:08	07:24	06:27	06:23	05:35	20:06 (1)	05:17	20:17 (1)	05:38	20:16 (1)	06:20		07:05	07:49	07:39	08:13
	16:59	17:50	18:34	20:21	21:04	27 20:33 (1)	21:31	16 20:33 (1)	21:18	28 20:44 (1)	20:31		19:27	18:25	16:37	16:26
21	08:08	07:22	06:25	06:21	05:34	20:06 (1)	05:17	20:17 (1)	05:40	20:16 (1)	06:22		07:06	07:51	07:40	08:14
	17:00	17:51	18:36	20:22	21:05	27 20:33 (1)	21:31	16 20:33 (1)	21:17	28 20:44 (1)	20:29		19:25	18:23	16:36	16:26
22	08:07	07:20	06:23	06:19	05:32	20:06 (1)	05:18	20:17 (1)	05:41	20:16 (1)	06:23		07:08	07:53	07:42	08:14
	17:02	17:53	18:37	20:24	21:07	28 20:34 (1)	21:31	16 20:33 (1)	21:16	28 20:44 (1)	20:27		19:23	18:21	16:35	16:27
23	08:06	07:18	06:21	06:18	05:31	20:06 (1)	05:18	20:18 (1)	05:42	20:16 (1)	06:24		07:09	07:54	07:43	08:15
	17:03	17:55	18:39	20:25	21:08	28 20:34 (1)	21:31	16 20:34 (1)	21:15	28 20:44 (1)	20:25		19:20	18:19	16:34	16:27
24	08:04	07:16	06:19	06:16	05:30	20:06 (1)	05:18	20:17 (1)	05:43	20:16 (1)	06:26		07:10	07:56	07:45	08:15
	17:05	17:56	18:40	20:27	21:09	28 20:34 (1)	21:31	17 20:34 (1)	21:14	27 20:43 (1)	20:23		19:18	18:17	16:33	16:28
25	08:03	07:15	06:17	06:14	05:29	20:07 (1)	05:18	20:17 (1)	05:44	20:16 (1)	06:27		07:12	06:57	07:46	08:16
	17:07	17:58	18:42	20:28	21:10	28 20:35 (1)	21:31	17 20:34 (1)	21:13	27 20:43 (1)	20:21		19:16	17:15	16:32	16:29
26	08:02	07:13	06:15	06:12	05:28	20:07 (1)	05:19	20:18 (1)	05:46	20:18 (1)	06:29		07:13	06:59	07:48	08:16
	17:08	17:59	18:43	20:30	21:11	28 20:35 (1)	21:31	17 20:35 (1)	21:11	25 20:43 (1)	20:19		19:14	17:14	16:31	16:29
27	08:01	07:11	06:13	06:10	05:27	20:07 (1)	05:19	20:17 (1)	05:47	20:18 (1)	06:30		07:15	07:01	07:49	08:16
	17:10	18:01	18:45	20:31	21:13	28 20:35 (1)	21:31	18 20:35 (1)	21:10	24 20:42 (1)	20:17		19:12	17:12	16:30	16:30
28	08:00	07:09	06:11	06:08	05:26	20:07 (1)	05:20	20:17 (1)	05:48	20:18 (1)	06:32		07:16	07:02	07:50	08:17
	17:11	18:03	18:46	20:33	21:14	27 20:34 (1)	21:31	18 20:35 (1)	21:09	22 20:40 (1)	20:15		19:10	17:10	16:30	16:31
29	07:59		07:08	06:07	05:25	20:07 (1)	05:20	20:17 (1)	05:50	20:19 (1)	06:33		07:18	07:04	07:52	08:17
	17:13		19:48	20:34	21:15	27 20:34 (1)	21:31	19 20:36 (1)	21:08	20 20:39 (1)	20:13		19:08	17:08	16:29	16:32
30	07:57		07:06	06:05	05:25	20:07 (1)	05:21	20:18 (1)	05:51	20:20 (1)	06:35		07:19	07:05	07:53	08:17
	17:15		19:49	20:36	21:16	27 20:34 (1)	21:31	19 20:37 (1)	21:06	18 20:38 (1)	20:11		19:05	17:06	16:28	16:32
31	07:56		07:04		05:24	20:08 (1)			05:52	20:21 (1)	06:36			07:07		08:17
	17:16		19:51		21:17	26 20:34 (1)			21:05	16 20:37 (1)	20:09			17:05		16:33
Potential sun hours	271	283	368	411	474		484		489		446		379	336	276	257
Total, worst case						520		584		767		27				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:18 / 9
Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:16/2.7.490

