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Onderwerp: Aanvulling Omgevingsvergunning Windpark Oostpolderdijk  
Onze referentie: 079422002 A  
Projectnummer: C05057.000103.0100  
Datum: 23-5-2017

Geachte heer/mevrouw,

Op 14 maart 2017 heeft Arcadis Nederland B.V., als gemachtigde van innogy Windpower Netherlands B.V. een aanvraag Omgevingsvergunning ingediend voor het oprichten van een windturbinepark, bestaande uit 3 windturbines op de Oostpolderdijk (Olo-kenmerk: 2808164).

Op 9 mei en 16 mei 2017 heeft de Omgevingsdienst Groningen verzocht om de aanvraag op de onderstaande aspecten aan te vullen en/of op te helderen:

- Slagschaduw onderzoek
- Akoestisch onderzoek
- Externe veiligheidsanalyse

#### Slagschaduw onderzoek

Het advies van de Omgevingsdienst Groningen, verstuurd d.d. 12 mei, verzoekt om opheldering omtrent de onderstaande punten:

- Coördinaten windturbines
- Flikkerfrequentie
- Tijdsduur toetsing
- Simulatiemodel
- Uitgangspunten berekeningen
- Gegevens bestaande windturbines
- Conclusies

Ter beantwoording op het advies van de Omgevingsdienst Groningen heeft Arcadis Nederland B.V. een aanvullend Slagschaduwonderzoek uitgevoerd (Kenmerk: 079417893-A) en als bijlage bij deze brief toegevoegd.

#### Akoestisch onderzoek

Bij het beoordelen en toetsen van het aspect geluid voor Windpark Oostpolderdijk te Eemshaven, heeft de Omgevingsdienst om de onderstaande aanvullingen gevraagd:



- Het akoestisch rapport R068243ag.00003.dv, versie 02-003, d.d. 9 maart 2016 van LBP Sight, gaat uit van de variant 2 (3x Vestas V90 3MW), in de aanvulling van 23 februari 2017 wordt dit nogmaals aangegeven, echter wordt gesteld dat de standaard ashoogte van de V90 wordt bijgesteld naar 100 meter dit in overeenstemming met het planologische maximum. Het door ons eerder opgevraagde en aangeleverde rekenmodel voorziet hier niet in.  
*Het rekenmodel is per e-mail verstuurd aan de heer P. Zwarts (Provincie Groningen) en mevrouw J. van der Veen (Omgevingsdienst Groningen) d.d. 23 mei 2017.*
- Bij de aanvraag zijn diverse specificatiebladen aangeleverd van windturbines echter het spectrum van de V90 (DELTA testrapport bij 7m/s, kenmerk AV 148/09 DANAK 100/2699 Rev.2. d.d. 05/05/2009) ontbreekt.  
*De specificatiebladen voor de V90 (V90-3.0MW mode 0 0005-9597) is als bijlage bij deze brief opgenomen.*

#### Externe veiligheid

In uw e-mail van 3 mei jl. heeft u de onderstaande vragen gesteld aangaande de aanvraag Omgevingsvergunning voor Windpark Oostpolderdijk (Kenmerk: 2808164). De beantwoording is er direct onder opgenomen

- In de QRA is niet duidelijk wat de trefkansen zijn en voor welke objecten deze zijn beoordeeld.  
*De geanalyseerde objecten en bijbehorende trefkansen zijn weergegeven in hoofdstuk 3 en 5 respectievelijk. Als het gaat om de trefkansen van de buisleiding is gerekend met behulp van door Gasuni aangeleverde coördinaten en diepteliggings van de buisleidingen. Die zijn niet als resultaat opgenomen omdat dit files van enkele duizenden coördinaten betreft. In hoofdstuk 4 is de aanpak van de dat deel van de analyse uitgebreid toegelicht.*
- In de QRA zijn de te raken leidingdelen op de verkeerde plek weergegeven daarnaast is er een deel dat dicht bij de windturbine ligt niet meegenomen.  
*De tekening is mogelijk niet representatief v.w.b. de locaties van de buisleidingen. De tekening is echter niet gebruikt voor de risico berekeningen, maar voor de absolute RD coördinaten van de buisleidingen t.o.v. de windturbines. Op deze wijze is het mogelijk om per buisleidingcoördinaat te bepalen of de toegevoegde risico's acceptabel zijn. De delen die niet 'lijken' meegenomen te zijn, zijn wel degelijk meegenomen, maar weg gescreend op basis van diepte ligging (hoofdstuk 4.2.2). Met andere woorden, de buisleidingen liggen zodanig diep dat er voldoende gronddekking is om impact van een windturbine blad op te vangen.*
- De faalfrequentie van de compressoren is niet te herleiden in de originele QRA van de Gasunie, de vraag is dan ook of deze wel correct is. (laatste QRA 2011).  
*Of de gegevens t.a.v. de autonoom falen van de compressoren correct zijn*

*kan niet geheel worden beoordeeld. Er zijn gegevens aangeleverd van DNV met goedkeuring van de Gasunie, zie referentie [M. Middel, „Email: WT's Spijk: ff componenten,” DNV-GL, Groningen, 2015]. Er is destijds aangegeven dat de autonome faalfrequenties van de compressoren in onze ogen erg hoog zijn waardoor de bijdrage van de windturbines te verwaarlozen is, maar Gasunie kon mij geen betere gegevens leveren dan dit.*

Ik hoop hiermee uw vragen naar behoren te hebben beantwoord en de aanvraag voldoende heb aangevuld.

Hoogachtend,  
Arcadis Nederland B.V.

A handwritten signature in black ink, appearing to read 'Freek van Tongeren'.

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Bijlage(n)  
Slagschaduwonderzoek Windpark Oostpolderdijk (079417893-A)  
V90-3.0MW mode 0 0005-9597  
WT's Spijk ff componenten

# SLAGSCHADUWONDERZOEK WINDPARK OOSTPOLDERDIJK

innogy Windpower Netherlands B.V.

22 MEI 2017





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## 1 INLEIDING

Innogy Windpower Netherlands B.V. is voornemens om maximaal 25 windturbines op primaire keringen te ontwikkelen rondom de Eemshaven, het project Dankzij de Dijken. Fase 1 van dit project bestaat uit de bouw van 3 windturbines op de Oostpolderdijk. Fase 2 bestaat uit de ontwikkeling van een windpark op de Emmapolderdijk ten westen van Eemshaven.

Het doel van het voorliggende onderzoek is om de slagschaduweffecten van de 3 turbines op de omgeving in beeld te brengen. Slagschaduw betreft de lichtflikkeringen die optreden vanwege de passerende schaduw van de draaiende rotorbladen van een windturbine. Deze lichtflikkeringen treden op als vanaf de ontvanger gezien de rotorbladen van een windturbine de zonnestralen onderbreken.

Het voorliggende rapport beschrijft allereerst de situatie en de uitgangspunten voor het windpark (hoofdstuk 2). Hoofdstuk 3 beschrijft het beoordelingskader. De berekeningsmethode is beschreven in hoofdstuk 4 en de berekeningsresultaten in hoofdstuk 5. Hoofdstuk 6 gaat in op de hinderbeperkende maatregelen. De conclusie van het onderzoek is samengevat in hoofdstuk 7.

## 2 SITUATIE EN UITGANGSPUNTEN

De drie windturbines van Fase 1 van Windpark Dankzij de Dijken zijn gepland op de Oostpolderdijk ten zuidoosten van de Eemshaven. Voor het windpark worden uitgegaan van 3 turbines uit de 3 MW klasse.

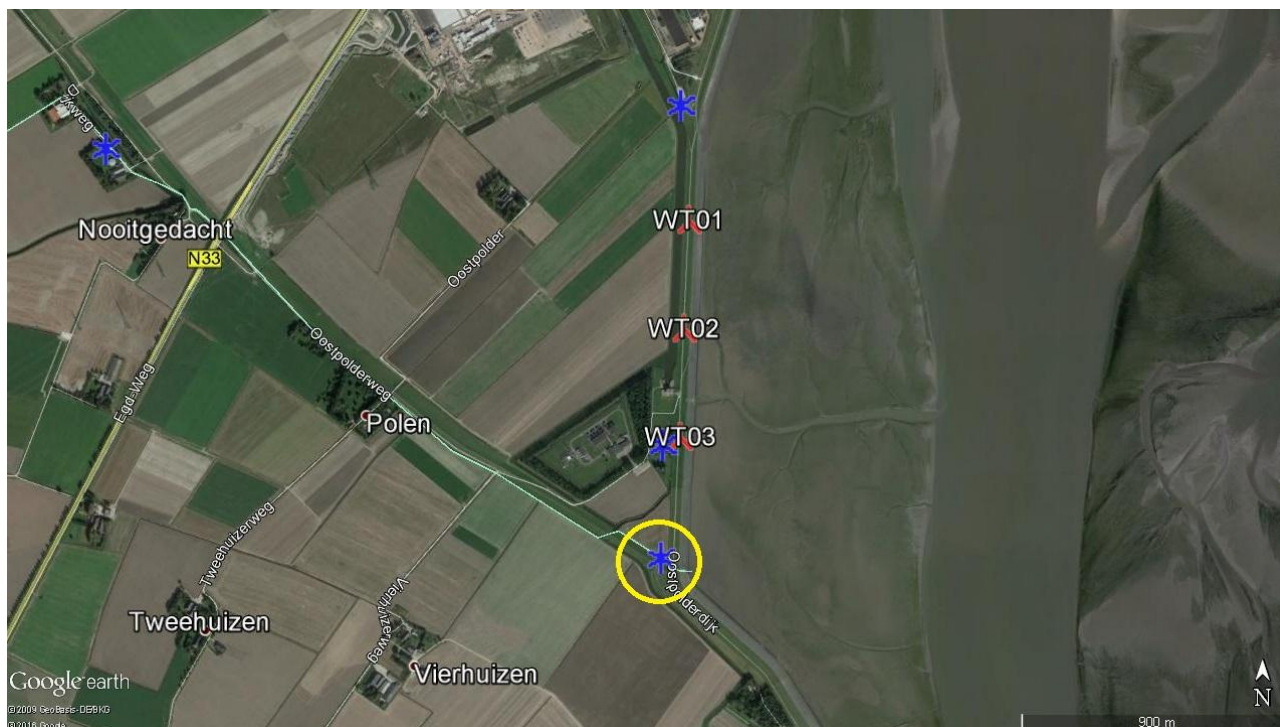
De coördinaten, de maximale ashoogte en de maximale rotordiameter van het windpark zijn vermeld in Tabel 1. De posities van de nieuwe turbines zijn met rode symbolen en nummering weergegeven in Afbeelding 1 en Afbeelding 2.

Tabel 1: Uitgangspunten Windpark Oostpolderdijk

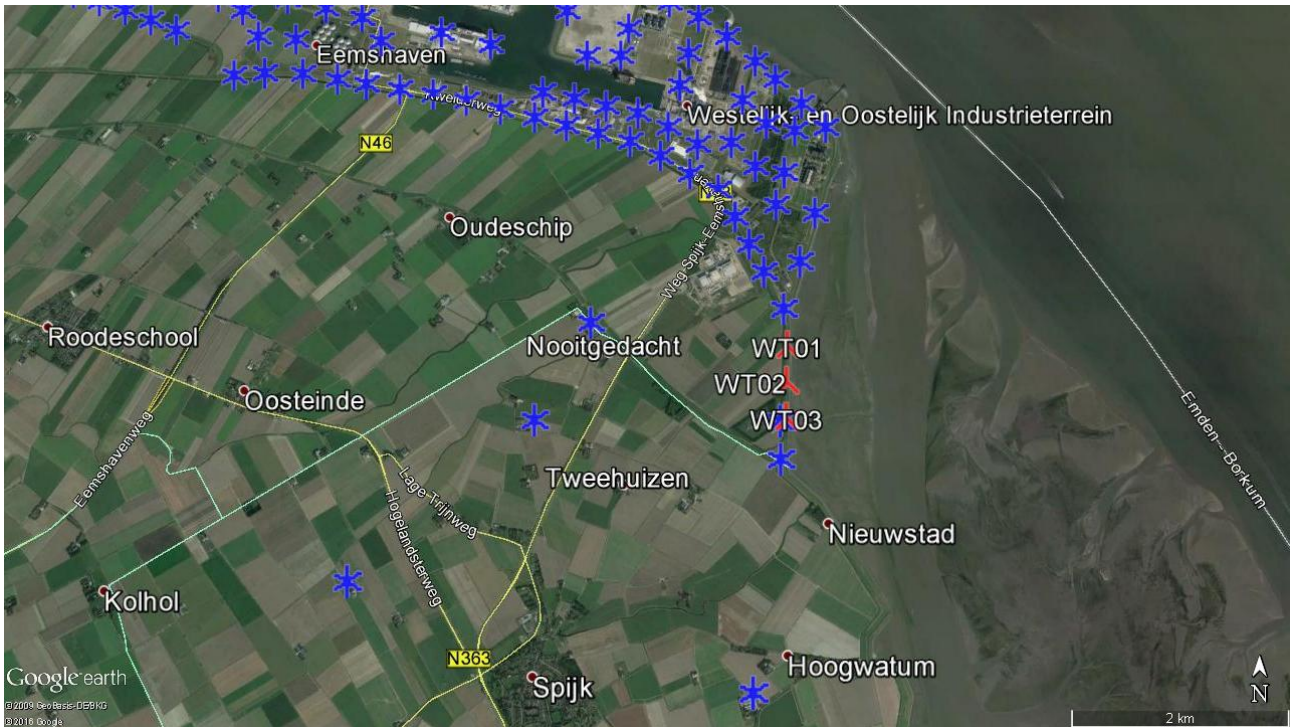
Turbine	Coördinaten		Ashoogte [m]	Ashoogte [m]
	X	Y	(maximaal)	(maximaal)
WT01	253864	604596	100	104
WT02	253855	604236	100	104
WT03	253850	603877	100	104

In en nabij de Eemshaven bevindt zich een groot aantal bestaande windturbines. De gegevens van deze turbines zijn vermeld in bijlage 1. De bestaande windturbines in de nabijheid van het Windpark Oostpolderdijk zijn als blauwe symbolen in Afbeelding 1 en Afbeelding 2 weergegeven.

In de zuidoosthoek, direct ten zuiden van het Windpark Oostpolderdijk, is recent een nieuwe turbine vergund. Deze is in Afbeelding 1 geel omcirkeld weergegeven. Deze turbine wordt ook als een bestaande turbine beschouwd. Recent zijn ook twee Lagerwey windturbines vergund en (deels) gerealiseerd aan de Meeuwenstraatweg in de Eemshaven. Deze turbines bevinden zich op meer dan 5 km afstand - buiten het invloedgebied - van het Windpark Oostpolderdijk en zijn verder buiten beschouwing gelaten.



Afbeelding 1: Overzicht van het onderzoeksgebied en de posities van de windturbines (1)



Afbeelding 2: Overzicht van het onderzoeksgebied en de posities van de windturbines (2)

### 3 BEOORDELINGSKADER

Slagschaduw betreft de lichtflikkeringen die optreden vanwege de passerende schaduw van de draaiende rotorbladen van een windturbine. Deze lichtflikkeringen treden op als vanaf de ontvanger gezien de rotorbladen van een windturbine de zonnestralen onderbreken. De slagschaduw reikt het verste bij een laagstaande zon. Afhankelijk van hoe lang en hoe vaak de slagschaduw optreedt, de frequentie van de flikkeringen en de intensiteit van de wisselingen in lichtsterkte kan dit tot hinder leiden. De hinder doet zich vooral voor als de slagschaduw op het raam van een woning valt en hierdoor binnen in de woning sterke wisselingen in de lichtsterkte optreden. Windturbines zullen geen slagschaduw veroorzaken als de lucht volledig bewolkt is, het (vrijwel) windstil is of als rotorbladen parallel staan met de lijn tussen de ontvanger en de zon.

Uit onderzoek is gebleken dat de hinder van lichtflikkeringen het grootst is bij een frequentie van 2,5 tot 14 Hz. Er kunnen dan verschijnselen als zeeziekte of - bij hiervoor gevoelige mensen - een epileptische aanval optreden. Voor moderne windturbines is het toerental van de rotor echter dermate laag dat de flikkerfrequentie minder dan 1 Hz bedraagt. Bij deze frequentie worden voornoemde gezondheidseffecten niet verwacht<sup>1</sup>.

Naast de wisselingen in lichtsterkte door de slagschaduw kunnen er ook wisselingen in lichtsterkte optreden door de rechtstreekse reflectie van het zonnelicht op de draaiende rotorbladen, vaak aangeduid als lichtschitteringen. De reflectie van licht wordt bij moderne windturbines echter zo veel mogelijk uitgesloten door de rotorbladen uit te voeren met een veelal matte, lichtgrijze kleur.

In Nederland is voor het voorkomen of beperken van slagschaduw in artikel 3.14, lid 4, van het 'Besluit algemene regels voor inrichtingen milieubeheer', het zogenaamde Activiteitenbesluit, opgenomen dat bij het in werking hebben van een windturbine de bij ministeriële regeling te stellen maatregelen worden toegepast. Deze maatregelen zijn beschreven in artikel 3.12 van de 'Regeling algemene regels voor inrichtingen milieubeheer', vaak aangeduid als de Activiteitenregeling. Dit artikel luidt als volgt:

1. Ten behoeve van het voorkomen of beperken van slagschaduw en lichtschittering is de windturbine voorzien van een automatische stilstandvoorziening die de windturbine afschakelt indien slagschaduw optreedt ter plaatse van gevoelige objecten voorzover de afstand tussen de windturbine en de gevoelige objecten minder dan 12 maal de rotordiameter bedraagt en gemiddeld meer dan 17 dagen per jaar gedurende meer dan 20 minuten per dag slagschaduw kan optreden en voorzover zich in de door de slagschaduw getroffen uitwendige scheidingsconstructie van gevoelige gebouwen of woonwagens ramen bevinden. De afstand geldt van een punt op ashoogte van de windturbine tot de gevel van het gevoelige object.
2. Het bevoegd gezag kan met betrekking tot het in werking hebben van een windturbine aanvullend maatwerkvoorschriften stellen ten behoeve van het voorkomen of beperken van hinder door slagschaduw indien het eerste lid in een specifiek geval niet toereikend is.

Voornoemde regeling is geënt op het voorkomen en beperken van slagschaduwhinder tijdens de operationele fase en bevat geen duidelijke normstelling voor prognose-onderzoeken. Voor het onderhavige onderzoek wordt er als 'worst case' benadering van uitgegaan dat er geen stilstandvoorziening nodig is, als bij een gevoelig object de gemiddelde slagschaduwduur per jaar niet meer bedraagt dan 5 uur en 40 minuten (17 x 20 minuten). Dit is in feite een strengere beoordeling dan volgens voornoemde regeling, omdat volgens deze regeling slagschaduw van minder dan 20 minuten per dag of van minder dan 17 dagen met meer dan 20 minuten per dag aanvaardbaar wordt geacht. Voor een precieze beoordeling moet voor alle woningen de slagschaduw per dag worden beoordeeld. Deze analyse zal plaatsvinden voor het instellen van de stilstandsregeling, maar voert te ver voor het huidige onderzoek.

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<sup>1</sup> RIVM Briefrapport 60933002/2008, Windturbines: invloed op de beleving en gezondheid van omwonenden



## 4 BEREKENINGSMETHODE

### 4.1 Simulatiemodel

De slagschaduwberekeningen zijn verricht met het softwarepakket WindPRO, versie 3.0. De potentiële slagschaduweffecten bij een specifieke ontvanger zijn berekend door de situatie te simuleren. De positie van de zon in relatie tot het vlak waarin de rotor beweegt en de resulterende slagschaduw is voor een geheel jaar berekend in intervallen van 1 minuut. Als in een bepaalde minuut het vlak waarin de rotor beweegt een schaduw op het raam kan werpen dat als ontvangerpunt is gedefinieerd, dan wordt dit geregistreerd als 1 minuut potentiële slagschaduwduur. Hierbij wordt het rotorvlak beschouwd als een gesloten vlak. Voor het onderhavige onderzoek zijn de beoordelingspunten bij woningen zodanig gemodelleerd dat deze uit alle richtingen slagschaduw kunnen ontvangen en is als 'worst case' benadering uitgegaan van een (fictief) raam dat een gevelvlak omvat van 8 meter breed en 5 meter hoog vanaf 0,5 meter hoogte. Een dergelijk gevelvlak omvat gewoonlijk alle ramen in de gevel van een woning.

Bij de slagschaduwberekeningen wordt rekening gehouden met gegevens zoals de posities van de windturbines, de ashoogte, de rotordiameter, de bladbreedte, relevante hoogteverschillen in het landschap, de geografische positie op aarde (lengte- en breedtegraad), de tijdzone en zomer- en wintertijd. Het simulatiemodel bevat ook informatie over de baan en de rotatie van de aarde ten opzichte van de zon.

### 4.2 Uitgangspunten berekeningen

Artikel 3.12 van de 'Regeling algemene regels voor inrichtingen milieubeheer' geeft aan dat de slagschaduw alleen hoeft te worden beschouwd als de afstand tussen de windturbine en de gevoelige objecten minder dan 12 maal de rotordiameter bedraagt. Op grotere afstanden zullen de veranderingen in lichtintensiteit dermate gering zijn, dat de slagschaduw niet als hinderlijk wordt ervaren. Ook bij een zonnestand van minder dan 3 graden wordt de slagschaduw niet als hinderlijk beschouwd. De reden hiervoor is dat bij een lage stand van de zon, bij zonsopkomst en -ondergang, het licht vrij diffuus en minder sterk is en vaak afscherming plaatsvindt door aanwezige begroeiing en bebouwing. Op basis van het bovenstaande is in de berekeningen de eventuele slagschaduw op een afstand van meer dan 12 maal de rotordiameter en/of bij een zonnestand van minder dan 3 graden buiten beschouwing gelaten.

De beplanting en gebouwen in het gebied zijn in de berekeningen buiten beschouwing gelaten. Deze kunnen de slagschaduwduur lokaal wel verminderen, omdat ze het zicht op de windturbines plaatselijk kunnen belemmeren.

### 4.3 Correcties op basis van langjarige zonneshijnduur- en windstatistieken

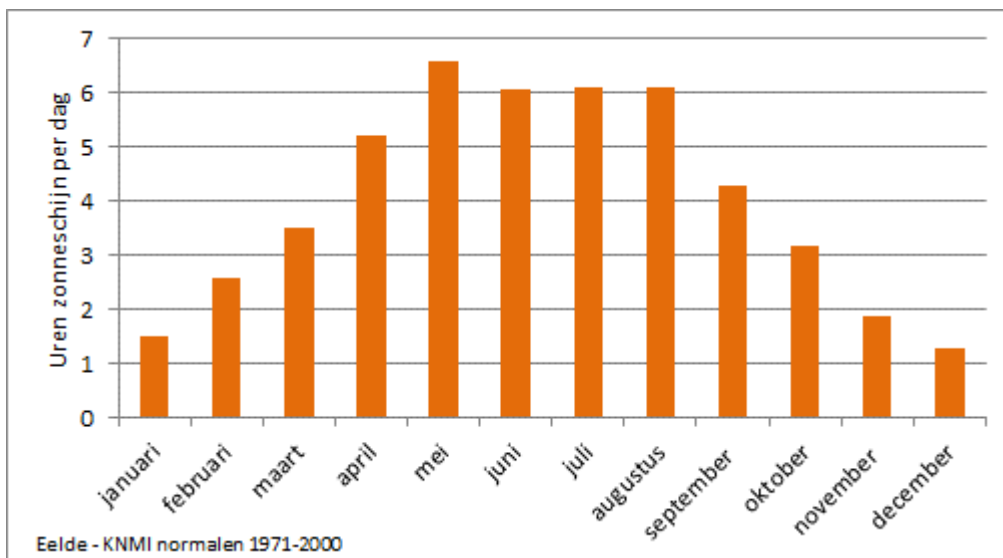
Op basis van de beschreven uitgangspunten wordt in eerste instantie de astronomisch maximaal mogelijke slagschaduwduur berekend. Dit is de slagschaduwduur die optreedt als de zon altijd schijnt, de hemel altijd helder is, de windturbines altijd draaien en de rotor altijd dwars op de lijn van de zon naar de ontvanger staat. Dit is een theoretisch maximale situatie die in werkelijkheid nooit zal optreden.

Slagschaduw treedt alleen op als de zon schijnt en de windturbines in bedrijf zijn. Het is echter regelmatig bewolkt en de windturbines draaien ook niet altijd. Daarnaast staat de rotor van een windturbine niet altijd dwars op de lijn van de zon naar de ontvanger. Om de werkelijk te verwachten slagschaduwduur te berekenen is een correctie toegepast op basis van de langjarige zonneshijnduur- en windstatistieken. De gehanteerde zonneshijnduur is weergegeven in Afbeelding 3. Hierbij is uitgegaan van KNMI gegevens voor de periode 1971-2000 voor het meteorostation Eelde. Op basis van de klimaatinformatie op [www.weersverwachting.nl/wereldweer/europa/nederland/eemshaven#klimaat](http://www.weersverwachting.nl/wereldweer/europa/nederland/eemshaven#klimaat) lijkt het aantal zonneshijnduren in de Eemshaven nog ietsjes lager te zijn. Om de slagschaduweffecten niet te onderschatten is uitgegaan van eerstgenoemde gegevens voor het meteorostation Eelde.

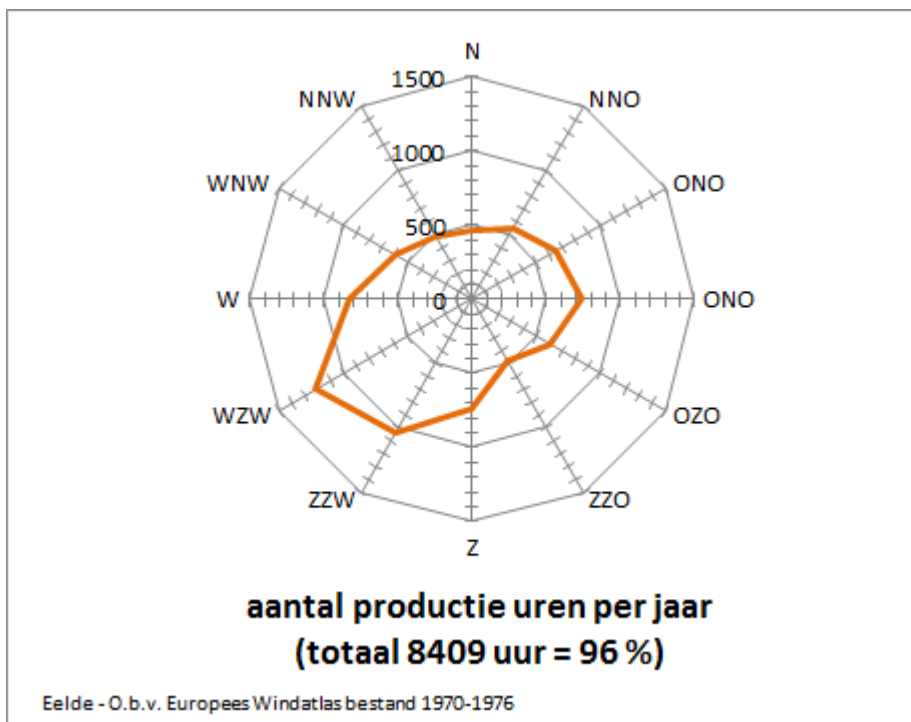
Op basis van de langjarige windstatistieken is een correctie toegepast voor het aantal productie uren van de windturbines per windrichtingssector. Hierbij is uitgegaan van het gegeneraliseerde Europese Windatlas bestand voor het meteorostation Eelde, dat met behulp van het softwarepakket WindPro/WASP is gecorrigeerd voor de ruwheid in de wijde omgeving van het windpark. Hierdoor is in de berekeningen rekening gehouden



met de ligging aan de kust. Het vastgestelde aantal productie uren is weergegeven in Afbeelding 4 en bedraagt in totaal circa 8409 uur per jaar. Dit betekent dat de windturbine circa 96% van de tijd in werking is.



Afbeelding 3: Gemiddeld aantal uren zonneshijm uren per dag op basis van KNMI meteostation Eelde



Afbeelding 4: Gemiddeld aantal productie uren per jaar, berekend op basis van het Europese Windatlas bestand voor meteostation Eelde

## 5 BEREKENINGSRESULTATEN

### 5.1 Windpark Oostpolderdijk

De posities van de beoordelingspunten bij woningen rondom het windpark zijn weergegeven in Afbeelding 5.



Afbeelding 5: Posities van de beoordelingspunten

De ter plaatse van woningen berekende slagschaduwduur is vermeld in Tabel 2. De woningen aan de Oostpolder met de beoordelingspunten 24 en 25 zijn aan de woonbestemming onttrokken. Deze woningen zijn wel in voornoemde tabellen opgenomen, maar in de beoordeling verder buiten beschouwing gelaten.

In de tabellen zijn de volgende gegevens weergegeven:

- Astronomisch maximale aantal uren slagschaduw per jaar.
- Astronomisch maximale aantal dagen met slagschaduw per jaar.
- Astronomisch maximale aantal uren slagschaduw per dag.
- Verwachte aantal uren slagschaduw per jaar. Hierbij wordt rekening gehouden met het langjarig gemiddelde aantal uren zonschijn per maand en het gemiddelde aantal draaiuren van de windturbines per windrichtingsector.

Voor de beoordeling van de effecten wordt uitgegaan van de verwachte slagschaduwduur. Uit het onderzoek blijkt dat vijf woningen een slagschaduwduur van meer dan 5:40 uur per jaar kunnen ondervinden (zie vetgedrukte waarden in Tabel 2). Deze woningen bevinden zich ten westen en ten noordwesten van de geplande windturbines. Van deze woningen is de woning Oostpolder 6 echter aan de woonbestemming onttrokken. De verwachte slagschaduwduur bij de overige vier woningen bedraagt maximaal 11 uur en 41 minuten per jaar.

De slagschaduwcontouren vanwege de nieuwe windturbines zijn weergegeven in Afbeelding 6.

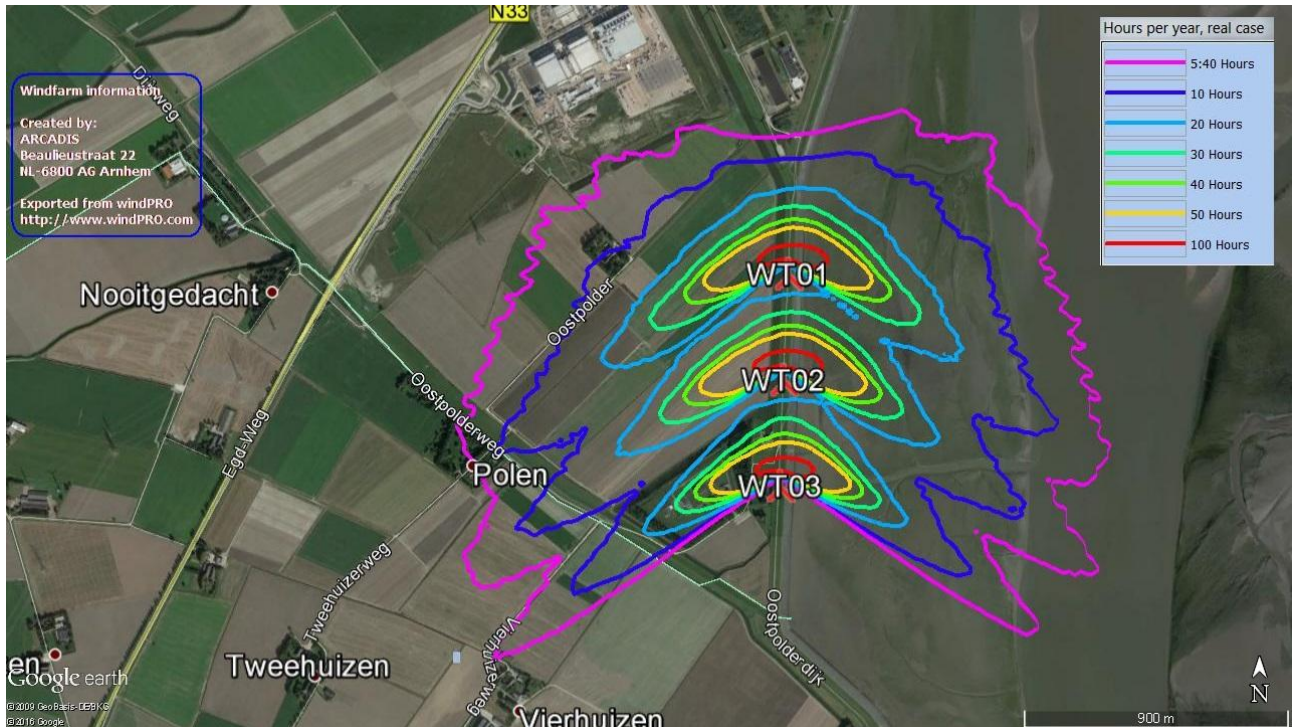
Het toerental van de windturbines bedraagt – afhankelijk van het precieze type - bij nominaal vermogen circa 14 tot 16 toeren per minuut. De windturbines hebben drie rotorbladen hetgeen betekent dat de passeerfrequentie van de slagschaduw – de flikkerfrequentie - 0,7 tot 0,8 Hz bedraagt. Dit is ruim lager dan de frequentie van 2,5 tot 14 Hz waarbij de hinder van lichtflikkeringen het grootst is.

Tabel 2: Slagschaduwduur bij woningen vanwege Windpark Oostpolderdijk

Beoordelingspunt		Astronomisch maximale slagschaduwduur			Verwachte slagschaduwduur
Nr.	Straatnaam en huisnummer	Aantal uren per jaar	Aantal dagen per jaar	Maximale duur per dag	Aantal uren per jaar
01	Nieuwstad 1	0:00	0	0:00	0:00
02	Nieuwstad 2	0:00	0	0:00	0:00
03	Nieuwstad 3	0:00	0	0:00	0:00
04	Nieuwstad 4	0:00	0	0:00	0:00
05	Nieuwstad 5	0:00	0	0:00	0:00
06	Nieuwstad 6	0:00	0	0:00	0:00
07	Nieuwstad 7	0:00	0	0:00	0:00
08	Nieuwstad 8	0:00	0	0:00	0:00
09	Oostpolderweg 19	0:00	0	0:00	0:00
10	Polen 1	17:53	66	0:24	4:00
11	Polen 2	19:24	67	0:25	4:21
12	Polen 4	42:04	140	0:26	<b>9:52</b>
13	Polen 5	14:57	58	0:23	3:05
14	Polen 6	43:00	140	0:26	<b>10:05</b>
15	Polen 7	12:45	53	0:21	2:27

Beoordelingspunt		Astronomisch maximale slagschaduwduur			Verwachte slagschaduw- duur
Nr.	Straatnaam en huisnummer	Aantal uren per jaar	Aantal dagen per jaar	Maximale duur per dag	Aantal uren per jaar
16	Polen 8	43:20	137	0:26	<b>10:08</b>
17	Polen 11	0:00	0	0:00	0:00
18	Tweehuizerweg 15	0:00	0	0:00	0:00
19	Tweehuizerweg 19	0:00	0	0:00	0:00
20	Vierhuizerweg 6	3:26	29	0:10	0:49
21	Vierhuizerweg 8	11:56	48	0:21	2:54
22	Vierhuizerweg 10	5:53	36	0:14	1:25
23	Oostpolder 1	21:51	79	0:26	2:55
24	Oostpolder 2*	29:15	89	0:30	3:55
25	Oostpolder 6*	76:28	88	0:59	<b>8:08</b>
26	Oostpolder 7	78:29	165	0:42	<b>11:41</b>
27	Polen 3	14:52	58	0:23	3:15
28	Vierhuizerweg 4a	0:00	0	0:00	0:00
29	Vierhuizerweg 4	0:00	0	0:00	0:00

*\* De woningen Oostpolder 2 en 6 zijn aan de woonbestemming onttrokken en zijn in de beoordeling verder buiten beschouwing gelaten*



Afbeelding 6: Slagschaduwcontouren Windpark Oostpolderdijk [verwachte duur in uren per jaar]

## 5.2 Bestaande windturbines

Bij de meest noordelijk gelegen woningen kan de slagschaduwduur van de nieuwe windturbines in principe cumuleren met de slagschaduwduur van de bestaande turbines in en nabij de Eemshaven. De slagschaduwduur vanwege de bestaande windturbines is vermeld in Tabel 3. De bijbehorende slagschaduwcontouren zijn voor het relevante deel van het gebied weergegeven in Afbeelding 7. Hierbij is geen rekening gehouden met een eventuele automatische stilstandsvoorziening.

Uit Tabel 3 blijkt dat de woningen die door de nieuwe windturbines worden belast, in principe ook kunnen worden belast door de bestaande windturbines. Dit betekent dat er cumulatieve effecten kunnen optreden. Gezien de verwachte slagschaduwduur mag echter worden aangenomen dat de bepalende bestaande windturbines reeds zijn voorzien van een automatische stilstandsvoorziening, waarmee de slagschaduweffecten worden voorkomen c.q. voldoende worden beperkt.

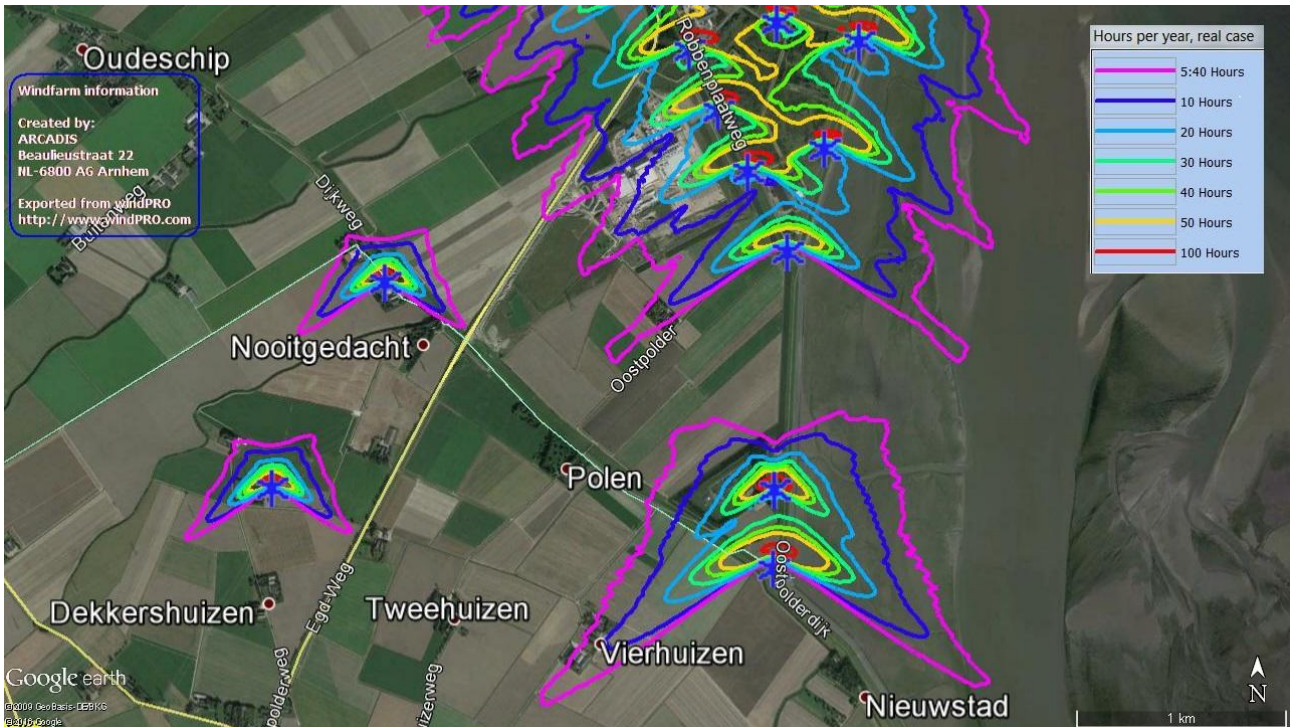
Tabel 3: Slagschaduwduur bij woningen vanwege de bestaande windturbines in en nabij de Eemshaven

Beoordelingspunt		Astronomisch maximale slagschaduwduur			Verwachte slagschaduwduur
Nr.	Straatnaam en huisnummer	Aantal uren per jaar	Aantal dagen per jaar	Maximale duur per dag	Aantal uren per jaar
01	Nieuwstad 1	0:00	0	0:00	0:00
02	Nieuwstad 2	0:00	0	0:00	0:00
03	Nieuwstad 3	0:00	0	0:00	0:00
04	Nieuwstad 4	0:00	0	0:00	0:00
05	Nieuwstad 5	0:00	0	0:00	0:00

Beoordelingspunt		Astronomisch maximale slagschaduwduur			Verwachte slagschaduw- duur
Nr.	Straatnaam en huisnummer	Aantal uren per jaar	Aantal dagen per jaar	Maximale duur per dag	Aantal uren per jaar
06	Nieuwstad 6	0:00	0	0:00	0:00
07	Nieuwstad 7	0:00	0	0:00	0:00
08	Nieuwstad 8	0:00	0	0:00	0:00
09	Oostpolderweg 19	0:00	0	0:00	0:00
10	Polen 1	11:31	34	0:26	1:52
11	Polen 2	12:20	35	0:27	2:00
12	Polen 4	13:10	37	0:28	2:06
13	Polen 5	10:10	34	0:24	1:34
14	Polen 6	13:23	37	0:28	2:08
15	Polen 7	8:52	33	0:23	1:18
16	Polen 8	13:53	39	0:29	2:13
17	Polen 11	0:00	0	0:00	0:00
18	Tweehuizerweg 15	0:00	0	0:00	0:00
19	Tweehuizerweg 19	0:00	0	0:00	0:00
20	Vierhuizerweg 6	1:38	62	0:32	<b>6:35</b>
21	Vierhuizerweg 8	23:09	56	0:33	<b>5:51</b>
22	Vierhuizerweg 10	2:01	62	0:34	<b>6:38</b>
23	Oostpolder 1	15:28	119	0:29	<b>9:23</b>
24	Oostpolder 2*	26:59	78	0:26	<b>6:12</b>
25	Oostpolder 6*	282:21	186	1:57	<b>13:02</b>
26	Oostpolder 7	33:55	69	0:34	<b>8:21</b>
27	Polen 3	9:58	33	0:25	1:36
28	Vierhuizerweg 4a	9:24	77	0:30	<b>8:17</b>
29	Vierhuizerweg 4	23:27	66	0:29	<b>6:02</b>

\* De woningen Oostpolder 2 en 6 zijn aan de woonbestemming onttrokken en zijn in de beoordeling verder buiten beschouwing gelaten





Afbeelding 7: Slagschaduwcontouren bestaande windturbines nabij Windpark Oostpolderdijk [verwachte duur in uren per jaar]

## 6 HINDERBEPERKENDE MAATREGELEN

De hinder vanwege de optredende slagschaduw kan worden voorkomen c.q. beperkt door een automatische stilstandsregeling, die de windturbine afschakelt op de momenten dat deze slagschaduw bij woningen kan veroorzaken. In de besturingssoftware van de windturbine kunnen hiervoor blokken van dagen en tijden met potentiële slagschaduw worden geprogrammeerd. Door dit met een zonneshijnsensor te combineren kan de stilstandsduur worden beperkt.

De stilstandsregeling is verplicht op grond van de 'Regeling algemene regels voor inrichtingen milieubeheer'. Het toepassen van een stilstandsregeling gaat wel ten koste van de energieopbrengst van het windpark.

De stilstandsvoorziening is verplicht voor alle drie de turbines. In Tabel 4 is de totale slagschaduwduur per turbine weergegeven. Het weergegeven verlies is berekend door het aantal uur slagschaduw te delen door het totale aantal uren in een jaar (8.760 uur/jaar). Dit is het verlies dat zou optreden als de turbine iedere keer zou worden stilgezet wanneer er daadwerkelijk slagschaduw op woningen optreedt. Door de stilstandsregeling te combineren met een zonneshijnsensor kan de stilstandsduur met circa 65% worden beperkt, omdat de zon gemiddeld circa 35% van de tijd schijnt. Het productieverlies bedraagt dan circa 0,3%. Met deze stilstandsvoorziening wordt slagschaduw hinder op de nabijgelegen woningen voorkomen. Hiermee worden ook cumulatieve effecten met de bestaande turbines voorkomen.