SHADOW - Calendar

Calculation: Zusatz-/Gesamtbelastung WEA 1 (worst case) **Shadow receptor:** I - IO I - Am Schellenbuckel 15 - Maienfels

Assumptions for shadow calculations

Maximum distance for influence	No limit
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April	May	June		July		August	September	October	November	December
1	08:17	07:55	07:07	07:02	06:03	05:23	20:40 (1)	05:21	20:35 (1)	05:54	06:37	07:21	07:09	07:54
	16:35	17:18	18:04	19:52	20:37	21:18	8 20:48 (1)	21:31	25 21:00 (1)	21:03	20:07	19:03	17:03	16:28
2	08:17	07:53	07:05	07:00	06:01	05:22	20:38 (1)	05:22	20:36 (1)	05:55	06:39	07:22	07:10	07:56
	16:36	17:20	18:06	19:54	20:39	21:19	11 20:49 (1)	21:31	24 21:00 (1)	21:02	20:05	19:01	17:01	16:27
3	08:17	07:52	07:03	06:58	06:00	05:22	20:36 (1)	05:22	20:36 (1)	05:56	06:40	07:24	07:12	07:57
	16:37	17:21	18:07	19:55	20:40	21:20	14 20:50 (1)	21:30	23 20:59 (1)	21:00	20:03	18:59	17:00	16:27
4	08:17	07:51	07:01	06:56	05:58	05:21	20:35 (1)	05:23	20:37 (1)	05:58	06:42	07:25	07:13	07:58
	16:38	17:23	18:09	19:57	20:42	21:21	16 20:51 (1)	21:30	22 20:59 (1)	20:59	20:01	18:57	16:58	16:26
5	08:17	07:49	06:59	06:54	05:56	05:20	20:34 (1)	05:24	20:39 (1)	05:59	06:43	07:27	07:15	08:00
	16:39	17:25	18:11	19:58	20:43	21:22	18 20:52 (1)	21:30	20 20:59 (1)	20:57	19:59	18:55	16:57	16:26
6	08:17	07:48	06:57	06:52	05:55	05:20	20:34 (1)	05:25	20:40 (1)	06:00	06:45	07:28	07:17	08:01
	16:40	17:26	18:12	20:00	20:45	21:23	19 20:53 (1)	21:29	19 20:59 (1)	20:56	19:57	18:53	16:55	16:26
7	08:16	07:46	06:55	06:50	05:53	05:19	20:33 (1)	05:25	20:40 (1)	06:02	06:46	07:30	07:18	08:02
	16:41	17:28	18:14	20:01	20:46	21:23	20 20:53 (1)	21:29	18 20:58 (1)	20:54	19:55	18:51	16:54	16:25
8	08:16	07:45	06:53	06:47	05:51	05:19	20:32 (1)	05:26	20:41 (1)	06:03	06:47	07:31	07:20	08:03
	16:42	17:30	18:15	20:03	20:48	21:24	22 20:54 (1)	21:28	17 20:58 (1)	20:52	19:53	18:49	16:52	16:25
9	08:16	07:43	06:51	06:45	05:50	05:19	20:32 (1)	05:27	20:43 (1)	06:05	06:49	07:33	07:21	08:04
	16:43	17:31	18:17	20:04	20:49	21:25	23 20:55 (1)	21:28	15 20:58 (1)	20:51	19:50	18:47	16:51	16:25
10	08:15	07:41	06:48	06:43	05:48	05:18	20:31 (1)	05:28	20:45 (1)	06:06	06:50	07:34	07:23	08:05
	16:45	17:33	18:19	20:06	20:50	21:26	24 20:55 (1)	21:27	12 20:57 (1)	20:49	19:48	18:45	16:49	16:25
11	08:15	07:40	06:46	06:41	05:47	05:18	20:31 (1)	05:29	20:47 (1)	06:07	06:52	07:36	07:25	08:06
	16:46	17:35	18:20	20:07	20:52	21:26	25 20:56 (1)	21:26	10 20:57 (1)	20:47	19:46	18:43	16:48	16:25
12	08:14	07:38	06:44	06:39	05:45	05:18	20:31 (1)	05:30	20:51 (1)	06:09	06:53	07:37	07:26	08:07
	16:47	17:36	18:22	20:09	20:53	21:27	26 20:57 (1)	21:26	3 20:54 (1)	20:46	19:44	18:40	16:46	16:25
13	08:14	07:36	06:42	06:37	05:44	05:17	20:31 (1)	05:31		06:10	06:55	07:39	07:28	08:08
	16:49	17:38	18:23	20:10	20:55	21:28	26 20:57 (1)	21:25		20:44	19:42	18:38	16:45	16:25
14	08:13	07:35	06:40	06:35	05:43	05:17	20:31 (1)	05:32		06:12	06:56	07:40	07:29	08:09
	16:50	17:40	18:25	20:12	20:56	21:28	27 20:58 (1)	21:24		20:42	19:40	18:36	16:44	16:25
15	08:12	07:33	06:38	06:33	05:41	05:17	20:31 (1)	05:33		06:13	06:58	07:42	07:31	08:10
	16:52	17:41	18:26	20:13	20:57	21:29	27 20:58 (1)	21:23		20:40	19:38	18:34	16:43	16:25
16	08:12	07:31	06:36	06:31	05:40	05:17	20:31 (1)	05:34		06:15	06:59	07:43	07:33	08:11
	16:53	17:43	18:28	20:15	20:59	21:29	28 20:59 (1)	21:22		20:38	19:35	18:32	16:41	16:25
17	08:11	07:29	06:34	06:29	05:39	05:17	20:31 (1)	05:35		06:16	07:00	07:45	07:34	08:11
	16:54	17:45	18:29	20:16	21:00	21:30	28 20:59 (1)	21:21		20:37	19:33	18:31	16:40	16:25
18	08:10	07:28	06:32	06:27	05:37	05:17	20:31 (1)	05:36		06:17	07:02	07:46	07:36	08:12
	16:56	17:46	18:31	20:18	21:01	21:30	29 21:00 (1)	21:21		20:35	19:31	18:29	16:39	16:25
19	08:09	07:26	06:30	06:25	05:36	05:17	20:31 (1)	05:37		06:19	07:03	07:48	07:37	08:13
	16:57	17:48	18:33	20:19	21:03	21:30	29 21:00 (1)	21:20		20:33	19:29	18:27	16:38	16:26
20	08:08	07:24	06:28	06:23	05:35	05:17	20:31 (1)	05:38		06:20	07:05	07:50	07:39	08:13
	16:59	17:50	18:34	20:21	21:04	21:31	29 21:00 (1)	21:19		20:31	19:27	18:25	16:37	16:26
21	08:08	07:22	06:25	06:21	05:34	05:17	20:31 (1)	05:40		06:22	07:06	07:51	07:40	08:14
	17:00	17:51	18:36	20:22	21:05	21:31	29 21:00 (1)	21:17		20:29	19:25	18:23	16:36	16:26
22	08:07	07:20	06:23	06:20	05:32	05:18	20:31 (1)	05:41		06:23	07:08	07:53	07:42	08:15
	17:02	17:53	18:37	20:24	21:07	21:31	29 21:00 (1)	21:16		20:27	19:23	18:21	16:35	16:27
23	08:06	07:18	06:21	06:18	05:31	05:18	20:32 (1)	05:42		06:25	07:09	07:54	07:43	08:15
	17:03	17:55	18:39	20:25	21:08	21:31	29 21:01 (1)	21:15		20:25	19:20	18:19	16:34	16:27
24	08:05	07:16	06:19	06:16	05:30	05:18	20:32 (1)	05:43		06:26	07:10	07:56	07:45	08:15
	17:05	17:56	18:40	20:27	21:09	21:31	29 21:01 (1)	21:14		20:23	19:18	18:17	16:33	16:28
25	08:03	07:15	06:17	06:14	05:29	05:18	20:32 (1)	05:44		06:27	07:12	06:57	07:46	08:16
	17:07	17:58	18:42	20:28	21:10	21:31	28 21:00 (1)	21:13		20:21	19:16	17:15	16:32	16:29
26	08:02	07:13	06:15	06:12	05:28	05:19	20:33 (1)	05:46		06:29	07:13	06:59	07:48	08:16
	17:08	17:59	18:43	20:30	21:11	21:31	28 21:01 (1)	21:12		20:19	19:14	17:14	16:31	16:29
27	08:01	07:11	06:13	06:10	05:27	05:19	20:33 (1)	05:47		06:30	07:15	07:01	07:49	08:17
	17:10	18:01	18:45	20:31	21:13	21:31	28 21:01 (1)	21:10		20:17	19:12	17:12	16:30	16:30
28	08:00	07:09	06:11	06:08	05:26	05:20	20:34 (1)	05:48		06:32	07:16	07:02	07:50	08:17
	17:11	18:03	18:46	20:33	21:14	21:31	27 21:01 (1)	21:09		20:15	19:10	17:10	16:30	16:31
29	07:59		07:08	06:07	05:25	05:20	20:34 (1)	05:50		06:33	07:18	07:04	07:52	08:17
	17:13		19:48	20:34	21:15	21:31	27 21:01 (1)	21:08		20:13	19:08	17:08	16:29	16:32
30	07:57		07:06	06:05	05:25	05:21	20:35 (1)	05:51		06:35	07:19	07:05	07:53	08:17
	17:15		19:49	20:36	21:16	21:31	26 21:01 (1)	21:06		20:11	19:05	17:06	16:28	16:32
31	07:56		07:04		05:24			05:52		06:36		07:07		08:17
	17:16		19:51		21:17			21:05		20:09		17:05		16:33
Potential sun hours	271	283	368	411	474	484		489		446	379	336	276	257
Total, worst case							729		208					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