Tabel 4: Totale slagschaduwduur en bijbehorend productieverlies per windturbine bij toepassing van een automatische stilstandsregeling

Windturbine	Astronomisch maximale slagschaduwduur* (uren/jaar)	Productieverlies uitgaande van astronomisch maximale slagschaduwduur* (%)	Productieverlies rekening houdend met zonneshijnsensor* (%)
WT01	65:02	0,74	0,26
WT02	67:42	0,77	0,27
WT03	62:33	0,71	0,25
<b>Gemiddeld</b>	<b>65:06</b>	<b>0,74</b>	<b>0,26</b>

\* De slagschaduwduur op de woningen Oostpolder 2 en 6 die aan de woonbestemming zijn onttrokken zijn in deze tabel buiten beschouwing gelaten

Indien er windturbines met een lagere ashoogte en/of kleinere rotordiameter worden geplaatst, zal het slagschaduw effect geringer zijn. Ook in dit geval zal een automatische stilstandsregeling naar alle waarschijnlijkheid noodzakelijk zijn, maar de stilstandsduur zal geringer zijn.



## 7 CONCLUSIE

Voor de onderzochte varianten geldt dat zonder maatregelen bij de dichtstbijzijnde woningen ten noorden en westen van het geplande windpark slagschaduw hinder kan optreden.

Uit het onderzoek blijkt dat vijf woningen een slagschaduwduur van meer dan 5:40 uur per jaar kunnen ondervinden. Deze woningen bevinden zich ten westen en ten noordwesten van de geplande windturbines. Van deze woningen is de woning Oostpolder 6 echter aan de woonbestemming onttrokken. De verwachte slagschaduwduur bij de overige vier woningen bedraagt maximaal 11 uur en 41 minuten per jaar. De passeerfrequentie van de slagschaduw – de flikkerfrequentie - bedraagt 0,7 tot 0,8 Hz. Dit is ruim lager dan de frequentie van 2,5 tot 14 Hz waarbij de hinder van lichtflikkeringen het grootst is.

De woningen die door de nieuwe windturbines worden belast kunnen in principe ook door de bestaande windturbines worden belast. Dit betekent dat er cumulatieve effecten kunnen optreden. Gezien de verwachte slagschaduwduur mag echter worden aangenomen dat de bepalende bestaande windturbines reeds zijn voorzien van een automatische stilstandsvoorziening, waarmee de slagschaduw effecten worden voorkomen c.q. voldoende worden beperkt.

De hinder vanwege de optredende slagschaduw van de nieuwe windturbines kan worden voorkomen c.q. voldoende worden beperkt door een automatische stilstandsregeling, die de windturbine afschakelt op de momenten dat deze slagschaduw bij woningen kan veroorzaken. Voor alle drie de turbines is deze stilstandsregeling ook verplicht op grond van de 'Regeling algemene regels voor inrichtingen milieubeheer'. Hiermee wordt aan de eisen ten aanzien van slagschaduw voldaan. Hiermee worden ook cumulatieve effecten met de bestaande turbines voorkomen. Dit gaat wel ten koste van de energieopbrengst van het windpark, maar de verliezen zijn beperkt. De verwachte productieverliezen bedragen circa 0,1%.

Indien er windturbines met een lagere ashoogte en/of kleinere rotordiameter worden geplaatst, zal het slagschaduw effect geringer zijn. Ook in dit geval zal een automatische stilstandsregeling waarschijnlijk noodzakelijk zijn, maar de stilstandsduur zal dan lager liggen.

## BIJLAGE 1 GEGEVENS VAN DE BESTAANDE TURBINES IN EN NABIJ DE EEMSHAVEN

Turbine type	Coördinaten		Ashoogte	Rotordiameter
	X	Y	[m]	[m]
VESTAS V52 850	253792	603854	40,0	52
VESTAS V47 660	251918	604799	40,0	47
VESTAS V47 660	251400	603813	40,0	47
VESTAS V44 600	249693	602239	40,0	44
VESTAS V47 660	253530	601303	40,0	47
ENERCON E-82 E3 3000	251691	608611	98,4	82
ENERCON E-82 E3 3000	252325	608423	98,4	82
ENERCON E-82 E3 3000	252642	608296	98,4	82
ENERCON E-82 E3 3000	252952	608132	98,4	82
ENERCON E-82 E3 3000	253251	607912	98,4	82
ENERCON E-82 E3 3000	253547	607637	98,4	82
ENERCON E-82 E3 3000	253756	607438	98,4	82
ENERCON E-82 E3 3000	253416	607203	98,4	82
ENERCON E-82 E3 3000	253302	606732	98,4	82
ENERCON E-82 E3 3000	249412	608052	98,4	82
ENERCON E-82 E3 3000	249023	608155	98,4	82
ENERCON E-82 E3 3000	248609	608251	98,4	82
ENERCON E-82 E3 3000	249242	608904	98,4	82
ENERCON E-82 E3 3000	249672	609314	98,4	82
ENERCON E-82 E3 3000	250005	609324	98,4	82
ENERCON E-82 E3 3000	250335	609195	98,4	82
ENERCON E-82 E3 3000	250665	609061	98,4	82
ENERCON E-82 E3 3000	250997	608936	98,4	82
ENERCON E-82 E3 3000	253344	605929	98,4	82
ENERCON E-82 E3 3000	253172	606215	98,4	82
ENERCON E-82 E3 3000	252882	606382	98,4	82

Turbine type	Coördinaten		Ashoogte	Rotordiameter
	X	Y	[m]	[m]
ENERCON E-82 E3 3000	252578	606570	98,4	82
ENERCON E-82 E3 3000	252263	606723	98,4	82
ENERCON E-82 E3 3000	251933	606803	98,4	82
ENERCON E-82 E3 3000	251603	606884	98,4	82
ENERCON E-82 E3 3000	251273	606964	98,4	82
ENERCON E-82 E3 3000	250916	607050	98,4	82
ENERCON E-82 E3 3000	250559	607137	98,4	82
ENERCON E-82 E3 3000	250212	607201	98,4	82
ENERCON E-82 E3 3000	249862	607252	98,4	82
ENERCON E-82 E3 3000	249510	607302	98,4	82
ENERCON E-82 E3 3000	249207	607349	98,4	82
ENERCON E-82 E3 3000	248841	607404	98,4	82
ENERCON E-82 E3 3000	248444	607404	98,4	82
ENERCON E-82 E3 3000	248127	607372	98,4	82
ENERCON E-82 E3 3000	245283	609076	98,4	82
ENERCON E-82 E3 3000	245591	609036	98,4	82
ENERCON E-82 E3 3000	245888	608987	98,4	82
ENERCON E-82 E3 3000	246175	608900	98,4	82
ENERCON E-82 E3 3000	246462	608812	98,4	82
ENERCON E-82 E3 3000	246750	608723	98,4	82
ENERCON E-82 E3 3000	247037	608633	98,4	82
ENERCON E-82 E3 3000	247316	608511	98,4	82
ENERCON E-82 E3 3000	247592	608379	98,4	82
ENERCON E-82 E3 3000	247874	608263	98,4	82
ENERCON E-82 E3 3000	248146	608111	98,4	82
ENERCON E-82 E3 3000	246045	608353	98,4	82
ENERCON E-82 E3 3000	246336	608279	98,4	82
ENERCON E-82 E3 3000	246622	608188	98,4	82
ENERCON E-82 E3 3000	246907	608088	98,4	82

Turbine type	Coördinaten		Ashoogte	Rotordiameter
	X	Y	[m]	[m]
ENERCON E-82 E3 3000	247190	607981	98,4	82
ENERCON E-82 E3 3000	247472	607870	98,4	82
VESTAS V90 3000	245161	608566	100,0	90
VESTAS V90 3000	245463	608501	100,0	90
VESTAS V90 3000	245754	608427	100,0	90
VESTAS V90 3000	249554	608828	100,0	90
VESTAS V90 3000	249866	608752	100,0	90
VESTAS V90 3000	250209	608669	100,0	90
VESTAS V90 3000	250550	608586	100,0	90
VESTAS V90 3000	250892	608503	100,0	90
VESTAS V90 3000	251566	608173	100,0	90
VESTAS V90 3000	251793	607668	100,0	90
VESTAS V90 3000	252219	607987	100,0	90
VESTAS V90 3000	252852	607716	100,0	90
VESTAS V90 3000	252144	607676	100,0	90
VESTAS V90 3000	252765	607355	100,0	90
VESTAS V90 3000	251347	607247	100,0	90
VESTAS V90 3000	251676	607186	100,0	90
VESTAS V90 3000	252006	607106	100,0	90
VESTAS V90 3000	252338	607035	100,0	90
VESTAS V90 3000	252652	606888	100,0	90
VESTAS V90 3000	252956	606705	100,0	90
ENERCON E-82 E3 3000	253830	604980	98,4	82
ENERCON E-82 E3 3000	253634	605359	98,4	82
ENERCON E-82 E3 3000	253487	605644	98,4	82
ENERCON E-82 E3 3000	253662	606943	98,4	82
ENERCON E-82 E3 3000	253548	606476	98,4	82
ENERCON E-82 E3 3000	254026	607172	98,4	82
ENERCON E-82 E3 3000	253954	606875	98,4	82

Turbine type	Coördinaten		Ashoogte	Rotordiameter
	X	Y	[m]	[m]
ENERCON E-82 E3 3000	253843	606417	98,4	82
ENERCON E-82 E3 3000	253758	606067	98,4	82
ENERCON E-82 E3 3000	254272	606915	98,4	82
ENERCON E-82 E3 3000	254151	605985	98,4	82
ENERCON E-82 E3 3000	253996	605473	98,4	82
VESTAS V90 3000	248340	607818	100,0	90
VESTAS V90 3000	248736	607792	100,0	90
2B Energy (estimate)	248899	608577	105,0	141
VESTAS V90 3000	249631	607787	100,0	90
REpower 6.2 M 6200 126.0	250257	607896	117,0	126
REpower 6.2 M 6200 126.0	250779	607769	117,0	126
VESTAS V117-3.3	252008	608545	91,5	117
VESTAS V52 850	243719	605290	40,0	52
VESTAS V52 850	244583	607295	40,0	52
VESTAS V52 850	242303	607429	40,0	52
VESTAS V117-3.6	253794	603479	121,0	117

**BIJLAGE 2 WINDPRO RAPPORT WINDPARK  
OOSTPOLDERDIJK**

## SHADOW - Main Result

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines

### Assumptions for shadow calculations

Maximum distance for influence 1. WTG distance circle radius  
 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
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data: NL Eelde, 1970-76

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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: CONTOURLINE\_ONLINEDATA\_1.wpo  
 Obstacles not used in calculation  
 Eye height: 1,5 m  
 Grid resolution: 20,0 m

All coordinates are in Dutch Stereo-RD/NAP 2000



Scale 1:40.000  
 New WTG (red triangle)  
 Shadow receptor (yellow circle)

### WTGs

	X (east)	Y (north)	Z [m]	Row data/Description	WTG type				Shadow data			
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
WT01	253.864	604.596	0,0	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8
WT02	253.855	604.236	0,0	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8
WT03	253.850	603.877	0,1	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8

### Shadow receptor-Input

No.	Name	X (east)	Y (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]	
01	Nieuwstad 1	254.125	602.733	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
02	Nieuwstad 2	254.140	602.775	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
03	Nieuwstad 3	254.202	602.849	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
04	Nieuwstad 4	254.225	602.875	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
05	Nieuwstad 5	254.181	602.906	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
06	Nieuwstad 6	254.124	602.938	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
07	Nieuwstad 7	254.080	602.971	0,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
08	Nieuwstad 8	254.100	603.057	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
09	Oostpolderweg 19	252.158	604.583	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
10	Polen 1	252.758	603.895	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
11	Polen 2	252.794	603.905	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
12	Polen 4	252.832	603.940	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
13	Polen 5	252.713	604.065	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
14	Polen 6	252.843	603.951	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
15	Polen 7	252.645	604.159	0,3	8,0	5,0	0,5	0,0	90,0	"Green house mode"
16	Polen 8	252.861	603.934	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
17	Polen 11	252.593	604.208	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
18	Tweehuizerweg 15	252.245	603.144	1,1	8,0	5,0	0,5	0,0	90,0	"Green house mode"
19	Tweehuizerweg 19	252.235	603.264	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
20	Vierhuizerweg 6	252.926	603.138	2,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
21	Vierhuizerweg 8	252.923	603.193	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
22	Vierhuizerweg 10	252.950	603.174	2,4	8,0	5,0	0,5	0,0	90,0	"Green house mode"
23	Oostpolder 1	252.941	605.012	4,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"

To be continued on next page...

## SHADOW - Main Result

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines

...continued from previous page

No.	Name	X (east)	Y (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
24	Oostpolder 2	253.041	604.951	1,6	8,0	5,0	0,5	0,0	90,0	"Green house mode"
25	Oostpolder 6	253.690	605.033	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
26	Oostpolder 7	253.255	604.646	3,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
27	Polen 3	252.690	603.961	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
28	Vierhuizerweg 4a	252.885	602.958	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
29	Vierhuizerweg 4	252.826	603.017	1,6	8,0	5,0	0,5	0,0	90,0	"Green house mode"

## Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow hours per year	Shadow hours per year
		[h/year]	[days/year]	[h/day]	[h/year]	[h/year]
01	Nieuwstad 1	0:00	0	0:00	0:00	0:00
02	Nieuwstad 2	0:00	0	0:00	0:00	0:00
03	Nieuwstad 3	0:00	0	0:00	0:00	0:00
04	Nieuwstad 4	0:00	0	0:00	0:00	0:00
05	Nieuwstad 5	0:00	0	0:00	0:00	0:00
06	Nieuwstad 6	0:00	0	0:00	0:00	0:00
07	Nieuwstad 7	0:00	0	0:00	0:00	0:00
08	Nieuwstad 8	0:00	0	0:00	0:00	0:00
09	Oostpolderweg 19	0:00	0	0:00	0:00	0:00
10	Polen 1	17:53	66	0:24	4:00	4:00
11	Polen 2	19:24	67	0:25	4:21	4:21
12	Polen 4	42:04	140	0:26	9:52	9:52
13	Polen 5	14:57	58	0:23	3:05	3:05
14	Polen 6	43:00	140	0:26	10:05	10:05
15	Polen 7	12:45	53	0:21	2:27	2:27
16	Polen 8	43:20	137	0:26	10:08	10:08
17	Polen 11	0:00	0	0:00	0:00	0:00
18	Tweehuizerweg 15	0:00	0	0:00	0:00	0:00
19	Tweehuizerweg 19	0:00	0	0:00	0:00	0:00
20	Vierhuizerweg 6	3:26	29	0:10	0:49	0:49
21	Vierhuizerweg 8	11:56	48	0:21	2:54	2:54
22	Vierhuizerweg 10	5:53	36	0:14	1:25	1:25
23	Oostpolder 1	21:51	79	0:26	2:55	2:55
24	Oostpolder 2	29:15	89	0:30	3:55	3:55
25	Oostpolder 6	76:28	88	0:59	8:08	8:08
26	Oostpolder 7	78:29	165	0:42	11:41	11:41
27	Polen 3	14:52	58	0:23	3:15	3:15
28	Vierhuizerweg 4a	0:00	0	0:00	0:00	0:00
29	Vierhuizerweg 4	0:00	0	0:00	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
WT01	SENVION 3.4M104 3400 104.0 IO! hub: 100,0 m (TOT: 152,0 m) (13)	146:02	22:38
WT02	SENVION 3.4M104 3400 104.0 IO! hub: 100,0 m (TOT: 152,0 m) (14)	72:54	12:53
WT03	SENVION 3.4M104 3400 104.0 IO! hub: 100,0 m (TOT: 152,0 m) (15)	62:33	10:16



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 01 - Nieuwstad 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:01	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
	16:45	17:44	18:37	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:37	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:45	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:24	06:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	08:21	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:24	06:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	08:23	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:22	06:11	06:00	05:13	05:06	05:46	06:39	07:34	08:29	08:26	08:49
	17:13	18:13	19:05	21:00	21:49	22:06	21:32	20:27	19:12	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 02 - Nieuwstad 2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:01	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
	16:45	17:44	18:37	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:37	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:45	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:24	06:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	08:21	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:23	06:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	08:23	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:21	06:11	06:00	05:13	05:06	05:46	06:39	07:33	08:28	08:25	08:49
	17:13	18:13	19:05	21:00	21:49	22:06	21:32	20:27	17:04	16:23	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 03 - Nieuwstad 3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:17	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:01	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:34	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
	16:45	17:44	18:37	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:37	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:45	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	09:19	09:16	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:21	09:18	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:33	08:28	09:23	09:20	08:49
	17:13	18:13	19:05	21:01	21:49	22:06	21:32	20:27	19:12	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 04 - Nieuwstad 4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:54	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:17	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:54	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:01	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:34	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
	16:45	17:44	18:37	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:37	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:45	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	09:19	09:16	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
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	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
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Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 05 - Nieuwstad 5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

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

	January	February	March	April	May	June	July	August	September	October	November	December
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	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
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	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
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	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
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20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:45	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	09:19	09:16	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:21	09:18	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:33	08:28	09:23	09:20	08:49
	17:13	18:13	19:05	20:55	21:49	22:06	21:32	20:27	19:12	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 06 - Nieuwstad 6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:17	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
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	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
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17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
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	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:21	09:18	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:33	08:28	09:23	09:20	08:49
	17:13	18:13	19:05	21:01	21:49	22:06	21:32	20:27	19:12	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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



SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 07 - Nieuwstad 7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:43	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:17	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:34	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
	16:45	17:44	18:37	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	17:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	17:10	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	09:19	09:16	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	17:08	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:21	09:18	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:34	08:29	09:24	09:21	08:49
	17:13	18:13	19:05	21:01	21:49	22:06	21:32	20:27	19:12	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 08 - Nieuwstad 8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:14	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:28	20:22	19:10	17:00	16:18
3	08:48	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:36	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:52	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:09	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:06	21:54	22:03	21:25	20:18	19:05	16:57	16:17
5	08:48	08:12	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:10	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:45	07:44	08:34
	16:33	17:28	18:23	20:19	21:13	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:45	08:35
	16:34	17:30	18:24	20:21	21:15	21:58	22:00	21:15	20:06	18:53	16:48	16:15
10	08:45	08:03	07:02	06:47	05:43	05:06	05:16	06:02	06:56	07:49	07:47	08:36
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:13	20:03	18:50	16:46	16:14
11	08:45	08:01	06:59	06:45	05:41	05:05	05:17	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:42	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:01	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:43	16:41	16:14
14	08:42	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:53	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:34	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:47	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:42
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17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:52	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:48	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:26	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:39	21:32	22:05	21:50	20:54	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:07	08:06	08:45
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:21	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:47	20:50	19:36	18:25	16:29	16:15
22	08:34	07:38	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:48	20:45	21:36	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:31	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:48	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	18:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:03	18:56	20:52	21:42	22:06	21:40	20:39	19:24	18:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:48
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:36	19:22	18:13	16:23	16:19
28	08:26	07:25	06:18	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:19	08:49
	17:07	18:07	18:59	20:56	21:45	22:05	21:37	20:34	19:19	18:10	16:22	16:20
29	08:24	07:24	06:16	06:05	05:15	05:07	05:43	06:35	07:29	08:24	08:21	08:49
	17:09	18:09	19:01	20:57	21:46	22:05	21:35	20:32	19:17	18:08	16:21	16:21
30	08:23	07:23	06:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	08:23	08:49
	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	18:05	16:20	16:22
31	08:21	07:21	06:11	06:00	05:13	05:06	05:46	06:39	07:33	08:28	08:25	08:49
	17:13	18:13	19:05	21:00	21:49	22:06	21:32	20:27	19:12	18:03	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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



### SHADOW - Calendar

Calculation: Windpark Oostpolderdijk - klasse 3 MW turbinesShadow receptor: 09 - Oostpolderweg 19  
 Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:20	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:15	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:05	21:29	20:22	19:10	17:01	16:18
3	08:49	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:37	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:53	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:10	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:07	21:54	22:04	21:25	20:18	19:05	16:57	16:17
5	08:48	08:13	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:32
	16:30	17:24	18:19	20:16	21:10	21:56	22:03	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:11	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:46	07:44	08:34
	16:33	17:28	18:23	20:20	21:14	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:46	08:35
	16:34	17:30	18:25	20:21	21:15	21:59	22:00	21:15	20:06	18:53	16:48	16:15
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	16:36	17:32	18:26	20:23	21:17	21:59	22:00	21:13	20:03	18:51	16:46	16:14
11	08:45	08:01	07:00	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:43	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:02	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:44	16:41	16:14
14	08:43	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:54	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:48	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:43
	16:45	17:44	18:38	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
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	16:47	17:46	18:39	20:36	21:29	22:04	21:53	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:49	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
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	16:50	17:50	18:43	20:40	21:32	22:05	21:50	20:55	19:41	18:30	16:32	16:15
20	08:37	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:08	08:06	08:46
	16:52	17:52	18:45	20:41	21:34	22:05	21:49	20:52	19:39	18:28	16:31	16:15
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	16:54	17:54	18:47	20:43	21:35	22:05	21:48	20:50	19:36	18:25	16:29	16:15
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25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:29	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	18:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:04	18:56	20:52	21:42	22:06	21:40	20:39	19:24	18:15	16:24	16:18
27	08:27	07:28	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:49
	17:05	18:06	18:58	20:54	21:44	22:06	21:39	20:37	19:22	18:13	16:23	16:19
28	08:26	07:25	06:19	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:20	08:49
	17:07	18:07	19:00	20:56	21:45	22:06	21:37	20:34	19:19	18:11	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:35	07:29	08:25	09:21	08:21	08:49
	17:09	18:10	19:02	20:58	21:46	22:05	21:36	20:32	19:17	18:08	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:22	08:23	08:49
	17:11	18:12	19:04	20:59	21:48	22:05	21:34	20:30	19:14	18:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:34	08:29	09:25	08:26	08:49
	17:13	18:14	19:06	20:59	21:49	22:06	21:32	20:27	19:10	18:01	16:23	16:23
Potential sun hours	252	274	367	419	492	508	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 10 - Polen 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	07:46 (WT03) 21:01	06:39 (WT02) 21:50
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	07:47 (WT03) 21:03	06:40 (WT02) 21:51
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	07:48 (WT03) 21:05	06:41 (WT02) 21:53
4	08:48 16:27	08:14 17:20	07:16 18:15	07:02 20:12	07:51 (WT03) 21:07	06:43 (WT02) 21:54
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	06:57 21:08	06:52 (WT02) 21:55
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	06:57 21:10	05:51 21:56
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:14	05:07 21:58
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15	05:06 21:59
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	06:47 21:17	05:06 21:59
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	06:45 21:19	05:05 22:00
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20	05:05 22:01
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	05:35 21:25	05:04 22:03
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04
18	08:39 16:49	07:47 17:48	06:43 18:41	06:29 20:38	06:53 (WT02) 21:30	05:04 22:04
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:40	06:51 (WT02) 21:32	05:04 22:05
20	08:36 16:52	07:43 17:52	06:38 18:45	06:24 20:41	06:49 (WT02) 21:33	05:04 22:05
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	06:59 (WT02) 21:35	05:04 22:05
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	06:59 (WT02) 21:37	05:04 22:06
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	07:00 (WT02) 21:38	05:04 22:06
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	06:42 (WT02) 21:39	05:05 22:06
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	06:59 (WT02) 21:40	05:05 22:06
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	07:01 (WT02) 21:42	05:06 22:06
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	07:01 (WT02) 21:44	05:06 22:06
28	08:26 17:07	07:25 18:07	06:19 19:00	06:07 20:56	06:38 (WT02) 21:45	05:07 22:06
29	08:24 17:09	07:23 18:09	06:17 19:02	06:05 20:58	06:38 (WT02) 21:46	05:07 22:06
30	08:23 17:11	07:21 18:11	06:15 19:04	06:03 20:59	06:59 (WT02) 21:48	05:08 22:06
31	08:21 17:13	07:19 18:13	06:13 19:06	06:01 21:00	07:01 (WT02) 21:49	05:08 22:06
Potential sun hours	252	274	367	419	492	508
Total, worst case			202	272		56
Sun reduction			0,30	0,37		0,41
Oper. time red.			0,96	0,96		0,96
Wind dir. red.			0,63	0,65		0,66
Total reduction			0,18	0,23		0,26
Total, real			36	63		15

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbines Shadow receptor: 10 - Polen 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409

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

	July	August	September	October	November	December
1	05:08 22:05	05:47 21:30	06:41 20:25	07:33 19:12	07:30 17:02	08:24 16:19
2	05:09 22:04	05:49 21:29	06:42 20:22	07:35 19:10	07:32 17:00	08:26 16:18
3	05:10 22:04	05:51 21:27	06:44 20:20	07:37 19:07	07:34 16:59	08:27 16:18
4	05:11 22:04	05:52 21:25	06:46 20:18	07:38 19:05	07:36 16:57	08:29 16:17
5	05:11 22:03	05:54 21:23	06:48 20:15	07:40 19:02	07:38 16:55	08:30 16:16
6	05:12 22:02	05:56 21:21	06:49 20:13	07:42 19:00	07:40 16:53	08:31 16:16
7	05:13 22:02	05:57 21:19	06:51 20:11	07:44 18:58	07:42 16:51	08:33 16:15
8	05:14 22:01	05:59 21:17	06:53 20:08	07:46 18:55	07:44 16:49	08:34 16:15
9	05:15 22:00	06:01 21:15	06:55 20:06	07:48 18:53	07:47 16:48	08:35 16:15
10	05:16 22:00	06:03 21:13	06:56 20:03	07:40 18:51	07:49 16:46	08:37 16:14
11	05:18 21:59	06:04 21:11	06:58 20:01	07:38 18:48	07:51 16:44	08:38 16:14
12	05:19 21:58	06:06 21:09	07:00 19:58	07:37 18:46	07:53 16:43	08:39 16:14
13	05:20 21:57	06:08 21:07	07:02 19:56	07:36 18:44	07:55 16:41	08:40 16:14
14	05:21 21:56	06:09 21:05	07:03 19:54	07:36 18:41	07:56 16:39	08:41 16:14
15	05:22 21:55	06:11 21:03	07:05 19:51	07:34 18:39	07:58 16:38	08:42 16:14
16	05:24 21:54	06:13 21:01	07:07 19:49	07:34 18:37	08:00 16:36	08:43 16:14
17	05:25 21:53	06:15 20:59	07:08 19:46	07:35 18:34	08:02 16:35	08:43 16:14
18	05:26 21:51	06:16 20:57	07:10 19:44	07:36 18:32	08:04 16:33	08:44 16:14
19	05:28 21:50	06:18 20:54	07:12 19:41	07:38 18:30	08:06 16:32	08:45 16:15
20	05:29 21:49	06:20 20:52	07:14 19:39	07:40 18:28	08:08 16:31	08:46 16:15
21	05:30 21:48	06:22 20:50	07:15 19:36	07:41 18:25	08:09 16:29	08:46 16:15
22	05:32 21:46	06:23 20:48	07:17 19:34	07:43 18:23	08:11 16:28	08:47 16:16
23	05:33 21:45	06:25 20:46	07:19 19:32	07:45 18:21	08:13 16:27	08:47 16:16
24	05:35 21:43	06:27 20:43	07:21 19:29	07:46 18:19	08:15 16:26	08:48 16:17
25	05:36 21:42	06:28 20:41	07:22 19:27	07:17 17:17	08:15 16:25	08:48 16:18
26	05:38 21:40	06:30 20:39	07:24 19:24	07:19 17:15	08:16 16:24	08:48 16:18
27	05:39 21:39	06:32 20:36	07:26 19:22	07:21 17:13	08:18 16:23	08:49 16:19
28	05:41 21:37	06:34 20:34	07:28 19:19	07:23 17:11	08:20 16:22	08:49 16:20
29	05:43 21:35	06:35 20:32	07:29 19:17	07:25 17:08	08:21 16:21	08:49 16:21
30	05:44 21:34	06:37 20:30	07:31 19:14	07:26 17:06	08:23 16:20	08:49 16:22
31	05:46 21:32	06:39 20:27		07:28 17:04		08:49 16:23
Potential sun hours	510	458	382	329	261	236
Total, worst case		285	258			
Sun reduction		0,41	0,34			
Oper. time red.		0,96	0,96			
Wind dir. red.		0,66	0,63			
Total reduction		0,26	0,20			
Total, real		74	53			

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 11 - Polen 2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June		
1	08:49	08:19	07:23	07:09	07:48 (WT03)	06:01	06:38 (WT02)	05:12
	16:24	17:15	18:09	20:07	18 08:06 (WT03)	21:01	21 06:59 (WT02)	21:50
2	08:49	08:18	07:21	07:06	07:49 (WT03)	05:59	06:39 (WT02)	05:11
	16:25	17:16	18:11	20:09	16 08:05 (WT03)	21:03	18 06:57 (WT02)	21:51
3	08:49	08:16	07:18	07:04	07:51 (WT03)	05:57	06:40 (WT02)	05:10
	16:26	17:18	18:13	20:10	11 08:02 (WT03)	21:05	16 06:56 (WT02)	21:53
4	08:48	08:14	07:16	07:02	05:55	06:41 (WT02)	05:10	05:10
	16:27	17:20	18:15	20:12	21:07	13 06:54 (WT02)	21:54	21:54
5	08:48	08:13	07:14	06:59	05:53	06:44 (WT02)	05:09	05:09
	16:29	17:22	18:17	20:14	21:08	9 06:53 (WT02)	21:55	21:55
6	08:48	08:11	07:11	06:57	05:51	05:08	05:08	05:08
	16:30	17:24	18:19	20:16	21:10	21:56	21:56	21:56
7	08:47	08:09	07:09	06:54	05:49	05:07	05:07	05:07
	16:31	17:26	18:21	20:18	21:12	21:57	21:57	21:57
8	08:47	08:07	07:07	06:52	05:47	05:07	05:07	05:07
	16:33	17:28	18:23	20:20	21:14	21:58	21:58	21:58
9	08:46	08:05	07:04	06:50	05:45	05:06	05:06	05:06
	16:34	17:30	18:24	20:21	21:15	21:59	21:59	21:59
10	08:46	08:03	07:02	06:47	05:43	05:06	05:06	05:06
	16:36	17:32	18:26	20:23	21:17	21:59	21:59	21:59
11	08:45	08:01	07:00	06:45	05:41	05:05	05:05	05:05
	16:37	17:34	18:28	20:25	21:19	22:00	22:00	22:00
12	08:44	07:59	06:57	06:43	05:40	05:05	05:05	05:05
	16:39	17:36	18:30	20:27	21:20	22:01	22:01	22:01
13	08:43	07:57	06:55	06:40	05:38	05:05	05:05	05:05
	16:40	17:38	18:32	20:29	21:22	22:02	22:02	22:02
14	08:43	07:55	06:52	06:38	05:36	05:04	05:04	05:04
	16:42	17:40	18:34	20:30	21:24	22:02	22:02	22:02
15	08:42	07:53	06:50	06:36	05:35	05:04	05:04	05:04
	16:43	17:42	18:36	20:32	21:25	22:03	22:03	22:03
16	08:41	07:51	06:48	06:33	05:33	05:04	05:04	05:04
	16:45	17:44	18:38	20:34	21:27	22:03	22:03	22:03
17	08:40	07:49	06:45	06:31	05:31	05:04	05:04	05:04
	16:47	17:46	18:39	20:36	21:29	22:04	22:04	22:04
18	08:39	07:47	06:43	06:29	06:53 (WT02)	05:30	05:04	05:04
	16:49	17:48	18:41	20:38	2 06:55 (WT02)	21:30	22:04	22:04
19	08:38	07:45	06:40	06:27	06:51 (WT02)	05:28	05:04	05:04
	16:50	17:50	18:43	20:39	7 06:58 (WT02)	21:32	22:05	22:05
20	08:36	07:43	06:38	06:24	06:49 (WT02)	05:27	05:04	05:04
	16:52	17:52	18:45	5 07:01 (WT03)	20:41	10 06:59 (WT02)	21:33	22:05
21	08:35	07:41	06:35	06:59 (WT03)	06:22	06:46 (WT02)	05:25	05:04
	16:54	17:54	18:47	10 07:09 (WT03)	20:43	13 06:59 (WT02)	21:35	22:05
22	08:34	07:39	06:33	06:56 (WT03)	06:20	06:44 (WT02)	05:24	05:04
	16:56	17:56	18:49	14 07:10 (WT03)	20:45	16 07:00 (WT02)	21:37	22:06
23	08:33	07:36	06:31	06:54 (WT03)	06:18	06:42 (WT02)	05:22	05:04
	16:57	17:58	18:50	17 07:11 (WT03)	20:47	19 07:01 (WT02)	21:38	22:06
24	08:31	07:34	06:28	06:52 (WT03)	06:15	06:40 (WT02)	05:21	05:05
	16:59	18:00	18:52	20 07:12 (WT03)	20:49	21 07:01 (WT02)	21:39	22:06
25	08:30	07:32	06:26	06:49 (WT03)	06:13	06:38 (WT02)	05:20	05:05
	17:01	18:02	18:54	23 07:12 (WT03)	20:50	23 07:01 (WT02)	21:41	22:06
26	08:29	07:30	06:23	06:48 (WT03)	06:11	06:38 (WT02)	05:19	05:06
	17:03	18:04	18:56	24 07:12 (WT03)	20:52	23 07:01 (WT02)	21:42	22:06
27	08:27	07:27	06:21	06:47 (WT03)	06:09	06:37 (WT02)	05:17	05:06
	17:05	18:05	18:58	24 07:11 (WT03)	20:54	24 07:01 (WT02)	21:44	22:06
28	08:26	07:25	06:19	06:47 (WT03)	06:07	06:37 (WT02)	05:16	05:06
	17:07	18:07	19:00	24 07:11 (WT03)	20:56	24 07:01 (WT02)	21:45	22:06
29	08:24	07:24	06:16	07:46 (WT03)	06:05	06:38 (WT02)	05:15	05:07
	17:09	18:09	19:01	24 08:10 (WT03)	20:58	22 07:00 (WT02)	21:46	22:05
30	08:23	07:23	06:14	07:47 (WT03)	06:03	06:38 (WT02)	05:14	05:08
	17:11	18:11	19:03	22 08:09 (WT03)	20:59	22 07:00 (WT02)	21:48	22:05
31	08:21	07:21	06:11	07:48 (WT03)	05:13	05:13	05:13	05:13
	17:13	18:13	19:05	21 08:09 (WT03)	21:49	492	508	508
Potential sun hours	252	274	367	419	492	508	508	508
Total, worst case			228	271		77		
Sun reduction			0,30	0,37		0,41		
Oper. time red.			0,96	0,96		0,96		
Wind dir. red.			0,63	0,65		0,66		
Total reduction			0,18	0,23		0,26		
Total, real			41	63		20		

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 11 - Polen 2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December		
1	05:08	05:47	06:41	07:33	07:30	08:24		
	22:05	21:30	20:25	19:12	17:02	16:19		
2	05:09	05:49	06:42	07:35	07:32	08:26		
	22:04	21:29	20:22	19:10	17:00	16:18		
3	05:10	05:51	06:44	07:37	07:34	08:27		
	22:04	21:27	20:20	19:07	16:59	16:18		
4	05:11	05:52	06:46	07:38	07:36	08:29		
	22:04	21:25	20:18	19:05	16:57	16:17		
5	05:11	05:54	06:48	07:40	07:38	08:30		
	22:03	21:23	20:15	19:02	16:55	16:16		
6	05:12	05:56	06:49	07:42	07:40	08:31		
	22:02	21:21	20:13	19:00	16:53	16:16		
7	05:13	05:57	06:55 (WT02)	06:51	07:44	07:42	08:33	
	22:02	21:19	4 06:59 (WT02)	20:10	18:58	16:51	16:15	
8	05:14	05:59	06:52 (WT02)	06:53	07:46	07:44	08:34	
	22:01	21:17	11 07:03 (WT02)	20:08	18:55	16:49	16:15	
9	05:15	06:01	06:50 (WT02)	06:55	07:45 (WT03)	07:47	07:46	08:35
	22:00	21:15	14 07:04 (WT02)	20:06	10 07:55 (WT03)	18:53	16:48	16:15
10	05:16	06:03	06:49 (WT02)	06:56	07:43 (WT03)	07:49	07:47	08:37
	22:00	21:13	17 07:06 (WT02)	20:03	15 07:58 (WT03)	18:51	16:46	16:14
11	05:18	06:04	06:47 (WT02)	06:58	07:40 (WT03)	07:51	07:49	08:38
	21:59	21:11	19 07:06 (WT02)	20:01	19 07:59 (WT03)	18:48	16:44	16:14
12	05:19	06:06	06:47 (WT02)	07:00	07:39 (WT03)	07:53	07:51	08:39
	21:58	21:09	20 07:07 (WT02)	19:58	21 08:00 (WT03)	18:46	16:43	16:14
13	05:20	06:08	06:46 (WT02)	07:02	07:38 (WT03)	07:55	07:53	08:40
	21:57	21:07	22 07:08 (WT02)	19:56	23 08:01 (WT03)	18:44	16:41	16:14
14	05:21	06:09	06:45 (WT02)	07:03	07:38 (WT03)	07:56	07:55	08:41
	21:56	21:05	23 07:08 (WT02)	19:54	23 08:01 (WT03)	18:41	16:39	16:14
15	05:22	06:11	06:45 (WT02)	07:05	07:36 (WT03)	07:58	07:57	08:42
	21:55	21:03	24 07:09 (WT02)	19:51	25 08:01 (WT03)	18:39	16:38	16:14
16	05:24	06:13	06:44 (WT02)	07:07	07:36 (WT03)	08:00	07:59	08:43
	21:54	21:01	24 07:08 (WT02)	19:49	25 08:01 (WT03)	18:37	16:36	16:14
17	05:25	06:15	06:44 (WT02)	07:08	07:36 (WT03)	08:02	08:00	08:43
	21:53	20:59	24 07:08 (WT02)	19:46	24 08:00 (WT03)	18:34	16:35	16:14
18	05:26	06:16	06:45 (WT02)	07:10	07:36 (WT03)	08:04	08:02	08:44
	21:51	20:57	23 07:08 (WT02)	19:44	23 07:59 (WT03)	18:32	16:33	16:14
19	05:28	06:18	06:46 (WT02)	07:12	07:38 (WT03)	08:06	08:04	08:45
	21:50	20:54	21 07:07 (WT02)	19:41	20 07:58 (WT03)	18:30	16:32	16:15
20	05:29	06:20	06:48 (WT02)	07:14	07:40 (WT03)	08:08	08:06	08:46
	21:49	20:52	18 07:06 (WT02)	19:39	18 07:58 (WT03)	18:28	16:31	16:15
21	05:30	06:22	06:50 (WT02)	07:15	07:41 (WT03)	08:09	08:08	08:46
	21:48	20:50	16 07:06 (WT02)	19:36	14 07:55 (WT03)	18:25	16:29	16:15
22	05:32	06:23	06:51 (WT02)	07:17	07:43 (WT03)	08:11	08:09	08:47
	21:46	20:48	13 07:04 (WT02)	19:34	11 07:54 (WT03)	18:23	16:28	16:16
23	05:33	06:25	06:53 (WT02)	07:19	07:45 (WT03)	08:13	08:11	08:47
	21:45	20:46	10 07:03 (WT02)	19:32	7 07:52 (WT03)	18:21	16:27	16:16
24	05:35	06:27	06:55 (WT02)	07:21	08:15	08:13	08:13	08:48
	21:43	20:43	6 07:01 (WT02)	19:29	18:19	16:26	16:17	16:17
25	05:36	06:28	06:56 (WT02)	07:22	07:17	08:15	08:15	08:48
	21:42	20:41	1 06:57 (WT02)	19:27	17:17	16:25	16:18	16:18
26	05:38	06:30		07:24	07:19	08:16	08:16	08:48
	21:40	20:39		19:24	17:15	16:24	16:18	16:18
27	05:39	06:32		07:26	07:21	08:18	08:18	08:49
	21:39	20:36		19:22	17:13	16:23	16:19	16:19
28	05:41	06:34		07:28	07:23	08:20	08:20	08:49
	21:37	20:34		19:19	17:11	16:22	16:20	16:20
29	05:43	06:35		07:29	07:25	08:21	08:21	08:49
	21:35	20:32		19:17	17:08	16:21	16:21	16:21
30	05:44	06:37		07:31	07:26	08:23	08:23	08:49
	21:34	20:30		19:14	17:06	16:20	16:22	16:22
31	05:46	06:39			07:28		08:24	08:49
	21:32	20:27			17:04		16:23	16:23
Potential sun hours	510	458	382	329	261	236		
Total, worst case		310	278					
Sun reduction		0,41	0,34					
Oper. time red.		0,96	0,96					
Wind dir. red.		0,66	0,63					
Total reduction		0,26	0,20					
Total, real		80	57					

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 12 - Polen 4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49	08:19	07:23	07:09	08:00 (WT03)	05:12
	16:24	17:15	18:09	20:07	06:01	05:44 (WT01)
2	08:49	08:18	07:21	07:06	8 08:08 (WT03)	21:50
	16:25	17:16	18:11	20:09	05:59	23 06:07 (WT01)
3	08:49	08:16	07:18	07:04	06:45 (WT02)	05:11
	16:26	17:18	18:13	20:10	05:57	05:45 (WT01)
4	08:48	08:14	07:16	07:02	21:03	23 06:08 (WT01)
	16:27	17:20	18:15	20:12	15 07:00 (WT02)	05:10
5	08:48	08:13	07:14	06:59	06:46 (WT02)	23 06:08 (WT01)
	16:29	17:22	18:17	20:14	12 06:58 (WT02)	05:10
6	08:48	08:11	07:11	06:57	05:55	23 06:08 (WT01)
	16:30	17:24	18:19	20:16	06:49 (WT02)	05:10
7	08:47	08:09	07:09	06:54	21:06	22 06:07 (WT01)
	16:31	17:26	18:21	20:18	6 06:55 (WT02)	05:09
8	08:47	08:07	07:07	06:52	05:53	22 06:08 (WT01)
	16:33	17:28	18:23	20:20	21:08	22 06:08 (WT01)
9	08:46	08:05	07:04	06:50	05:51	22 06:08 (WT01)
	16:34	17:30	18:24	20:21	21:10	22 06:08 (WT01)
10	08:46	08:03	07:02	06:47	05:49	21 06:07 (WT01)
	16:36	17:32	18:26	20:23	21:12	21 06:08 (WT01)
11	08:45	08:01	07:00	06:45	05:47	20 06:07 (WT01)
	16:37	17:34	18:28	20:25	21:14	21 06:08 (WT01)
12	08:44	07:59	06:57	06:43	05:45	20 06:08 (WT01)
	16:39	17:36	18:30	20:27	21:15	21 06:08 (WT01)
13	08:43	07:57	06:55	06:40	05:43	19 06:08 (WT01)
	16:40	17:38	18:32	20:29	21:17	19 06:08 (WT01)
14	08:43	07:55	06:52	06:38	05:41	19 06:08 (WT01)
	16:42	17:40	18:34	20:30	21:19	19 06:08 (WT01)
15	08:42	07:53	06:50	06:36	05:40	19 06:08 (WT01)
	16:43	17:42	18:36	20:32	21:20	19 06:08 (WT01)
16	08:41	07:51	06:48	06:33	21:22	19 06:08 (WT01)
	16:45	17:44	18:38	20:34	05:38	19 06:08 (WT01)
17	08:40	07:49	06:45	07:09 (WT03)	06:57 (WT02)	18 06:08 (WT01)
	16:47	17:46	18:39	5 07:14 (WT03)	05:33	18 06:08 (WT01)
18	08:39	07:47	06:43	07:06 (WT03)	21:27	18 06:08 (WT01)
	16:48	17:48	18:41	10 07:16 (WT03)	05:31	18 06:08 (WT01)
19	08:38	07:45	06:40	07:04 (WT03)	05:29	18 06:08 (WT01)
	16:50	17:50	18:43	06:27	05:30	18 06:08 (WT01)
20	08:36	07:43	06:38	07:01 (WT03)	05:30	18 06:08 (WT01)
	16:52	17:52	18:45	06:24	05:58 (WT01)	18 06:08 (WT01)
21	08:35	07:41	06:35	07:18 (WT03)	05:30	18 06:08 (WT01)
	16:54	17:54	18:47	17 07:18 (WT03)	05:30	18 06:08 (WT01)
22	08:34	07:39	06:33	06:59 (WT03)	05:28	18 06:08 (WT01)
	16:56	17:56	18:49	20:43	05:28	18 06:08 (WT01)
23	08:33	07:36	06:31	07:20 (WT03)	05:27	18 06:08 (WT01)
	16:57	17:58	18:50	20:45	05:27	18 06:08 (WT01)
24	08:31	07:34	06:28	06:55 (WT03)	05:25	18 06:08 (WT01)
	16:59	18:00	18:52	06:15	05:25	18 06:08 (WT01)
25	08:30	07:32	06:26	07:19 (WT03)	05:24	18 06:08 (WT01)
	17:01	18:02	18:54	20:49	05:24	18 06:08 (WT01)
26	08:29	07:30	06:23	06:54 (WT03)	05:24	18 06:08 (WT01)
	17:03	18:04	18:56	06:13	05:24	18 06:08 (WT01)
27	08:27	07:27	06:21	07:19 (WT03)	05:22	18 06:08 (WT01)
	17:05	18:05	18:58	20:52	05:22	18 06:08 (WT01)
28	08:26	07:25	06:19	06:55 (WT03)	05:22	18 06:08 (WT01)
	17:07	18:07	19:00	06:15	05:21	18 06:08 (WT01)
29	08:24	07:24	06:16	07:20 (WT03)	05:21	18 06:08 (WT01)
	17:09	18:09	19:02	20:49	05:21	18 06:08 (WT01)
30	08:23	07:23	06:14	06:54 (WT03)	05:20	18 06:08 (WT01)
	17:11	18:11	19:04	06:13	05:20	18 06:08 (WT01)
31	08:21	07:21	06:11	07:19 (WT03)	05:20	18 06:08 (WT01)
	17:13	18:13	19:06	20:59	05:20	18 06:08 (WT01)
Potential sun hours	252	274	367	419	492	508
Total, worst case			288	289	263	588
Sun reduction			0,30	0,37	0,41	0,36
Oper. time red.			0,96	0,96	0,96	0,96
Wind dir. red.			0,62	0,66	0,69	0,70
Total reduction			0,18	0,23	0,27	0,24
Total, real			51	68	72	141