WindPRO version 2.7.490 Sep 2011

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

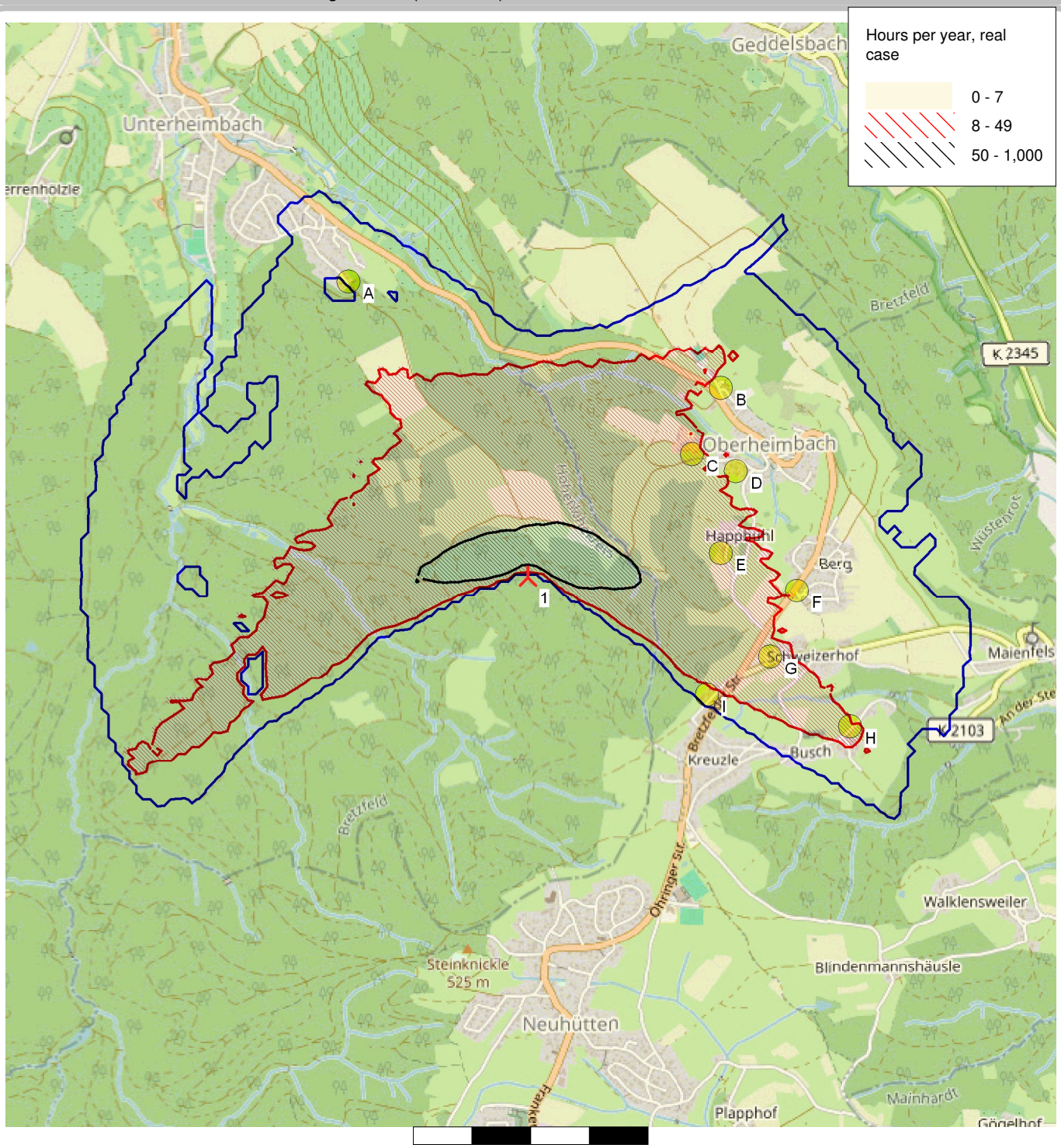
Printed/Page
12/03/2024 15:24 / 1

Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de

Calculated:
12/03/2024 15:24/2.7.490

SHADOW - Map

Calculation: Zusatz-/Gesamtbelastung WEA 1 (real case)



Map: , Print scale 1:25,000, Map center ETRS 89 Zone: 32 East: 535,260 North: 5,441,220

New WTG
Shadow receptor

Isolines showing shadow in Hours per year, real case

0 8 50

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

Printed/Page
12/03/2024 15:24 / 1
Licensed user:
MeteoServ GbR
Spessartring 7