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

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



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 12 - Polen 4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December			
1	05:08	05:52 (WT01)	05:47	06:41	07:33	07:30	08:24		
	22:05	20 06:12 (WT01)	21:30	20:25	19:12	17:02	16:19		
2	05:09	05:53 (WT01)	05:49	06:42	07:35	07:32	08:26		
	22:04	20 06:13 (WT01)	21:29	20:22	19:10	17:00	16:18		
3	05:10	05:52 (WT01)	05:51	06:44	07:37	07:34	08:27		
	22:04	20 06:12 (WT01)	21:27	20:20	19:07	16:59	16:18		
4	05:11	05:52 (WT01)	05:52	06:46	07:38	07:36	08:29		
	22:04	21 06:13 (WT01)	21:25	20:18	19:05	16:57	16:17		
5	05:11	05:52 (WT01)	05:54	06:48	07:40	07:38	08:30		
	22:03	21 06:13 (WT01)	21:23	20:15	19:02	16:55	16:16		
6	05:12	05:52 (WT01)	05:56	06:49	07:42	07:40	08:31		
	22:02	22 06:14 (WT01)	21:21	20:13	19:00	16:53	16:16		
7	05:13	05:53 (WT01)	05:57	06:51	07:44	07:42	08:33		
	22:02	21 06:14 (WT01)	21:19	20:10	18:58	16:51	16:15		
8	05:14	05:53 (WT01)	05:59	06:53	07:46	07:44	08:34		
	22:01	22 06:15 (WT01)	21:17	20:08	18:55	16:49	16:15		
9	05:15	05:53 (WT01)	06:01	06:57 (WT02)	07:47	07:46	08:35		
	22:00	22 06:15 (WT01)	21:15	9 20:06	18:53	16:48	16:15		
10	05:16	05:53 (WT01)	06:03	06:55 (WT02)	07:49	07:47	08:37		
	22:00	22 06:15 (WT01)	21:13	13 20:03	18:51	16:46	16:14		
11	05:18	05:53 (WT01)	06:04	06:53 (WT02)	07:51	07:49	08:38		
	21:59	22 06:15 (WT01)	21:11	16 20:01	7 08:00 (WT03)	18:48	16:44	16:14	
12	05:19	05:53 (WT01)	06:06	06:52 (WT02)	07:00	07:49 (WT03)	07:53	07:51	08:39
	21:58	23 06:16 (WT01)	21:09	19 07:11 (WT02)	19:58	14 08:03 (WT03)	18:46	16:43	16:14
13	05:20	05:53 (WT01)	06:08	06:51 (WT02)	07:02	07:48 (WT03)	07:55	07:53	08:40
	21:57	23 06:16 (WT01)	21:07	21 07:12 (WT02)	19:56	17 08:05 (WT03)	18:44	16:41	16:14
14	05:21	05:53 (WT01)	06:09	06:50 (WT02)	07:03	07:46 (WT03)	07:56	07:55	08:41
	21:56	23 06:16 (WT01)	21:05	22 07:12 (WT02)	19:54	20 08:06 (WT03)	18:41	16:39	16:14
15	05:22	05:54 (WT01)	06:11	06:49 (WT02)	07:05	07:44 (WT03)	07:58	07:57	08:42
	21:55	22 06:16 (WT01)	21:03	24 07:13 (WT02)	19:51	22 08:06 (WT03)	18:39	16:38	16:14
16	05:24	05:55 (WT01)	06:13	06:48 (WT02)	07:07	07:43 (WT03)	08:00	07:59	08:43
	21:54	20 06:15 (WT01)	21:01	24 07:12 (WT02)	19:49	24 08:07 (WT03)	18:37	16:36	16:14
17	05:25	05:57 (WT01)	06:15	06:48 (WT02)	07:08	07:43 (WT03)	08:02	08:00	08:43
	21:53	19 06:16 (WT01)	20:59	25 07:13 (WT02)	19:46	24 08:07 (WT03)	18:34	16:35	16:14
18	05:26	05:58 (WT01)	06:16	06:48 (WT02)	07:10	07:42 (WT03)	08:04	08:02	08:44
	21:51	18 06:16 (WT01)	20:57	25 07:13 (WT02)	19:44	25 08:07 (WT03)	18:32	16:33	16:14
19	05:28	05:59 (WT01)	06:18	06:47 (WT02)	07:12	07:41 (WT03)	08:06	08:04	08:45
	21:50	16 06:15 (WT01)	20:54	25 07:12 (WT02)	19:41	26 08:07 (WT03)	18:30	16:32	16:15
20	05:29	06:00 (WT01)	06:20	06:48 (WT02)	07:14	07:41 (WT03)	08:08	08:06	08:46
	21:49	15 06:15 (WT01)	20:52	24 07:12 (WT02)	19:39	25 08:06 (WT03)	18:28	16:31	16:15
21	05:30	06:02 (WT01)	06:22	06:50 (WT02)	07:15	07:41 (WT03)	08:09	08:08	08:46
	21:48	13 06:15 (WT01)	20:50	22 07:12 (WT02)	19:36	24 08:05 (WT03)	18:25	16:29	16:15
22	05:32	06:03 (WT01)	06:23	06:51 (WT02)	07:17	07:43 (WT03)	08:11	08:09	08:47
	21:46	11 06:14 (WT01)	20:48	19 07:10 (WT02)	19:34	21 08:04 (WT03)	18:23	16:28	16:16
23	05:33	06:04 (WT01)	06:25	06:53 (WT02)	07:19	07:45 (WT03)	08:13	08:11	08:47
	21:45	9 06:13 (WT01)	20:46	17 07:10 (WT02)	19:31	18 08:03 (WT03)	18:21	16:27	16:16
24	05:35	06:06 (WT01)	06:27	06:55 (WT02)	07:21	07:47 (WT03)	08:15	08:13	08:48
	21:43	7 06:13 (WT01)	20:43	14 07:09 (WT02)	19:29	15 08:02 (WT03)	18:19	16:26	16:17
25	05:36	06:07 (WT01)	06:28	06:56 (WT02)	07:22	07:48 (WT03)	07:17	08:15	08:48
	21:42	4 06:11 (WT01)	20:41	11 07:07 (WT02)	19:27	12 08:00 (WT03)	17:17	16:25	16:18
26	05:38	06:09 (WT01)	06:30	06:58 (WT02)	07:24	07:50 (WT03)	07:19	08:16	08:48
	21:40	1 06:10 (WT01)	20:39	7 07:05 (WT02)	19:24	7 07:57 (WT03)	17:15	16:24	16:18
27	05:39	06:32	06:59 (WT02)	07:26	07:21	08:18	08:49		
	21:39	20:36	1 07:00 (WT02)	19:22	17:13	16:23	16:19		
28	05:41	06:34	07:28	07:28	07:23	08:20	08:49		
	21:37	20:34	19:19	19:19	17:11	16:22	16:20		
29	05:43	06:35	07:29	07:29	07:25	08:21	08:49		
	21:35	20:32	19:17	19:17	17:08	16:21	16:21		
30	05:44	06:37	07:31	07:31	07:26	08:23	08:49		
	21:34	20:30	19:14	19:14	17:06	16:20	16:22		
31	05:46	06:39	07:28	07:28	07:28	08:23	08:49		
	21:32	20:27	17:04	17:04	17:04	16:23	16:23		
Potential sun hours	510	458	382	329	261	236			
Total, worst case	457	338	301						
Sun reduction	0,37	0,41	0,34						
Oper. time red.	0,96	0,96	0,96						
Wind dir. red.	0,70	0,66	0,62						
Total reduction	0,25	0,26	0,20						
Total, real	113	88	61						

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

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



## SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 13 - Polen 5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	06:01 21:01	05:12 21:50
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	05:59 21:03	05:11 21:51
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	05:57 21:05	05:10 21:53
4	08:48 16:27	08:14 17:20	07:16 18:15	07:02 20:12	07:25 (WT02) 21:07	05:55 21:54
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	07:23 (WT02) 21:08	05:53 21:55
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	07:20 (WT02) 21:10	05:51 21:56
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	07:18 (WT02) 21:12	05:49 21:57
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	07:32 (WT02) 21:14	05:47 21:58
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	07:33 (WT02) 21:15	05:45 21:59
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	07:32 (WT02) 21:17	05:43 21:59
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	07:11 (WT02) 21:19	05:41 22:00
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	07:33 (WT02) 21:20	05:40 22:01
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	07:09 (WT02) 21:22	05:38 22:02
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	07:10 (WT02) 21:24	05:36 22:02
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	07:11 (WT02) 21:25	05:35 22:03
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	07:29 (WT02) 21:27	05:33 22:03
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	07:11 (WT02) 21:29	05:31 22:04
18	08:39 16:48	07:47 17:48	06:43 18:41	06:29 20:38	07:25 (WT02) 21:30	05:30 22:04
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:40	07:16 (WT02) 21:32	05:28 22:05
20	08:37 16:52	07:43 17:52	06:38 18:45	06:24 20:41	07:18 (WT03) 21:33	05:27 22:05
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	07:31 (WT03) 21:35	05:25 22:05
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	07:22 (WT02) 21:37	05:24 22:06
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	07:16 (WT03) 21:38	05:22 22:06
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	07:37 (WT03) 21:39	05:21 22:06
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	07:16 (WT03) 21:41	05:20 22:06
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	07:34 (WT03) 21:42	05:19 22:06
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	07:19 (WT03) 21:44	05:17 22:06
28	08:26 17:07	07:25 18:07	06:19 19:00	06:07 20:56	07:31 (WT03) 21:45	05:16 22:06
29	08:24 17:09	07:16 20:01	06:16 20:01	06:05 20:58	07:28 (WT03) 21:46	05:15 22:05
30	08:23 17:11	07:14 20:03	06:14 20:03	06:03 20:59	07:16 (WT03) 21:48	05:14 22:05
31	08:21 17:13	07:11 20:05	06:11 20:05	06:01 20:59	07:13 (WT03) 21:49	05:13 21:49
Potential sun hours	252	274	367	419	492	508
Total, worst case			216			232
Sun reduction			0,30			0,37
Oper. time red.			0,96			0,96
Wind dir. red.			0,60			0,65
Total reduction			0,17			0,23
Total, real			37			54

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 13 - Polen 5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December	
1	05:08 22:05	05:47 21:30	06:41 20:25	07:09 (WT02) 19:12	07:33 19	07:59 (WT03) 17:02	08:24 16:19
2	05:09 22:04	05:49 21:29	06:42 20:22	07:09 (WT02) 19:10	07:35 16	08:01 (WT03) 17:00	08:26 16:18
3	05:10 22:04	05:51 21:27	06:44 20:20	07:11 (WT02) 19:07	07:37 13	08:03 (WT03) 16:59	08:27 16:18
4	05:11 22:04	05:52 21:25	06:46 20:18	07:13 (WT02) 19:05	07:38 10	08:05 (WT03) 16:57	08:29 16:17
5	05:11 22:03	05:54 21:23	06:48 20:15	07:14 (WT02) 19:02	07:40 6	08:06 (WT03) 16:55	08:30 16:16
6	05:12 22:02	05:56 21:21	06:49 20:13	07:16 (WT02) 19:00	07:42 1	08:08 (WT03) 16:53	08:32 16:16
7	05:13 22:02	05:57 21:19	06:51 20:11	07:18 (WT02) 18:58	07:44 8	07:42 16:51	08:33 16:15
8	05:14 22:01	05:59 21:17	06:53 20:08	07:19 (WT02) 18:55	07:46 4	07:44 16:49	08:34 16:15
9	05:15 22:00	06:01 21:15	06:55 20:06	07:23 (WT02) 18:53	07:47 18:53	07:46 16:48	08:35 16:15
10	05:16 22:00	06:03 21:13	06:56 20:03	07:24 (WT02) 18:51	07:49 18:51	07:47 16:46	08:37 16:14
11	05:18 21:59	06:04 21:11	06:58 20:01	07:25 (WT02) 18:48	07:51 18:48	07:49 16:44	08:38 16:14
12	05:19 21:58	06:06 21:09	07:00 19:58	07:26 (WT02) 18:46	07:53 18:46	07:51 16:43	08:39 16:14
13	05:20 21:57	06:08 21:07	07:02 19:56	07:27 (WT02) 18:44	07:55 18:44	07:53 16:41	08:40 16:14
14	05:21 21:56	06:09 21:05	07:03 19:54	07:28 (WT02) 18:41	07:56 18:41	07:55 16:39	08:41 16:14
15	05:22 21:55	06:11 21:03	07:05 19:51	07:29 (WT02) 18:39	07:58 18:39	07:57 16:38	08:42 16:14
16	05:24 21:54	06:13 21:01	07:07 19:49	07:30 (WT02) 18:37	08:00 18:37	07:59 16:36	08:43 16:14
17	05:25 21:53	06:15 20:59	07:08 19:46	07:31 (WT02) 18:34	08:02 18:34	08:00 16:35	08:43 16:14
18	05:26 21:51	06:16 20:57	07:10 19:44	07:32 (WT02) 18:32	08:04 18:32	08:02 16:33	08:44 16:14
19	05:28 21:50	06:18 20:54	07:12 19:41	07:33 (WT02) 18:30	08:06 18:30	08:04 16:32	08:45 16:15
20	05:29 21:49	06:20 20:52	07:14 19:39	07:34 (WT02) 18:28	08:08 18:28	08:06 16:31	08:46 16:15
21	05:30 21:48	06:22 20:50	07:15 19:36	07:35 (WT02) 18:25	08:09 18:25	08:08 16:29	08:46 16:15
22	05:32 21:46	06:23 20:48	07:17 19:34	07:36 (WT02) 18:23	08:11 18:23	08:09 16:28	08:47 16:16
23	05:33 21:45	06:25 20:46	07:19 19:32	07:37 (WT02) 18:21	08:13 18:21	08:11 16:27	08:47 16:16
24	05:35 21:43	06:27 20:43	07:21 19:29	07:38 (WT02) 18:19	08:15 18:19	08:13 16:26	08:48 16:17
25	05:36 21:42	06:28 20:41	07:22 19:27	07:39 (WT02) 18:17	08:17 18:17	08:15 16:25	08:48 16:18
26	05:38 21:40	06:30 20:39	07:16 (WT02) 19:24	07:24 20	07:58 (WT03) 17:15	07:19 17:15	08:48 16:18
27	05:39 21:39	06:32 20:36	07:13 (WT02) 19:22	07:26 21	07:58 (WT03) 17:13	07:21 17:13	08:49 16:19
28	05:41 21:37	06:34 20:34	07:12 (WT02) 19:19	07:28 22	07:57 (WT03) 17:11	07:23 17:11	08:49 16:20
29	05:43 21:35	06:35 20:32	07:11 (WT02) 19:17	07:29 22	07:57 (WT03) 17:08	07:25 17:08	08:49 16:21
30	05:44 21:34	06:37 20:30	07:10 (WT02) 19:14	07:31 21	07:57 (WT03) 17:06	07:26 17:06	08:49 16:22
31	05:46 21:32	06:39 20:27	07:09 (WT02) 19:14	07:31 22	08:18 (WT03) 17:04	07:28 17:04	08:49 16:23
Potential sun hours	510	458	382	329	261	236	
Total, worst case		116	268	65			
Sun reduction		0,41	0,34	0,30			
Oper. time red.		0,96	0,96	0,96			
Wind dir. red.		0,65	0,62	0,60			
Total reduction		0,26	0,20	0,17			
Total, real		30	54	11			

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

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

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 14 - Polen 6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	
1	08:49	08:19	07:23	07:09	06:01	06:46 (WT02) 05:12	05:45 (WT01)
	16:24	17:15	18:09	20:07	21:01	17 07:03 (WT02) 21:50	23 06:08 (WT01)
2	08:49	08:18	07:21	07:06	05:59	06:47 (WT02) 05:11	05:46 (WT01)
	16:25	17:16	18:11	20:09	21:03	14 07:01 (WT02) 21:51	23 06:09 (WT01)
3	08:49	08:16	07:18	07:04	05:57	06:49 (WT02) 05:10	05:46 (WT01)
	16:26	17:18	18:13	20:10	21:05	9 06:58 (WT02) 21:53	23 06:09 (WT01)
4	08:48	08:14	07:16	07:02	05:55	05:10	05:46 (WT01)
	16:27	17:20	18:15	20:12	21:06	21:54	22 06:08 (WT01)
5	08:48	08:13	07:14	06:59	05:53	05:09	05:47 (WT01)
	16:29	17:22	18:17	20:14	21:08	21:55	22 06:09 (WT01)
6	08:48	08:11	07:11	06:57	05:51	05:08	05:47 (WT01)
	16:30	17:24	18:19	20:16	21:10	21:56	21 06:08 (WT01)
7	08:47	08:09	07:09	06:54	05:49	05:07	05:46 (WT01)
	16:31	17:26	18:21	20:18	21:12	21:57	22 06:08 (WT01)
8	08:47	08:07	07:07	06:52	05:47	05:07	05:47 (WT01)
	16:33	17:28	18:23	20:20	21:14	21:58	21 06:08 (WT01)
9	08:46	08:05	07:04	06:50	05:45	05:06	05:48 (WT01)
	16:34	17:30	18:24	20:21	21:15	21:59	21 06:09 (WT01)
10	08:46	08:03	07:02	06:47	05:43	05:06	05:48 (WT01)
	16:36	17:32	18:26	20:23	21:17	21:59	20 06:08 (WT01)
11	08:45	08:01	07:00	06:45	05:41	05:05	05:49 (WT01)
	16:37	17:34	18:28	20:25	21:19	22:00	20 06:09 (WT01)
12	08:44	07:59	06:57	06:43	05:40	05:05	05:49 (WT01)
	16:39	17:36	18:30	20:27	21:20	22:01	20 06:09 (WT01)
13	08:43	07:57	06:55	06:40	05:38	05:05	05:49 (WT01)
	16:40	17:38	18:32	20:29	21:22	22:02	19 06:08 (WT01)
14	08:43	07:55	06:52	06:38	05:36	05:04	05:49 (WT01)
	16:42	17:40	18:34	20:30	21:24	22:02	19 06:08 (WT01)
15	08:42	07:53	06:50	06:36	05:35	05:04	05:50 (WT01)
	16:43	17:42	18:36	20:32	21:25	22:03	18 06:08 (WT01)
16	08:41	07:51	06:48	07:11 (WT03) 06:33	06:57 (WT02) 05:33	05:04	05:50 (WT01)
	16:45	17:44	18:38	5 07:16 (WT03) 20:34	6 07:03 (WT02) 21:27	22:03	19 06:09 (WT01)
17	08:40	07:49	06:45	07:09 (WT03) 06:31	06:55 (WT02) 05:31	05:59 (WT01) 05:04	05:51 (WT01)
	16:47	17:46	18:39	10 07:19 (WT03) 20:36	10 07:05 (WT02) 21:29	1 06:00 (WT01) 22:04	18 06:09 (WT01)
18	08:39	07:47	06:43	07:06 (WT03) 06:29	06:53 (WT02) 05:30	05:58 (WT01) 05:04	05:51 (WT01)
	16:48	17:48	18:41	14 07:20 (WT03) 20:38	13 07:06 (WT02) 21:30	4 06:02 (WT01) 22:04	18 06:09 (WT01)
19	08:38	07:45	06:40	07:04 (WT03) 06:27	06:51 (WT02) 05:28	05:56 (WT01) 05:04	05:51 (WT01)
	16:50	17:50	18:43	18 07:22 (WT03) 20:39	16 07:07 (WT02) 21:32	7 06:03 (WT01) 22:05	18 06:09 (WT01)
20	08:36	07:43	06:38	07:01 (WT03) 06:24	06:49 (WT02) 05:27	05:55 (WT01) 05:04	05:51 (WT01)
	16:52	17:52	18:45	21 07:22 (WT03) 20:41	19 07:08 (WT02) 21:33	9 06:04 (WT01) 22:05	18 06:09 (WT01)
21	08:35	07:41	06:35	06:59 (WT03) 06:22	06:46 (WT02) 05:25	05:54 (WT01) 05:04	05:51 (WT01)
	16:54	17:54	18:47	24 07:23 (WT03) 20:43	22 07:08 (WT02) 21:35	11 06:05 (WT01) 22:05	18 06:09 (WT01)
22	08:34	07:39	06:33	06:57 (WT03) 06:20	06:44 (WT02) 05:24	05:52 (WT01) 05:04	05:52 (WT01)
	16:56	17:56	18:49	25 07:22 (WT03) 20:45	24 07:08 (WT02) 21:37	13 06:05 (WT01) 22:06	18 06:10 (WT01)
23	08:33	07:36	06:31	06:57 (WT03) 06:18	06:43 (WT02) 05:22	05:51 (WT01) 05:04	05:52 (WT01)
	16:57	17:58	18:50	25 07:22 (WT03) 20:47	25 07:08 (WT02) 21:38	15 06:06 (WT01) 22:06	18 06:10 (WT01)
24	08:31	07:34	06:28	06:57 (WT03) 06:15	06:43 (WT02) 05:21	05:50 (WT01) 05:05	05:52 (WT01)
	16:59	18:00	18:52	26 07:23 (WT03) 20:49	25 07:08 (WT02) 21:39	16 06:06 (WT01) 22:06	18 06:10 (WT01)
25	08:30	07:32	06:26	06:56 (WT03) 06:13	06:43 (WT02) 05:20	05:49 (WT01) 05:05	05:53 (WT01)
	17:01	18:02	18:54	25 07:21 (WT03) 20:50	25 07:08 (WT02) 21:41	18 06:07 (WT01) 22:06	18 06:11 (WT01)
26	08:29	07:30	06:23	06:57 (WT03) 06:11	06:43 (WT02) 05:19	05:48 (WT01) 05:06	05:52 (WT01)
	17:03	18:04	18:56	24 07:21 (WT03) 20:52	25 07:08 (WT02) 21:42	19 06:07 (WT01) 22:06	19 06:11 (WT01)
27	08:27	07:27	06:21	06:57 (WT03) 06:09	06:43 (WT02) 05:17	05:47 (WT01) 05:06	05:53 (WT01)
	17:05	18:05	18:58	22 07:19 (WT03) 20:54	24 07:07 (WT02) 21:44	21 06:08 (WT01) 22:06	19 06:12 (WT01)
28	08:26	07:25	06:19	06:58 (WT03) 06:07	06:44 (WT02) 05:16	05:46 (WT01) 05:06	05:53 (WT01)
	17:07	18:07	19:00	21 07:19 (WT03) 20:56	22 07:06 (WT02) 21:45	22 06:08 (WT01) 22:06	18 06:11 (WT01)
29	08:24	07:16	06:15	07:58 (WT03) 06:05	06:44 (WT02) 05:15	05:45 (WT01) 05:07	05:53 (WT01)
	17:09	18:01	18:54	18 08:16 (WT03) 20:58	21 07:05 (WT02) 21:46	23 06:08 (WT01) 22:05	19 06:12 (WT01)
30	08:23	07:14	06:10	08:00 (WT03) 06:03	06:45 (WT02) 05:14	05:45 (WT01) 05:08	05:52 (WT01)
	17:11	18:03	18:56	14 08:14 (WT03) 20:59	19 07:04 (WT02) 21:48	23 06:08 (WT01) 22:05	20 06:12 (WT01)
31	08:21	07:11	06:08	08:02 (WT03)	05:13	05:45 (WT01)	
	17:13	18:05	19:00	10 08:12 (WT03)	21:49	23 06:08 (WT01)	
Potential sun hours	252	274	367	419	492	508	
Total, worst case			302	296	265	590	
Sun reduction			0,30	0,37	0,41	0,36	
Oper. time red.			0,96	0,96	0,96	0,96	
Wind dir. red.			0,62	0,66	0,69	0,70	
Total reduction			0,18	0,23	0,27	0,24	
Total, real			53	69	72	141	

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 14 - Polen 6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December			
1	05:08	05:53 (WT01)	05:47	06:41	07:33	07:30	08:24		
	22:05	20 06:13 (WT01)	21:30	20:25	19:12	17:02	16:19		
2	05:09	05:53 (WT01)	05:49	06:42	07:35	07:32	08:26		
	22:04	20 06:13 (WT01)	21:29	20:22	19:10	17:00	16:18		
3	05:10	05:52 (WT01)	05:51	06:44	07:37	07:34	08:27		
	22:04	21 06:13 (WT01)	21:27	20:20	19:07	16:59	16:18		
4	05:11	05:53 (WT01)	05:52	06:46	07:38	07:36	08:29		
	22:04	21 06:14 (WT01)	21:25	20:18	19:05	16:57	16:17		
5	05:11	05:53 (WT01)	05:54	06:48	07:40	07:38	08:30		
	22:03	21 06:14 (WT01)	21:23	20:15	19:02	16:55	16:16		
6	05:12	05:53 (WT01)	05:56	06:49	07:42	07:40	08:31		
	22:02	22 06:15 (WT01)	21:21	20:13	19:00	16:53	16:16		
7	05:13	05:53 (WT01)	05:57	06:51	07:44	07:42	08:33		
	22:02	22 06:15 (WT01)	21:19	20:10	18:58	16:51	16:15		
8	05:14	05:53 (WT01)	05:59	06:53	07:46	07:44	08:34		
	22:01	22 06:15 (WT01)	21:17	20:08	18:55	16:49	16:15		
9	05:15	05:53 (WT01)	06:01	07:00 (WT02)	07:47	07:46	08:35		
	22:00	23 06:16 (WT01)	21:15	5 07:05 (WT02)	20:06	18:53	16:48	16:15	
10	05:16	05:53 (WT01)	06:03	06:56	07:49	07:47	08:37		
	22:00	23 06:16 (WT01)	21:13	11 07:09 (WT02)	20:03	18:51	16:46	16:14	
11	05:18	05:53 (WT01)	06:04	06:58	07:51	07:49	08:38		
	21:59	23 06:16 (WT01)	21:11	15 07:10 (WT02)	20:01	18:48	16:44	16:14	
12	05:19	05:53 (WT01)	06:06	06:54 (WT02)	07:00	07:54 (WT03)	07:53	07:51	08:39
	21:58	23 06:16 (WT01)	21:09	18 07:12 (WT02)	19:58	8 08:02 (WT03)	18:46	16:43	16:14
13	05:20	05:53 (WT01)	06:08	06:53 (WT02)	07:02	07:51 (WT03)	07:55	07:53	08:40
	21:57	23 06:16 (WT01)	21:07	20 07:13 (WT02)	19:56	14 08:05 (WT03)	18:44	16:41	16:14
14	05:21	05:53 (WT01)	06:09	06:52 (WT02)	07:03	07:50 (WT03)	07:56	07:55	08:41
	21:56	23 06:16 (WT01)	21:05	21 07:13 (WT02)	19:54	17 08:07 (WT03)	18:41	16:39	16:14
15	05:22	05:54 (WT01)	06:11	06:51 (WT02)	07:05	07:47 (WT03)	07:58	07:57	08:42
	21:55	22 06:16 (WT01)	21:03	23 07:14 (WT02)	19:51	21 08:08 (WT03)	18:39	16:38	16:14
16	05:24	05:55 (WT01)	06:13	06:50 (WT02)	07:07	07:46 (WT03)	08:00	07:59	08:43
	21:54	21 06:16 (WT01)	21:01	24 07:14 (WT02)	19:49	23 08:09 (WT03)	18:37	16:36	16:14
17	05:25	05:57 (WT01)	06:15	06:50 (WT02)	07:08	07:45 (WT03)	08:02	08:00	08:43
	21:53	20 06:17 (WT01)	20:59	24 07:14 (WT02)	19:46	24 08:09 (WT03)	18:34	16:35	16:14
18	05:26	05:58 (WT01)	06:16	06:50 (WT02)	07:10	07:44 (WT03)	08:04	08:02	08:44
	21:51	19 06:17 (WT01)	20:57	25 07:15 (WT02)	19:44	25 08:09 (WT03)	18:32	16:33	16:14
19	05:28	05:59 (WT01)	06:18	06:49 (WT02)	07:12	07:44 (WT03)	08:06	08:04	08:45
	21:50	17 06:16 (WT01)	20:54	25 07:14 (WT02)	19:41	25 08:09 (WT03)	18:30	16:32	16:15
20	05:29	06:00 (WT01)	06:20	06:49 (WT02)	07:14	07:43 (WT03)	08:08	08:06	08:46
	21:49	16 06:16 (WT01)	20:52	25 07:14 (WT02)	19:39	26 08:09 (WT03)	18:28	16:31	16:15
21	05:30	06:02 (WT01)	06:22	06:50 (WT02)	07:15	07:42 (WT03)	08:09	08:08	08:46
	21:48	14 06:16 (WT01)	20:50	24 07:14 (WT02)	19:36	26 08:08 (WT03)	18:25	16:29	16:15
22	05:32	06:03 (WT01)	06:23	06:51 (WT02)	07:17	07:43 (WT03)	08:11	08:09	08:47
	21:46	12 06:15 (WT01)	20:48	21 07:12 (WT02)	19:34	24 08:07 (WT03)	18:23	16:28	16:16
23	05:33	06:04 (WT01)	06:25	06:53 (WT02)	07:19	07:45 (WT03)	08:13	08:11	08:47
	21:45	10 06:14 (WT01)	20:46	19 07:12 (WT02)	19:31	22 08:07 (WT03)	18:21	16:27	16:16
24	05:35	06:06 (WT01)	06:27	06:55 (WT02)	07:21	07:47 (WT03)	08:15	08:13	08:48
	21:43	8 06:14 (WT01)	20:43	16 07:11 (WT02)	19:29	19 08:06 (WT03)	18:19	16:26	16:17
25	05:36	06:07 (WT01)	06:28	06:56 (WT02)	07:22	07:48 (WT03)	07:17	08:15	08:48
	21:42	6 06:13 (WT01)	20:41	13 07:09 (WT02)	19:27	15 08:03 (WT03)	17:17	16:25	16:18
26	05:38	06:09 (WT01)	06:30	06:58 (WT02)	07:24	07:50 (WT03)	07:19	08:16	08:48
	21:40	3 06:12 (WT01)	20:39	10 07:08 (WT02)	19:24	12 08:02 (WT03)	17:15	16:24	16:18
27	05:39	06:32	06:32	06:59 (WT02)	07:26	07:52 (WT03)	07:21	08:18	08:49
	21:39	06:34	5 07:04 (WT02)	19:22	7 07:59 (WT03)	17:13	16:23	16:19	
28	05:41	06:34	06:34	07:28	07:28	07:23	08:20	08:49	
	21:37	20:34	19:19	19:19	17:11	16:22	16:20		
29	05:43	06:35	06:35	07:29	07:29	07:25	08:21	08:49	
	21:35	20:32	19:17	19:17	17:08	16:21	16:21		
30	05:44	06:37	07:31	07:31	07:26	08:23	08:49		
	21:34	20:30	19:14	19:14	17:06	16:20	16:22		
31	05:46	06:39	07:28	07:28	07:28	07:28	08:49		
	21:32	20:27	17:04	17:04	17:04	16:23	16:23		
Potential sun hours	510	458	382	329	261	236			
Total, worst case	475	344	308						
Sun reduction	0,37	0,41	0,34						
Oper. time red.	0,96	0,96	0,96						
Wind dir. red.	0,70	0,66	0,62						
Total reduction	0,25	0,26	0,20						
Total, real	118	89	62						

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 15 - Polen 7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	07:32 (WT02) 06:01	05:12 21:50
2	08:49 16:25	08:18 17:16	07:21 18:11	07:45 (WT03) 20:09	07:30 (WT02) 05:59	05:11 21:51
3	08:49 16:26	08:16 17:18	07:18 18:13	07:43 (WT03) 20:10	07:28 (WT02) 05:57	05:10 21:53
4	08:48 16:27	08:14 17:20	07:16 18:15	07:40 (WT03) 20:12	07:28 (WT02) 05:55	05:10 21:54
5	08:48 16:29	08:13 17:22	07:14 18:17	07:38 (WT03) 20:14	07:28 (WT02) 05:53	05:09 21:55
6	08:48 16:30	08:11 17:24	07:11 18:19	07:35 (WT03) 20:16	07:28 (WT02) 05:51	05:08 21:56
7	08:47 16:31	08:09 17:26	07:09 18:21	07:33 (WT03) 20:18	07:29 (WT02) 05:49	05:07 21:57
8	08:47 16:33	08:07 17:28	07:07 18:23	07:31 (WT03) 20:20	07:31 (WT02) 05:47	05:07 21:58
9	08:46 16:34	08:05 17:30	07:04 18:25	07:30 (WT03) 20:21	07:32 (WT02) 05:45	05:06 21:59
10	08:46 16:36	08:03 17:32	07:02 18:26	07:30 (WT03) 20:23	07:40 (WT02) 05:43	05:06 21:59
11	08:45 16:37	08:01 17:34	07:00 18:28	07:30 (WT03) 20:25	05:41 21:19	05:05 22:00
12	08:44 16:39	07:59 17:36	06:57 18:30	07:31 (WT03) 20:27	05:40 21:20	05:05 22:01
13	08:43 16:40	07:57 17:38	06:55 18:32	07:32 (WT03) 20:29	05:38 21:22	05:05 22:02
14	08:43 16:42	07:55 17:40	06:52 18:34	07:34 (WT03) 20:30	05:36 21:24	05:04 22:02
15	08:42 16:43	07:53 17:42	06:50 18:36	07:43 (WT03) 20:32	06:36 21:25	05:04 22:03
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04
18	08:39 16:48	07:47 17:48	06:43 18:41	06:29 20:38	05:30 21:30	05:04 22:04
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:40	05:28 21:32	05:04 22:05
20	08:37 16:52	07:43 17:52	06:38 18:45	06:24 20:41	05:27 21:33	05:04 22:05
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	05:25 21:35	05:04 22:05
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	05:24 21:37	05:04 22:06
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	05:22 21:38	05:04 22:06
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	05:21 21:39	05:05 22:06
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	05:20 21:41	05:05 22:06
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	05:19 21:42	05:06 22:06
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	05:17 21:44	05:06 22:06
28	08:26 17:07	07:25 18:07	06:19 19:00	06:07 20:56	05:16 21:45	05:06 22:06
29	08:24 17:09	07:16 20:01	06:16 19:09	06:05 20:58	05:15 21:46	05:07 22:05
30	08:23 17:11	07:14 20:03	06:14 19:12	06:03 20:59	05:14 21:48	05:08 22:05
31	08:21 17:13	07:11 20:05	06:11 19:15	06:01 21:00	05:13 21:49	05:08 22:05
Potential sun hours	252	274	367	419	492	508
Total, worst case			222	157		
Sun reduction			0,30	0,37		
Oper. time red.			0,96	0,96		
Wind dir. red.			0,60	0,64		
Total reduction			0,17	0,23		
Total, real			38	36		

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 15 - Polen 7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December				
1	05:08	05:47	06:41	07:33	08:11 (WT03)	07:30	08:24			
	22:05	21:30	20:25	19:12	15	08:26 (WT03)	17:02	16:19		
2	05:09	05:49	06:42	07:35	08:09 (WT03)	07:32	08:26			
	22:04	21:29	20:22	19:10	18	08:27 (WT03)	17:00	16:18		
3	05:10	05:51	06:44	07:30 (WT02)	07:37	08:08 (WT03)	07:34	08:27		
	22:04	21:27	20:20	8	07:38 (WT02)	19:07	08:28 (WT03)	16:59	16:18	
4	05:11	05:52	06:46	07:28 (WT02)	07:38	08:08 (WT03)	07:36	08:29		
	22:04	21:25	20:18	13	07:41 (WT02)	19:05	20	08:28 (WT03)	16:57	16:17
5	05:11	05:54	06:48	07:26 (WT02)	07:40	08:06 (WT03)	07:38	08:30		
	22:03	21:23	20:15	16	07:42 (WT02)	19:02	21	08:27 (WT03)	16:55	16:16
6	05:12	05:56	06:49	07:24 (WT02)	07:42	08:08 (WT03)	07:40	08:32		
	22:02	21:21	20:13	19	07:43 (WT02)	19:00	19	08:27 (WT03)	16:53	16:16
7	05:13	05:57	06:51	07:24 (WT02)	07:44	08:10 (WT03)	07:42	08:33		
	22:02	21:19	20:11	20	07:44 (WT02)	18:58	17	08:27 (WT03)	16:51	16:15
8	05:14	05:59	06:53	07:22 (WT02)	07:46	08:12 (WT03)	07:44	08:34		
	22:01	21:17	20:08	21	07:43 (WT02)	18:55	14	08:26 (WT03)	16:49	16:15
9	05:15	06:01	06:55	07:22 (WT02)	07:47	08:14 (WT03)	07:46	08:35		
	22:00	21:15	20:06	21	07:43 (WT02)	18:53	11	08:25 (WT03)	16:48	16:15
10	05:16	06:03	06:56	07:23 (WT02)	07:49	08:16 (WT03)	07:47	08:37		
	22:00	21:13	20:03	20	07:43 (WT02)	18:51	8	08:24 (WT03)	16:46	16:14
11	05:18	06:04	06:58	07:24 (WT02)	07:51	08:18 (WT03)	07:49	08:38		
	21:59	21:11	20:01	18	07:42 (WT02)	18:48	4	08:22 (WT03)	16:44	16:14
12	05:19	06:06	07:00	07:26 (WT02)	07:53	07:51	08:39			
	21:58	21:09	19:58	15	07:41 (WT02)	18:46	16:43	16:14		
13	05:20	06:08	07:02	07:28 (WT02)	07:55	07:53	08:40			
	21:57	21:07	19:56	13	07:41 (WT02)	18:44	16:41	16:14		
14	05:21	06:09	07:03	07:30 (WT02)	07:56	07:55	08:41			
	21:56	21:05	19:54	9	07:39 (WT02)	18:41	16:39	16:14		
15	05:22	06:11	07:05	07:31 (WT02)	07:58	07:57	08:42			
	21:55	21:03	19:51	6	07:37 (WT02)	18:39	16:38	16:14		
16	05:24	06:13	07:07	07:33 (WT02)	08:00	07:59	08:43			
	21:54	21:01	19:49	1	07:34 (WT02)	18:37	16:36	16:14		
17	05:25	06:15	07:08	08:02	08:00	08:00	08:43			
	21:53	20:59	19:46	18:34	16:35	16:14				
18	05:26	06:16	07:10	08:04	08:02	08:02	08:44			
	21:51	20:57	19:44	18:32	16:33	16:14				
19	05:28	06:18	07:12	08:06	08:04	08:04	08:45			
	21:50	20:55	19:41	18:30	16:32	16:15				
20	05:29	06:20	07:14	08:08	08:06	08:06	08:46			
	21:49	20:52	19:39	18:28	16:31	16:15				
21	05:30	06:22	07:15	08:09	08:08	08:08	08:46			
	21:48	20:50	19:36	18:25	16:29	16:15				
22	05:32	06:23	07:17	08:11	08:09	08:09	08:47			
	21:46	20:48	19:34	18:23	16:28	16:16				
23	05:33	06:25	07:19	08:13	08:11	08:11	08:47			
	21:45	20:46	19:32	18:21	16:27	16:16				
24	05:35	06:27	07:21	08:15	08:13	08:13	08:48			
	21:43	20:43	19:29	18:19	16:26	16:17				
25	05:36	06:28	07:22	07:17	08:15	08:15	08:48			
	21:42	20:41	19:27	17:17	16:25	16:18				
26	05:38	06:30	07:24	07:19	08:16	08:16	08:48			
	21:40	20:39	19:24	17:15	16:24	16:18				
27	05:39	06:32	07:26	07:21	08:18	08:18	08:49			
	21:39	20:36	19:22	17:13	16:23	16:19				
28	05:41	06:34	07:28	07:23	08:20	08:20	08:49			
	21:37	20:34	19:19	17:11	16:22	16:20				
29	05:43	06:35	07:29	08:16 (WT03)	07:25	08:21	08:49			
	21:35	20:32	19:17	7	08:23 (WT03)	17:08	16:21	16:21		
30	05:44	06:37	07:31	08:12 (WT03)	07:26	08:23	08:49			
	21:34	20:30	19:14	12	08:24 (WT03)	17:06	16:20	16:22		
31	05:46	06:39		07:28		08:24	08:49			
	21:32	20:27		17:04		16:23	16:23			
Potential sun hours	510	458	382	329	261	236				
Total, worst case			219	167						
Sun reduction			0,34	0,30						
Oper. time red.			0,96	0,96						
Wind dir. red.			0,64	0,59						
Total reduction			0,21	0,17						
Total, real			45	28						

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

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



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 16 - Polen 8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	07:57 (WT03) 21:01	06:40 (WT02) 21:50
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	08:00 (WT03) 21:03	06:40 (WT02) 21:51
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	08:07 (WT03) 21:03	06:41 (WT02) 21:53
4	08:48 16:27	08:14 17:20	07:16 18:15	07:02 20:12	05:57 21:06	06:42 (WT02) 21:54
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	05:53 21:08	06:44 (WT02) 21:55
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10	06:46 (WT02) 21:56
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:14	05:07 21:58
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15	05:06 21:59
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17	05:06 21:59
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19	05:05 22:00
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20	05:05 22:01
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	05:35 21:25	05:04 22:03
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04
18	08:39 16:48	07:47 17:48	06:43 18:41	06:29 20:38	06:53 (WT02) 21:30	05:04 22:04
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:39	06:51 (WT02) 21:32	05:04 22:05
20	08:36 16:52	07:43 17:52	06:38 18:45	06:24 20:41	07:01 (WT03) 21:33	05:04 22:05
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	07:03 (WT02) 21:35	05:04 22:05
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	06:44 (WT02) 21:36	05:04 22:06
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	06:42 (WT02) 21:38	05:04 22:06
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	07:04 (WT02) 21:39	05:05 22:06
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	06:39 (WT02) 21:41	05:05 22:06
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	07:05 (WT02) 21:42	05:06 22:06
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	06:39 (WT02) 21:44	05:06 22:06
28	08:26 17:07	07:25 18:07	06:18 19:00	06:07 20:56	07:04 (WT02) 21:45	05:06 22:06
29	08:24 17:09	07:16 20:01	06:05 19:03	06:05 20:58	06:39 (WT02) 21:46	05:07 22:05
30	08:23 17:11	07:14 20:03	06:03 19:05	06:03 20:59	07:03 (WT02) 21:48	05:08 22:05
31	08:21 17:13	07:11 20:05	06:01 19:07	06:01 20:59	07:03 (WT02) 21:49	05:08 22:05
Potential sun hours	252	274	367	419	492	508
Total, worst case			300	282	248	671
Sun reduction			0,30	0,37	0,41	0,36
Oper. time red.			0,96	0,96	0,96	0,96
Wind dir. red.			0,63	0,65	0,68	0,70
Total reduction			0,18	0,23	0,27	0,24
Total, real			53	66	67	161