DE-61194 Niddatal
+49 6034 90 230 10
MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:24/2.7.490

SHADOW - Main Result

Calculation: Zusatz-/Gesamtbelastung WEA 1 (real case)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) []

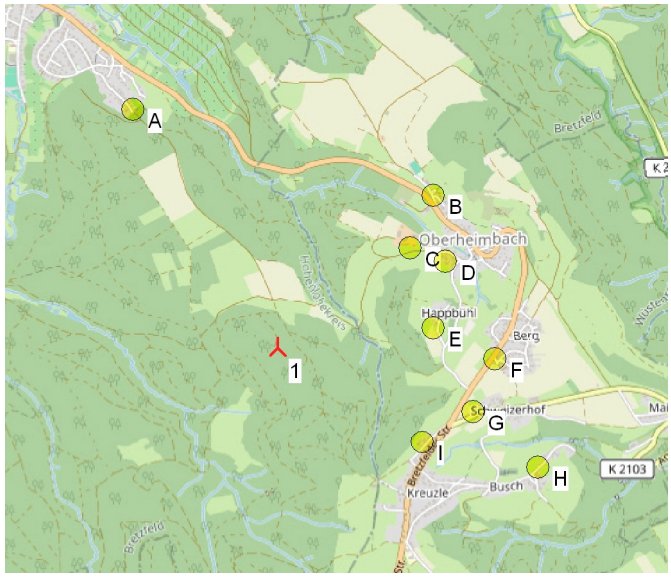
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.70	3.20	4.20	6.10	7.00	7.70	7.60	6.50	5.70	4.00	2.50	2.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
298	403	456	657	745	491	578	858	1,463	1,778	674	359	8,760

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: topo-unterheimbach.map (1)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10 m