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

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



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 16 - Polen 8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December			
1	05:08	05:47 (WT01)	05:47	06:41	07:33	07:30	08:24		
	22:05	23 06:10 (WT01)	21:30	20:25	19:12	17:02	16:19		
2	05:09	05:48 (WT01)	05:49	06:42	07:35	07:32	08:26		
	22:04	23 06:11 (WT01)	21:29	20:22	19:10	17:00	16:18		
3	05:10	05:47 (WT01)	05:51	06:44	07:37	07:34	08:27		
	22:04	23 06:10 (WT01)	21:27	20:20	19:07	16:59	16:18		
4	05:11	05:48 (WT01)	05:52	06:46	07:38	07:36	08:29		
	22:04	23 06:11 (WT01)	21:25	20:18	19:05	16:57	16:17		
5	05:11	05:48 (WT01)	05:54	06:48	07:40	07:38	08:30		
	22:03	23 06:11 (WT01)	21:23	20:15	19:02	16:55	16:16		
6	05:12	05:48 (WT01)	05:56	06:49	07:42	07:40	08:31		
	22:02	23 06:11 (WT01)	21:21	20:13	19:00	16:53	16:16		
7	05:13	05:48 (WT01)	05:57	06:51	07:44	07:42	08:33		
	22:02	24 06:12 (WT01)	21:19	9 07:04 (WT02)	20:10	18:58	16:51	16:15	
8	05:14	05:49 (WT01)	05:59	06:53 (WT02)	06:53	07:46	07:44	08:34	
	22:01	23 06:12 (WT01)	21:17	14 07:07 (WT02)	20:08	18:55	16:49	16:15	
9	05:15	05:49 (WT01)	06:01	06:51 (WT02)	06:55	07:47	07:46	08:35	
	22:00	23 06:12 (WT01)	21:15	17 07:08 (WT02)	20:06	18:53	16:48	16:15	
10	05:16	05:49 (WT01)	06:03	06:50 (WT02)	06:56	7 07:53 (WT03)	07:49	08:37	
	22:00	23 06:12 (WT01)	21:13	19 07:09 (WT02)	20:03	7 08:00 (WT03)	18:51	16:46	16:14
11	05:18	05:50 (WT01)	06:04	06:48 (WT02)	06:58	07:49 (WT03)	07:51	07:49	08:38
	21:59	22 06:12 (WT01)	21:11	22 07:10 (WT02)	20:01	13 08:02 (WT03)	18:48	16:44	16:14
12	05:19	05:51 (WT01)	06:06	06:48 (WT02)	07:00	07:47 (WT03)	07:53	07:51	08:39
	21:58	21 06:12 (WT01)	21:09	23 07:11 (WT02)	19:58	17 08:04 (WT03)	18:46	16:43	16:14
13	05:20	05:52 (WT01)	06:08	06:48 (WT02)	07:02	07:46 (WT03)	07:55	07:53	08:40
	21:57	20 06:12 (WT01)	21:07	23 07:11 (WT02)	19:56	20 08:06 (WT03)	18:44	16:41	16:14
14	05:21	05:53 (WT01)	06:09	06:46 (WT02)	07:03	07:45 (WT03)	07:56	07:55	08:41
	21:56	19 06:12 (WT01)	21:05	25 07:11 (WT02)	19:54	22 08:07 (WT03)	18:41	16:39	16:14
15	05:22	05:54 (WT01)	06:11	06:46 (WT02)	07:05	07:43 (WT03)	07:58	07:57	08:42
	21:55	18 06:12 (WT01)	21:03	26 07:12 (WT02)	19:51	24 08:07 (WT03)	18:39	16:38	16:14
16	05:24	05:55 (WT01)	06:13	06:45 (WT02)	07:07	07:42 (WT03)	08:00	07:59	08:43
	21:54	16 06:11 (WT01)	21:01	26 07:11 (WT02)	19:49	25 08:07 (WT03)	18:37	16:36	16:14
17	05:25	05:57 (WT01)	06:15	06:46 (WT02)	07:08	07:42 (WT03)	08:02	08:00	08:43
	21:53	15 06:12 (WT01)	20:59	25 07:11 (WT02)	19:46	26 08:08 (WT03)	18:34	16:35	16:14
18	05:26	05:58 (WT01)	06:16	06:46 (WT02)	07:10	07:41 (WT03)	08:04	08:02	08:44
	21:51	13 06:11 (WT01)	20:57	25 07:11 (WT02)	19:44	26 08:07 (WT03)	18:32	16:33	16:14
19	05:28	05:59 (WT01)	06:18	06:46 (WT02)	07:12	07:41 (WT03)	08:06	08:04	08:45
	21:50	12 06:11 (WT01)	20:54	24 07:10 (WT02)	19:41	26 08:07 (WT03)	18:30	16:32	16:15
20	05:29	06:00 (WT01)	06:20	06:48 (WT02)	07:14	07:41 (WT03)	08:08	08:06	08:46
	21:49	10 06:10 (WT01)	20:52	22 07:10 (WT02)	19:39	25 08:06 (WT03)	18:28	16:31	16:15
21	05:30	06:02 (WT01)	06:22	06:50 (WT02)	07:15	07:41 (WT03)	08:09	08:08	08:46
	21:48	8 06:10 (WT01)	20:50	19 07:09 (WT02)	19:36	24 08:05 (WT03)	18:25	16:29	16:15
22	05:32	06:03 (WT01)	06:23	06:51 (WT02)	07:17	07:43 (WT03)	08:11	08:09	08:47
	21:46	5 06:08 (WT01)	20:48	16 07:07 (WT02)	19:34	21 08:04 (WT03)	18:23	16:28	16:16
23	05:33	06:04 (WT01)	06:25	06:53 (WT02)	07:19	07:45 (WT03)	08:13	08:11	08:47
	21:45	3 06:07 (WT01)	20:46	13 07:06 (WT02)	19:31	18 08:03 (WT03)	18:21	16:27	16:16
24	05:35		06:27	06:55 (WT02)	07:21	07:47 (WT03)	08:15	08:13	08:48
	21:43		20:43	10 07:05 (WT02)	19:29	14 08:01 (WT03)	18:19	16:26	16:17
25	05:36		06:28	06:56 (WT02)	07:22	07:48 (WT03)	07:17	08:15	08:48
	21:42		20:41	5 07:01 (WT02)	19:27	10 07:58 (WT03)	17:17	16:25	16:18
26	05:38		06:30		07:24	07:50 (WT03)	07:19	08:16	08:48
	21:40		20:39		19:24	5 07:55 (WT03)	17:15	16:24	16:18
27	05:39		06:32		07:26		07:21	08:18	08:49
	21:39		20:36		19:22		17:13	16:23	16:19
28	05:41		06:34		07:28		07:23	08:20	08:49
	21:37		20:34		19:19		17:11	16:22	16:20
29	05:43		06:35		07:29		07:25	08:21	08:49
	21:35		20:32		19:17		17:08	16:21	16:21
30	05:44		06:37		07:31		07:26	08:23	08:49
	21:34		20:30		19:14		17:06	16:20	16:22
31	05:46		06:39				07:28		08:49
	21:32		20:27				17:04		16:23
Potential sun hours	510	458		382		329	261		236
Total, worst case	413		363		323				
Sun reduction	0,37		0,41		0,34				
Oper. time red.	0,96		0,96		0,96				
Wind dir. red.	0,70		0,66		0,63				
Total reduction	0,25		0,26		0,20				
Total, real	103		94		65				

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 17 - Polen 11

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:15	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:29	20:22	19:10	17:00	16:18
3	08:49	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:37	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:53	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:10	05:11	05:52	06:46	07:38	07:36	08:29
	16:27	17:20	18:15	20:12	21:07	21:54	22:04	21:25	20:18	19:05	16:57	16:17
5	08:48	08:13	07:14	06:59	05:53	05:09	05:11	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:32
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:11	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:46	07:44	08:34
	16:33	17:28	18:23	20:20	21:14	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:46	08:35
	16:34	17:30	18:25	20:21	21:15	21:59	22:00	21:15	20:06	18:53	16:48	16:15
10	08:46	08:03	07:02	06:47	05:43	05:06	05:16	06:03	06:56	07:49	07:47	08:37
	16:36	17:32	18:26	20:23	21:17	21:59	22:00	21:13	20:03	18:51	16:46	16:14
11	08:45	08:01	07:00	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:43	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:02	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:44	16:41	16:14
14	08:43	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:54	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:43	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:48	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:43
	16:45	17:44	18:38	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:53	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:49	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:27	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:40	21:32	22:05	21:50	20:55	19:41	18:30	16:32	16:15
20	08:37	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:08	08:06	08:46
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:35	06:22	05:25	05:04	05:30	06:22	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:48	20:50	19:36	18:25	16:29	16:15
22	08:34	07:39	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:49	20:45	21:37	22:06	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:22	05:04	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:32	18:21	16:27	16:16
24	08:32	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:49	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:28	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	18:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:04	18:56	20:52	21:42	22:06	21:40	20:39	19:24	18:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:49
	17:05	18:05	18:58	20:54	21:44	22:06	21:39	20:37	19:22	18:13	16:23	16:19
28	08:26	07:25	06:19	06:07	05:16	05:06	05:41	06:34	07:28	08:23	08:20	08:49
	17:07	18:07	19:00	20:56	21:45	22:06	21:37	20:34	19:19	18:11	16:22	16:20
29	08:24	07:24	06:16	06:05	05:15	05:07	05:43	06:35	07:29	08:25	08:21	08:49
	17:09	18:09	19:02	20:58	21:46	22:05	21:35	20:32	19:17	18:08	16:21	16:21
30	08:23	07:23	06:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	08:23	08:49
	17:11	18:11	19:04	20:59	21:48	22:05	21:34	20:30	19:14	18:06	16:20	16:22
31	08:21	07:21	06:11	06:00	05:13	05:06	05:46	06:39	07:33	08:28	08:25	08:49
	17:13	18:13	19:06	20:55	21:44	22:01	21:32	20:27	19:11	18:02	16:20	16:23
Potential sun hours	252	274	367	419	492	508	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 18 - Tweehuizerweg 15  
 Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

#### Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:15	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:03	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:17	18:11	20:09	21:03	21:51	22:04	21:29	20:22	19:10	17:01	16:18
3	08:49	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:37	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:53	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:10	05:11	05:52	06:46	07:38	07:36	08:29
	16:28	17:20	18:15	20:12	21:07	21:54	22:04	21:25	20:18	19:05	16:57	16:17
5	08:48	08:13	07:14	06:59	05:53	05:09	05:12	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:11	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:46	07:44	08:34
	16:33	17:28	18:23	20:20	21:14	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:46	08:35
	16:34	17:30	18:25	20:21	21:15	21:59	22:00	21:15	20:06	18:53	16:48	16:15
10	08:46	08:03	07:02	06:47	05:43	05:06	05:16	06:03	06:56	07:49	07:47	08:37
	16:36	17:32	18:26	20:23	21:17	21:59	22:00	21:13	20:03	18:51	16:46	16:14
11	08:45	08:01	07:00	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:43	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:02	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:44	16:41	16:14
14	08:43	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:54	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:44	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
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	16:45	17:44	18:38	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:53	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:49	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:27	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:40	21:32	22:05	21:50	20:55	19:41	18:30	16:32	16:15
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	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:36	06:22	05:25	05:04	05:30	06:22	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:48	20:50	19:36	18:26	16:29	16:15
22	08:34	07:39	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:49	20:45	21:37	22:05	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:23	05:05	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:32	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:49	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:29	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:04	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:49
	17:05	18:06	18:58	20:54	21:44	22:06	21:39	20:37	19:22	17:13	16:23	16:19
28	08:26	07:25	06:19	06:07	05:16	05:07	05:41	06:34	07:28	08:23	08:20	08:49
	17:07	18:07	19:00	20:56	21:45	22:06	21:37	20:34	19:19	17:11	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:36	07:29	08:25	09:21	08:21	08:49
	17:09	18:10	19:02	20:58	21:46	22:05	21:35	20:32	19:17	17:09	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:22	08:23	08:49
	17:11	18:12	19:04	20:59	21:48	22:05	21:34	20:30	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:34	08:29	09:25	08:26	08:49
	17:13	18:14	19:06	20:59	21:49	22:06	21:32	20:27	19:10	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 19 - Tweehuizerweg 19  
 Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

#### Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:15	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:03	16:19
2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:17	18:11	20:09	21:03	21:51	22:04	21:29	20:22	19:10	17:01	16:18
3	08:49	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:37	07:34	08:27
	16:26	17:18	18:13	20:10	21:05	21:53	22:04	21:27	20:20	19:07	16:59	16:18
4	08:48	08:14	07:16	07:02	05:55	05:10	05:11	05:52	06:46	07:38	07:36	08:29
	16:28	17:20	18:15	20:12	21:07	21:54	22:04	21:25	20:18	19:05	16:57	16:17
5	08:48	08:13	07:14	06:59	05:53	05:09	05:12	05:54	06:48	07:40	07:38	08:30
	16:29	17:22	18:17	20:14	21:08	21:55	22:03	21:23	20:15	19:02	16:55	16:16
6	08:48	08:11	07:11	06:57	05:51	05:08	05:12	05:56	06:49	07:42	07:40	08:31
	16:30	17:24	18:19	20:16	21:10	21:56	22:02	21:21	20:13	19:00	16:53	16:16
7	08:47	08:09	07:09	06:54	05:49	05:07	05:13	05:57	06:51	07:44	07:42	08:33
	16:31	17:26	18:21	20:18	21:12	21:57	22:02	21:19	20:11	18:58	16:51	16:15
8	08:47	08:07	07:07	06:52	05:47	05:07	05:14	05:59	06:53	07:46	07:44	08:34
	16:33	17:28	18:23	20:20	21:14	21:58	22:01	21:17	20:08	18:55	16:49	16:15
9	08:46	08:05	07:04	06:50	05:45	05:06	05:15	06:01	06:55	07:47	07:46	08:35
	16:34	17:30	18:25	20:21	21:15	21:59	22:00	21:15	20:06	18:53	16:48	16:15
10	08:46	08:03	07:02	06:47	05:43	05:06	05:16	06:03	06:56	07:49	07:47	08:37
	16:36	17:32	18:26	20:23	21:17	21:59	22:00	21:13	20:03	18:51	16:46	16:14
11	08:45	08:01	07:00	06:45	05:41	05:05	05:18	06:04	06:58	07:51	07:49	08:38
	16:37	17:34	18:28	20:25	21:19	22:00	21:59	21:11	20:01	18:48	16:44	16:14
12	08:44	07:59	06:57	06:43	05:40	05:05	05:19	06:06	07:00	07:53	07:51	08:39
	16:39	17:36	18:30	20:27	21:20	22:01	21:58	21:09	19:58	18:46	16:43	16:14
13	08:43	07:57	06:55	06:40	05:38	05:05	05:20	06:08	07:02	07:55	07:53	08:40
	16:40	17:38	18:32	20:29	21:22	22:02	21:57	21:07	19:56	18:44	16:41	16:14
14	08:43	07:55	06:52	06:38	05:36	05:04	05:21	06:09	07:03	07:56	07:55	08:41
	16:42	17:40	18:34	20:30	21:24	22:02	21:56	21:05	19:54	18:41	16:39	16:14
15	08:42	07:53	06:50	06:36	05:35	05:04	05:22	06:11	07:05	07:58	07:57	08:42
	16:44	17:42	18:36	20:32	21:25	22:03	21:55	21:03	19:51	18:39	16:38	16:14
16	08:41	07:51	06:48	06:33	05:33	05:04	05:24	06:13	07:07	08:00	07:59	08:43
	16:45	17:44	18:38	20:34	21:27	22:03	21:54	21:01	19:49	18:37	16:36	16:14
17	08:40	07:49	06:45	06:31	05:31	05:04	05:25	06:15	07:08	08:02	08:00	08:43
	16:47	17:46	18:39	20:36	21:29	22:04	21:53	20:59	19:46	18:34	16:35	16:14
18	08:39	07:47	06:43	06:29	05:30	05:04	05:26	06:16	07:10	08:04	08:02	08:44
	16:49	17:48	18:41	20:38	21:30	22:04	21:51	20:57	19:44	18:32	16:33	16:14
19	08:38	07:45	06:40	06:27	05:28	05:04	05:28	06:18	07:12	08:06	08:04	08:45
	16:50	17:50	18:43	20:40	21:32	22:05	21:50	20:55	19:41	18:30	16:32	16:15
20	08:36	07:43	06:38	06:24	05:27	05:04	05:29	06:20	07:14	08:08	08:06	08:46
	16:52	17:52	18:45	20:41	21:33	22:05	21:49	20:52	19:39	18:28	16:31	16:15
21	08:35	07:41	06:36	06:22	05:25	05:04	05:30	06:22	07:15	08:09	08:08	08:46
	16:54	17:54	18:47	20:43	21:35	22:05	21:48	20:50	19:36	18:26	16:29	16:15
22	08:34	07:39	06:33	06:20	05:24	05:04	05:32	06:23	07:17	08:11	08:09	08:47
	16:56	17:56	18:49	20:45	21:37	22:06	21:46	20:48	19:34	18:23	16:28	16:16
23	08:33	07:36	06:31	06:18	05:23	05:05	05:33	06:25	07:19	08:13	08:11	08:47
	16:57	17:58	18:50	20:47	21:38	22:06	21:45	20:46	19:32	18:21	16:27	16:16
24	08:31	07:34	06:28	06:15	05:21	05:05	05:35	06:27	07:21	08:15	08:13	08:48
	16:59	18:00	18:52	20:49	21:39	22:06	21:43	20:43	19:29	18:19	16:26	16:17
25	08:30	07:32	06:26	06:13	05:20	05:05	05:36	06:29	07:22	08:17	08:15	08:48
	17:01	18:02	18:54	20:50	21:41	22:06	21:42	20:41	19:27	17:17	16:25	16:18
26	08:29	07:30	06:23	06:11	05:19	05:06	05:38	06:30	07:24	08:19	08:16	08:48
	17:03	18:04	18:56	20:52	21:42	22:06	21:40	20:39	19:24	17:15	16:24	16:18
27	08:27	07:27	06:21	06:09	05:17	05:06	05:39	06:32	07:26	08:21	08:18	08:49
	17:05	18:06	18:58	20:54	21:44	22:06	21:39	20:37	19:22	17:13	16:23	16:19
28	08:26	07:25	06:19	06:07	05:16	05:07	05:41	06:34	07:28	08:23	08:20	08:49
	17:07	18:07	19:00	20:56	21:45	22:06	21:37	20:34	19:19	17:11	16:22	16:20
29	08:24	07:16	06:05	05:15	05:07	05:43	06:36	07:29	08:25	09:21	08:21	08:49
	17:09	18:10	19:02	20:58	21:46	22:05	21:35	20:32	19:17	17:09	16:21	16:21
30	08:23	07:14	06:03	05:14	05:08	05:44	06:37	07:31	08:26	09:23	08:23	08:49
	17:11	18:12	19:04	20:59	21:48	22:05	21:34	20:30	19:14	17:06	16:20	16:22
31	08:21	07:11	06:01	05:13	05:07	05:44	06:39	07:34	08:29	09:26	08:26	08:49
	17:13	18:14	19:06	20:59	21:49	22:06	21:32	20:27	19:10	17:04	16:23	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 20 - Vierhuizerweg 6  
 Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	06:01 21:01	05:12 21:50	05:08 22:05	05:41 (WT03) 21:30	05:47 20:25	06:41 19:12	07:33 17:02	07:30 16:19
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	05:59 21:03	05:11 21:51	05:09 22:04	6 05:42 (WT03) 21:29	05:49 20:22	06:42 19:10	07:35 17:01	07:32 16:18
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	05:57 21:05	05:10 21:52	05:10 22:04	5 05:47 (WT03) 21:27	05:51 20:20	06:44 19:07	07:37 16:59	07:34 16:18
4	08:48 16:28	08:14 17:20	07:16 18:15	07:02 20:12	05:55 21:06	05:10 21:54	05:11 22:04	4 05:46 (WT03) 21:25	05:52 20:18	06:46 19:05	07:38 16:57	07:36 16:17
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	05:53 21:08	05:09 21:55	05:12 22:03	3 05:44 (WT03) 21:23	05:54 20:15	06:48 19:02	07:40 16:55	07:38 16:16
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10	05:08 21:56	05:12 22:02	2 05:46 (WT03) 21:21	05:56 20:13	06:49 19:00	07:42 16:53	07:40 16:16
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57	05:13 22:02	05:38 (WT03) 21:19	05:13 20:10	06:51 18:58	07:44 16:51	07:42 16:15
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:13	05:07 21:58	05:14 22:01	1 05:38 (WT03) 22:01	05:14 21:17	06:53 20:08	07:46 18:55	07:44 16:49
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15	05:06 21:59	05:15 22:00	3 05:41 (WT03) 22:00	05:15 21:15	06:55 20:06	07:47 18:53	07:45 16:48
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17	05:06 21:59	05:16 22:00	4 05:42 (WT03) 22:00	05:16 21:13	06:03 20:03	07:49 18:51	07:47 16:46
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19	05:05 22:00	05:18 21:59	5 05:42 (WT03) 21:59	05:18 21:11	06:58 20:01	07:51 18:48	07:49 16:44
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20	05:05 22:01	05:19 22:01	6 05:43 (WT03) 21:58	05:19 21:09	07:00 19:58	07:53 18:46	07:51 16:43
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02	05:20 21:57	7 05:37 (WT03) 21:57	05:20 21:07	07:02 19:56	07:55 18:44	07:53 16:41
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02	05:21 21:56	7 05:43 (WT03) 21:56	05:21 21:05	07:03 19:54	07:56 18:41	07:55 16:39
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	05:35 21:25	05:04 22:03	05:22 21:55	8 05:44 (WT03) 21:55	05:22 21:03	07:05 19:51	07:58 18:39	07:57 16:38
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03	05:24 21:54	8 05:44 (WT03) 21:54	05:24 21:01	07:07 19:49	08:00 18:37	07:59 16:36
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04	05:25 21:53	9 05:45 (WT03) 21:53	05:25 20:59	07:08 19:46	08:02 18:34	08:00 16:35
18	08:39 16:49	07:47 17:48	06:43 18:41	06:29 20:38	05:30 21:30	05:04 22:04	05:26 21:51	9 05:36 (WT03) 21:51	05:26 20:57	08:02 19:44	08:04 18:32	08:02 16:33
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:39	05:28 21:32	05:04 22:05	05:28 21:50	10 05:36 (WT03) 21:50	05:28 20:54	07:12 19:41	08:06 18:30	08:04 16:32
20	08:36 16:52	07:43 17:52	06:38 18:45	06:24 20:41	05:27 21:33	05:04 22:05	05:29 21:49	10 05:46 (WT03) 21:49	05:29 20:52	07:14 19:39	08:08 18:28	08:06 16:31
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	05:25 21:35	05:04 22:05	05:30 21:47	10 05:36 (WT03) 21:47	05:30 20:50	07:15 19:36	08:09 18:25	08:08 16:29
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	05:24 21:36	05:04 22:05	05:32 21:46	10 05:47 (WT03) 21:46	05:32 20:48	07:17 19:34	08:11 18:23	08:09 16:28
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	05:22 21:38	05:05 22:06	05:33 21:45	10 05:37 (WT03) 21:45	05:33 20:46	07:19 19:31	08:13 18:21	08:11 16:27
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	05:21 21:39	05:05 22:06	05:35 21:43	10 05:37 (WT03) 21:43	05:35 20:43	07:21 19:29	08:15 18:19	08:13 16:26
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	05:20 21:41	05:05 22:06	05:36 21:42	10 05:47 (WT03) 21:42	05:36 20:41	07:22 19:27	07:17 17:17	08:15 16:25
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	05:19 21:42	05:06 22:06	05:38 21:40	9 05:47 (WT03) 21:40	05:38 20:39	07:24 19:24	07:19 17:15	08:16 16:24
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	05:17 21:44	05:06 22:06	05:39 21:39	9 05:39 (WT03) 21:39	05:39 20:36	07:26 19:22	07:21 17:13	08:18 16:23
28	08:26 17:07	07:25 18:07	06:19 18:59	06:07 20:56	05:16 21:45	05:07 22:06	05:41 21:37	9 05:48 (WT03) 21:37	05:41 20:34	07:28 19:19	07:23 17:11	08:20 16:22
29	08:24 17:09	07:16 18:09	06:05 20:01	05:15 20:58	05:07 21:46	05:07 22:05	05:43 21:35	8 05:40 (WT03) 21:35	05:43 20:32	07:29 19:17	07:24 17:08	08:21 16:21
30	08:23 17:11	07:14 18:03	06:03 20:03	05:14 20:59	05:14 21:48	05:08 22:05	05:44 21:34	8 05:40 (WT03) 21:34	05:44 20:29	07:31 19:14	07:26 17:06	08:23 16:20
31	08:21 17:13	07:11 18:05	07:11 20:05	05:13 21:49	05:13 21:49	05:13 21:49	05:46 21:32	7 05:47 (WT03) 21:32	05:46 20:27	07:28 17:04	07:28 17:04	08:49 16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case							186					20
Sun reduction							0,36					0,37
Oper. time red.							0,96					0,96
Wind dir. red.							0,70					0,70
Total reduction							0,24					0,25
Total, real							45					5