Scale 1:40,000
New WTG
Shadow receptor

WTGs

	ETRS 89 Zone: 32 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	ETRS 89 Zone: 32		[m]					[kW]	[m]	[m]	[m]	[RPM]
1	535,255	5,441,206	437.0	WEA 1	Yes	NORDEX	N175/6.X-6,800	6,800	175.0	179.0	1,899	10.8

Shadow receptor-Input

No.	Name	ETRS 89 Zone: 32 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	IO A - Oberer Wasen 29 - Unterheimbach	534,488	5,442,468	321.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
B	IO B - Im Greutle 1 - Maienfels	536,079	5,442,015	390.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
C	IO C - Hagenauer Straße 28 - Maienfels	535,957	5,441,733	392.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
D	IO D - Hagenauer Straße 25 - Maienfels	536,142	5,441,660	396.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
E	IO E - Happbühl 1 - Maienfels	536,079	5,441,311	448.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
F	IO F - Neuer Ring 1 - Maienfels	536,405	5,441,149	461.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
G	IO G - Ochsenhof 1 - Maienfels	536,289	5,440,871	477.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
H	IO H - Lange Straße 55 - Maienfels	536,631	5,440,573	456.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
I	IO I - Am Schellenbuckel 15 - Maienfels	536,020	5,440,708	489.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	IO A - Oberer Wasen 29 - Unterheimbach	3:31
B	IO B - Im Greutle 1 - Maienfels	6:26
C	IO C - Hagenauer Straße 28 - Maienfels	9:07
D	IO D - Hagenauer Straße 25 - Maienfels	7:05
E	IO E - Happbühl 1 - Maienfels	11:46
F	IO F - Neuer Ring 1 - Maienfels	6:45
G	IO G - Ochsenhof 1 - Maienfels	10:49
H	IO H - Lange Straße 55 - Maienfels	9:25

To be continued on next page...

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
Bürgerwindpark Hohenlohe GmbH
Braunsbergweg 5
D-74676 Niedernhall

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MeteoServ GbR / info@meteoserv.de

Calculated:
12/03/2024 15:24/2.7.490

SHADOW - Main Result

Calculation: Zusatz-/Gesamtbelastung WEA 1 (real case)

...continued from previous page

No.	Name	Shadow, expected values Shadow hours per year [h/year]
I	IO I - Am Schellenbuckel 15 - Maienfels	4:28

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	WEA 1	254:02	67:46

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
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Braunsbergweg 5
D-74676 Niedernhall

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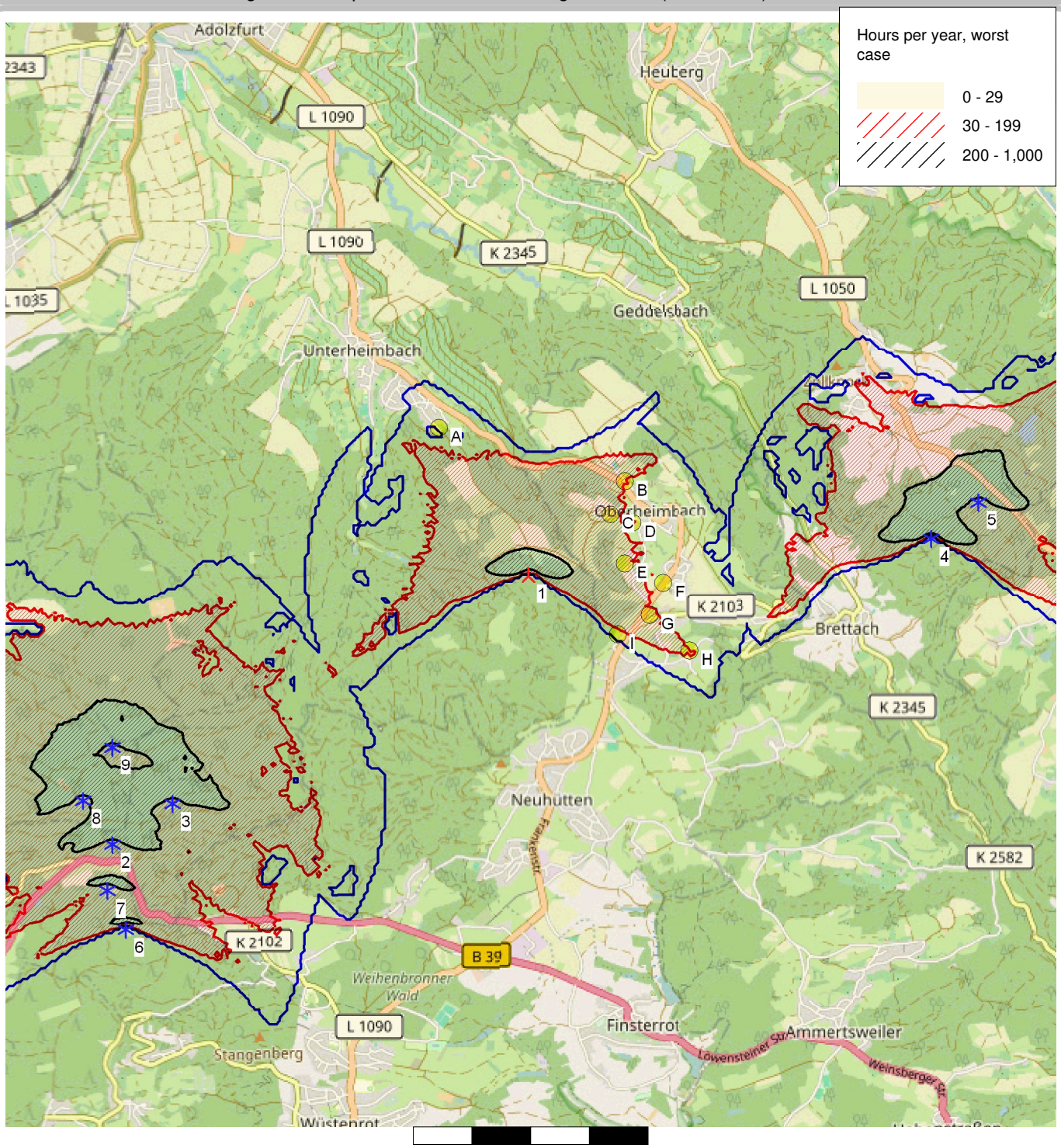
Calculated:
12/03/2024 15:13/2.7.490

SHADOW - Map

Calculation: Zusatzbelastung WEA 1 u. potenzielle Vorbelastung WEA 2-9 (worst case)



Map: , Print scale 1:50,000, Map center ETRS 89 Zone: 32 East: 535,260 North: 5,441,220

New WTG Existing WTG Shadow receptor

Isolines showing shadow in Hours per year, worst case

0 30 200

Project:
Unterheimbach

Description:
Planung WEA 1:
1x Nordex N175/6.X,
Nabenhöhe: 179 m

Auftraggeber:
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Calculated:
12/03/2024 15:13/2.7.490

SHADOW - Main Result

Calculation: Zusatzbelastung WEA 1 u. potenzielle Vorbelastung WEA 2-9 (worst case)

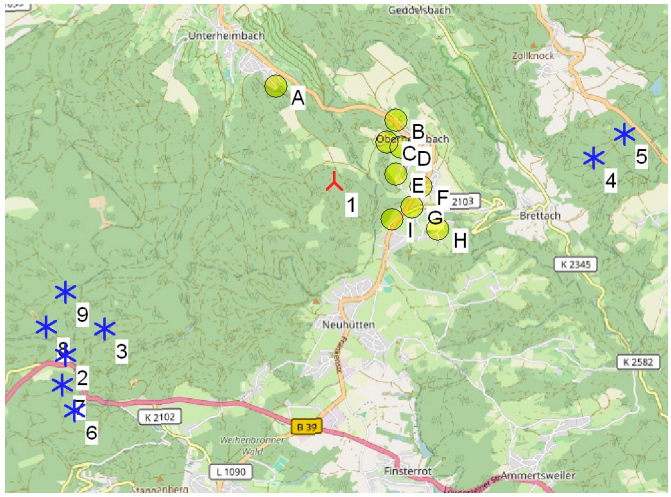
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: topo-unterheimbach.map (1)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10 m



Scale 1:100,000

New WTG | Existing WTG | Shadow receptor

WTGs

	ETRS 89 Zone: 32 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	ETRS 89 Zone: 32		[m]					[kW]	[m]	[m]	[m]	[RPM]
1	535,255	5,441,206	437.0	WEA 1	Yes	NORDEX	N175/6.X-6,800	6,800	175.0	179.0	1,899	10.8
2	531,699	5,438,916	504.0	WEA 2	Yes	NORDEX	N149/4.0-4.5-4,500	4,500	149.1	164.0	1,805	12.3
3	532,215	5,439,266	502.0	WEA 3	Yes	NORDEX	N149/4.0-4.5-4,500	4,500	149.1	164.0	1,805	12.3
4	538,696	5,441,524	459.0	WEA 4	Yes	GE WIND ENERGY	6.0-164-6,000	6,000	164.0	167.0	1,729	9.7
5	539,100	5,441,837	467.0	WEA 5	Yes	GE WIND ENERGY	6.0-164-6,000	6,000	164.0	167.0	1,729	9.7
6	531,814	5,438,189	546.0	WEA 6	Yes	ENERCON	E-92-2,350	2,350	92.0	138.4	1,513	16.0
7	531,655	5,438,523	495.0	WEA 7	Yes	ENERCON	E-92-2,350	2,350	92.0	138.4	1,513	16.0
8	531,447	5,439,292	491.0	WEA 8	Yes	NORDEX	N149/4.0-4.5-4,500	4,500	149.1	164.0	1,805	12.3
9	531,700	5,439,749	472.0	WEA 9	Yes	NORDEX	N175/6.X-6,800	6,800	175.0	179.0	1,899	10.8

Shadow receptor-Input

No.	Name	ETRS 89 Zone: 32 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	IO A - Oberer Wasen 29 - Unterheimbach	534,488	5,442,468	321.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
B	IO B - Im Greutle 1 - Maienfels	536,079	5,442,015	390.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
C	IO C - Hagenauer Straße 28 - Maienfels	535,957	5,441,733	392.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
D	IO D - Hagenauer Straße 25 - Maienfels	536,142	5,441,660	396.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
E	IO E - Happbühl 1 - Maienfels	536,079	5,441,311	448.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
F	IO F - Neuer Ring 1 - Maienfels	536,405	5,441,149	461.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
G	IO G - Ochsenhof 1 - Maienfels	536,289	5,440,871	477.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
H	IO H - Lange Straße 55 - Maienfels	536,631	5,440,573	456.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"
I	IO I - Am Schellenbuckel 15 - Maienfels	536,020	5,440,708	489.0	1.0	1.0	1.0	0.0	0.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	IO A - Oberer Wasen 29 - Unterheimbach	22:58	56	0:29
B	IO B - Im Greutle 1 - Maienfels	30:35	67	0:36
C	IO C - Hagenauer Straße 28 - Maienfels	36:39	63	0:45

To be continued on next page...

Project:
Unterheimbach

Description:
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Nabenhöhe: 179 m

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MeteoServ GbR / info@meteoserv.de
Calculated:
12/03/2024 15:13/2.7.490

SHADOW - Main Result

Calculation: Zusatzbelastung WEA 1 u. potenzielle Vorbelastung WEA 2-9 (worst case)

...continued from previous page

Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
D	IO D - Hagenauer Straße 25 - Maienfels	26:45	52	0:40
E	IO E - Happbühl 1 - Maienfels	38:11	62	0:48
F	IO F - Neuer Ring 1 - Maienfels	21:31	47	0:35
G	IO G - Ochsenhof 1 - Maienfels	36:28	76	0:39
H	IO H - Lange Straße 55 - Maienfels	31:38	86	0:28
I	IO I - Am Schellenbuckel 15 - Maienfels	15:37	42	0:29

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	WEA 1	254:02	
2	WEA 2	0:00	
3	WEA 3	0:00	
4	WEA 4	0:00	
5	WEA 5	0:00	
6	WEA 6	0:00	
7	WEA 7	0:00	
8	WEA 8	0:00	
9	WEA 9	0:00	