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

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



## SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbines Shadow receptor: 21 - Vierhuizerweg 8  
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	06:01 21:01	05:12 21:50	05:42 (WT03) 05:08 8	05:41 (WT03) 05:47 18	06:41 07:33 17:02	07:30 08:24 16:19	07:30 08:24 16:19	07:30 08:24 16:19
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	05:59 21:03	05:11 21:51	05:42 (WT03) 05:09 9	05:42 (WT03) 05:49 18	06:42 07:35 19:10	07:32 08:26 16:18	07:32 08:26 16:18	07:32 08:26 16:18
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	05:57 21:05	05:10 21:52	05:41 (WT03) 05:10 11	05:42 (WT03) 05:51 17	06:44 07:37 19:07	07:34 08:27 16:18	07:34 08:27 16:18	07:34 08:27 16:18
4	08:48 16:28	08:14 17:20	07:16 18:15	07:02 20:12	05:55 21:06	05:10 21:54	05:40 (WT03) 05:11 12	05:43 (WT03) 05:52 16	06:46 07:38 19:05	07:36 08:29 16:17	07:36 08:29 16:17	07:36 08:29 16:17
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	05:53 21:08	05:09 21:55	05:40 (WT03) 05:12 13	05:44 (WT03) 05:54 15	06:48 07:40 19:02	07:38 08:30 16:16	07:38 08:30 16:16	07:38 08:30 16:16
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10	05:08 21:56	05:39 (WT03) 05:12 14	05:45 (WT03) 05:56 14	06:49 07:42 19:00	07:40 08:31 16:16	07:40 08:31 16:16	07:40 08:31 16:16
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57	05:38 (WT03) 05:13 15	05:46 (WT03) 05:57 13	06:51 07:44 19:00	07:44 08:33 16:15	07:44 08:33 16:15	07:44 08:33 16:15
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:13	05:07 21:58	05:38 (WT03) 05:14 16	05:47 (WT03) 05:59 12	06:53 07:46 19:08	07:46 08:34 16:15	07:46 08:34 16:15	07:46 08:34 16:15
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15	05:06 21:59	05:38 (WT03) 05:15 17	05:48 (WT03) 06:01 11	06:55 07:47 19:08	07:45 08:35 16:15	07:45 08:35 16:15	07:45 08:35 16:15
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17	05:06 21:59	05:37 (WT03) 05:16 17	05:49 (WT03) 06:03 10	06:56 07:49 19:08	07:47 08:36 16:14	07:47 08:36 16:14	07:47 08:36 16:14
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19	05:05 22:00	05:37 (WT03) 05:18 18	05:50 (WT03) 06:04 8	06:58 07:51 19:08	07:49 08:38 16:14	07:49 08:38 16:14	07:49 08:38 16:14
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20	05:05 22:01	05:37 (WT03) 05:19 19	05:51 (WT03) 06:06 7	07:00 07:53 19:58	07:53 08:42 16:14	07:53 08:42 16:14	07:53 08:42 16:14
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02	05:36 (WT03) 05:20 19	05:52 (WT03) 06:08 5	07:02 07:55 19:56	07:55 08:44 16:14	07:55 08:44 16:14	07:55 08:44 16:14
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02	05:36 (WT03) 05:21 20	05:53 (WT03) 06:09 3	07:03 07:56 19:54	07:56 08:41 16:39	07:56 08:41 16:39	07:56 08:41 16:39
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	05:35 21:25	05:04 22:03	05:36 (WT03) 05:22 20	05:54 (WT03) 06:11 1	07:05 07:58 19:51	07:57 08:42 16:38	07:57 08:42 16:38	07:57 08:42 16:38
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03	05:36 (WT03) 05:24 20	06:13 07:07 21:01	07:07 08:00 19:49	08:00 08:43 16:36	08:00 08:43 16:36	08:00 08:43 16:36
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04	05:36 (WT03) 05:25 21	06:15 07:08 20:59	08:02 08:43 19:46	08:02 08:44 16:35	08:02 08:44 16:35	08:02 08:44 16:35
18	08:39 16:49	07:47 17:48	06:43 18:41	06:29 20:38	05:30 21:30	05:04 22:04	05:36 (WT03) 05:26 21	06:16 07:10 20:57	08:04 08:45 19:44	08:04 08:45 16:34	08:04 08:45 16:34	08:04 08:45 16:34
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:39	05:28 21:32	05:04 22:05	05:36 (WT03) 05:28 21	06:18 07:12 20:54	08:06 08:46 19:41	08:06 08:46 16:32	08:06 08:46 16:32	08:06 08:46 16:32
20	08:36 16:52	07:43 17:52	06:38 18:45	06:24 20:41	05:27 21:33	05:04 22:05	05:36 (WT03) 05:29 21	06:20 07:14 20:52	08:08 08:46 19:39	08:08 08:46 16:31	08:08 08:46 16:31	08:08 08:46 16:31
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	05:25 21:35	05:04 22:05	05:36 (WT03) 05:30 21	06:22 07:15 20:50	08:09 08:46 19:36	08:09 08:46 16:29	08:09 08:46 16:29	08:09 08:46 16:29
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	05:24 21:36	05:04 22:05	05:37 (WT03) 05:32 21	06:23 07:17 20:48	08:11 08:47 19:34	08:11 08:47 16:28	08:11 08:47 16:28	08:11 08:47 16:28
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	05:22 21:38	05:05 22:06	05:37 (WT03) 05:33 21	06:25 07:19 20:46	08:13 08:47 19:31	08:13 08:47 16:27	08:13 08:47 16:27	08:13 08:47 16:27
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	05:21 21:39	05:05 22:06	05:37 (WT03) 05:35 21	06:27 07:21 20:43	08:15 08:48 19:29	08:15 08:48 16:26	08:15 08:48 16:26	08:15 08:48 16:26
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	05:20 21:41	05:05 22:06	05:38 (WT03) 05:36 21	06:28 07:22 20:41	08:17 08:48 19:27	08:17 08:48 16:25	08:17 08:48 16:25	08:17 08:48 16:25
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	05:19 21:42	05:06 22:06	05:38 (WT03) 05:38 21	06:30 07:24 20:39	08:19 08:48 19:24	08:19 08:48 16:24	08:19 08:48 16:24	08:19 08:48 16:24
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	05:17 21:44	05:06 22:06	05:39 (WT03) 05:39 20	06:32 07:26 20:36	08:21 08:48 19:22	08:21 08:48 16:23	08:21 08:48 16:23	08:21 08:48 16:23
28	08:26 17:07	07:25 18:07	06:19 18:59	06:07 20:56	05:16 21:45	05:07 22:06	05:39 (WT03) 05:41 20	06:34 07:28 20:34	08:23 08:48 19:19	08:23 08:48 16:22	08:23 08:48 16:22	08:23 08:48 16:22
29	08:24 17:09	07:16 18:01	06:16 19:01	06:05 20:58	05:15 21:46	05:07 22:06	05:40 (WT03) 05:43 19	06:35 07:29 20:32	08:24 08:48 19:17	08:24 08:48 16:21	08:24 08:48 16:21	08:24 08:48 16:21
30	08:23 17:11	07:14 18:03	06:14 19:03	06:03 20:59	05:14 21:48	05:08 22:05	05:40 (WT03) 05:44 19	06:37 07:31 20:29	08:26 08:48 19:14	08:26 08:48 16:20	08:26 08:48 16:20	08:26 08:48 16:20
31	08:21 17:13	07:11 18:05	06:11 19:05	06:01 21:49	05:13 21:45	05:09 22:05	05:43 (WT03) 05:46 19	06:39 07:33 20:27	08:28 08:48 17:04	08:28 08:48 16:20	08:28 08:48 16:20	08:28 08:48 16:20
Potential sun hours	252	274	367	419	492	507	536	510	458	382	329	261
Total, worst case					12		536	168				236
Sun reduction					0,41		0,36	0,37				
Oper. time red.					0,96		0,96	0,96				
Wind dir. red.					0,70		0,70	0,70				
Total reduction					0,28		0,24	0,25				
Total, real					3		129	42				

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)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		





### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 22 - Vierhuizerweg 10  
 Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	06:01 21:01	05:12 21:50	05:08 22:05	05:41 (WT03) 21:30	05:47 20:25	06:41 19:12	07:33 17:02	07:30 16:19
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	05:59 21:03	05:11 21:51	05:11 22:04	05:42 (WT03) 21:29	05:49 20:22	06:42 19:10	07:35 17:01	07:32 16:18
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	05:57 21:05	05:10 21:52	05:10 22:04	05:42 (WT03) 21:27	05:51 20:20	06:44 19:07	07:37 16:59	07:34 16:18
4	08:48 16:28	08:14 17:20	07:16 18:15	07:02 20:12	05:55 21:06	05:10 21:54	05:11 22:04	05:43 (WT03) 21:25	05:52 20:18	06:46 19:05	07:38 16:57	07:36 16:17
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	05:53 21:08	05:09 21:55	05:12 22:03	05:44 (WT03) 21:23	05:54 20:15	06:48 19:02	07:40 16:55	07:38 16:16
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10	05:08 21:56	05:12 22:02	05:45 (WT03) 21:21	05:56 20:13	06:49 19:00	07:42 16:53	07:40 16:16
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57	05:13 22:02	05:46 (WT03) 21:19	05:57 20:10	06:51 18:58	07:44 16:51	07:42 16:15
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:13	05:07 21:58	05:14 22:01	05:47 (WT03) 22:01	05:59 21:17	06:53 20:08	07:46 18:55	07:44 16:49
9	08:46 16:34	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15	05:06 21:59	05:15 22:00	05:48 (WT03) 21:15	06:01 20:06	06:55 18:53	07:47 16:48	07:45 16:15
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17	05:06 21:59	05:16 22:00	05:37 (WT03) 21:13	06:03 20:03	06:56 18:51	07:49 16:46	07:47 16:14
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19	05:05 22:00	05:18 21:59	05:37 (WT03) 21:11	06:04 20:01	06:58 18:48	07:51 16:44	07:49 16:14
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20	05:05 22:01	05:19 21:58	05:37 (WT03) 21:09	06:06 19:58	07:00 18:46	07:53 16:43	07:51 16:14
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02	05:20 21:57	05:48 (WT03) 21:07	06:08 19:56	07:02 18:44	07:55 16:41	07:53 16:14
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02	05:21 21:56	05:46 (WT03) 21:05	06:09 19:54	07:03 18:41	07:56 16:39	07:55 16:14
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	05:35 21:25	05:04 22:03	05:22 21:55	05:48 (WT03) 21:03	06:11 19:51	07:05 18:39	07:58 16:38	07:57 16:14
16	08:41 16:45	07:51 17:44	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03	05:24 21:54	05:36 (WT03) 21:01	06:13 19:49	07:07 18:37	08:00 16:36	07:59 16:14
17	08:40 16:47	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04	05:25 21:53	05:36 (WT03) 21:06	06:15 19:46	07:08 18:34	08:02 16:35	08:00 16:14
18	08:39 16:49	07:47 17:48	06:43 18:41	06:29 20:38	05:30 21:30	05:04 22:04	05:26 21:51	05:49 (WT03) 21:05	06:16 19:44	07:10 18:32	08:04 16:33	08:02 16:14
19	08:38 16:50	07:45 17:50	06:40 18:43	06:27 20:39	05:28 21:32	05:04 22:05	05:28 21:50	05:36 (WT03) 21:05	06:18 19:41	07:12 18:30	08:06 16:32	08:04 16:15
20	08:36 16:52	07:43 17:52	06:38 18:45	06:24 20:41	05:27 21:33	05:04 22:05	05:29 21:49	05:50 (WT03) 21:06	06:20 19:39	07:14 18:28	08:08 16:31	08:06 16:15
21	08:35 16:54	07:41 17:54	06:35 18:47	06:22 20:43	05:25 21:35	05:04 22:05	05:30 21:47	05:36 (WT03) 21:07	06:22 19:36	07:15 18:25	08:09 16:29	08:08 16:15
22	08:34 16:56	07:39 17:56	06:33 18:49	06:20 20:45	05:24 21:36	05:04 22:05	05:32 21:46	05:37 (WT03) 21:08	06:23 19:34	07:17 18:23	08:11 16:28	08:09 16:16
23	08:33 16:57	07:36 17:58	06:31 18:50	06:18 20:47	05:22 21:38	05:05 22:06	05:33 21:45	05:37 (WT03) 21:09	06:25 19:31	07:19 18:21	08:13 16:27	08:11 16:16
24	08:31 16:59	07:34 18:00	06:28 18:52	06:15 20:49	05:21 21:39	05:05 22:06	05:35 21:43	05:37 (WT03) 21:10	06:27 19:29	07:21 18:19	08:15 16:26	08:13 16:17
25	08:30 17:01	07:32 18:02	06:26 18:54	06:13 20:50	05:20 21:41	05:05 22:06	05:36 21:42	05:38 (WT03) 21:11	06:28 19:27	07:22 17:17	07:17 16:25	08:15 16:18
26	08:29 17:03	07:30 18:04	06:23 18:56	06:11 20:52	05:19 21:42	05:06 22:06	05:38 21:40	05:51 (WT03) 21:12	06:30 19:24	07:19 17:15	08:16 16:24	08:48 16:18
27	08:27 17:05	07:27 18:05	06:21 18:58	06:09 20:54	05:17 21:44	05:06 22:06	05:39 21:39	05:39 (WT03) 21:13	06:32 19:22	07:26 17:13	07:21 16:23	08:18 16:19
28	08:26 17:07	07:25 18:07	06:18 18:59	06:07 20:56	05:16 21:45	05:07 22:06	05:41 21:37	05:39 (WT03) 21:14	06:34 19:19	07:28 17:11	07:23 16:22	08:20 16:20
29	08:24 17:09	07:16 18:09	06:05 20:01	05:15 20:58	05:07 21:46	05:07 22:05	05:43 21:35	05:40 (WT03) 21:15	06:35 19:17	07:29 17:08	07:24 16:21	08:21 16:21
30	08:23 17:11	07:14 18:03	06:03 20:03	05:14 20:59	05:14 21:48	05:08 22:05	05:44 21:34	05:40 (WT03) 21:16	06:37 19:14	07:31 17:06	07:26 16:20	08:23 16:22
31	08:21 17:13	08:21 17:13	07:11 20:05	05:13 21:49	05:13 21:49	05:13 21:49	05:46 21:32	05:46 (WT03) 21:07	06:39 20:27	07:28 17:04	07:28 16:23	08:49 16:23
Potential sun hours	252	274	367	419	492	507	295	58	458	382	329	261
Total, worst case							295	58				236
Sun reduction							0,36	0,37				
Oper. time red.							0,96	0,96				
Wind dir. red.							0,70	0,70				
Total reduction							0,24	0,25				
Total, real							71	14				

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

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



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 23 - Oostpolder 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June		
1	08:49 16:24	08:19 17:14	09:10 (WT02) 09:21 (WT02)	07:23 18:09	08:14 (WT01) 08:25 (WT01)	07:09 20:07	06:01 21:01	05:12 21:50
2	08:49 16:25	08:18 17:16	09:12 (WT02) 09:19 (WT02)	07:21 18:11		07:06 20:09	05:59 21:03	05:11 21:51
3	08:49 16:26	08:16 17:18		07:18 18:13		07:04 20:10	05:57 21:05	05:10 21:53
4	08:48 16:27	08:14 17:20		07:16 18:15		07:02 20:12	05:55 21:07	05:09 21:54
5	08:48 16:29	08:13 17:22		07:14 18:17		06:59 20:14	05:53 21:08	05:09 21:55
6	08:48 16:30	08:11 17:24		07:11 18:19		06:57 20:16	05:51 21:10	05:08 21:56
7	08:47 16:31	08:09 17:26		07:09 18:21		06:54 20:18	05:49 21:12	05:07 21:57
8	08:47 16:33	08:07 17:28		07:07 18:23		06:52 20:20	05:47 21:14	05:07 21:58
9	08:46 16:34	08:05 17:30		07:04 18:24		06:50 20:21	05:45 21:15	05:06 21:59
10	08:46 16:36	08:03 17:32		07:02 18:26		06:47 20:23	05:43 21:17	05:06 21:59
11	08:45 16:37	08:01 17:34		07:00 18:28		06:45 20:25	05:41 21:19	05:05 22:00
12	08:44 16:39	09:16 (WT02) 09:17 (WT02)	07:59 17:36	06:57 18:30		06:43 20:27	05:40 21:20	05:05 22:01
13	08:43 16:40	09:15 (WT02) 09:18 (WT02)	07:57 17:38	08:23 (WT01) 08:27 (WT01)	06:55 18:32	06:40 20:29	05:38 21:22	05:05 22:02
14	08:43 16:42	09:14 (WT02) 09:19 (WT02)	07:55 17:40	08:21 (WT01) 08:29 (WT01)	06:52 18:34	06:38 20:30	05:36 21:24	05:04 22:02
15	08:42 16:43	09:12 (WT02) 09:20 (WT02)	07:53 17:42	08:19 (WT01) 08:31 (WT01)	06:50 18:36	06:36 20:32	05:34 21:25	05:04 22:03
16	08:41 16:45	09:11 (WT02) 09:21 (WT02)	07:51 17:44	08:17 (WT01) 08:32 (WT01)	06:48 18:38	06:33 20:34	05:33 21:27	05:04 22:03
17	08:40 16:47	09:10 (WT02) 09:22 (WT02)	07:49 17:46	08:15 (WT01) 08:33 (WT01)	06:45 18:39	06:31 20:36	05:31 21:29	05:04 22:04
18	08:39 16:48	09:09 (WT02) 09:23 (WT02)	07:47 17:48	08:12 (WT01) 08:33 (WT01)	06:43 18:41	06:29 20:38	05:30 21:30	05:04 22:04
19	08:38 16:50	09:08 (WT02) 09:24 (WT02)	07:45 17:50	08:10 (WT01) 08:34 (WT01)	06:40 18:43	06:27 20:40	05:28 21:32	05:04 22:05
20	08:37 16:52	09:06 (WT02) 09:24 (WT02)	07:43 17:52	08:09 (WT01) 08:34 (WT01)	06:38 18:45	06:24 20:41	05:27 21:33	05:04 22:05
21	08:35 16:54	09:05 (WT02) 09:25 (WT02)	07:41 17:54	08:09 (WT01) 08:35 (WT01)	06:35 18:47	06:22 20:43	05:25 21:35	05:04 22:05
22	08:34 16:56	09:03 (WT02) 09:25 (WT02)	07:39 17:56	08:08 (WT01) 08:34 (WT01)	06:33 18:49	06:20 20:45	05:24 21:37	05:04 22:06
23	08:33 16:57	09:03 (WT02) 09:25 (WT02)	07:36 17:58	08:08 (WT01) 08:34 (WT01)	06:31 18:50	06:18 20:47	05:22 21:38	05:04 22:06
24	08:32 16:59	09:02 (WT02) 09:25 (WT02)	07:34 18:00	08:09 (WT01) 08:34 (WT01)	06:28 18:52	06:15 20:49	05:21 21:40	05:05 22:06
25	08:30 17:01	09:03 (WT02) 09:26 (WT02)	07:32 18:02	08:10 (WT01) 08:33 (WT01)	06:26 18:54	06:13 20:50	05:20 21:41	05:05 22:06
26	08:29 17:03	09:03 (WT02) 09:26 (WT02)	07:30 18:04	08:10 (WT01) 08:31 (WT01)	06:23 18:56	06:11 20:52	05:19 21:42	05:05 22:06
27	08:27 17:05	09:05 (WT02) 09:26 (WT02)	07:27 18:05	08:11 (WT01) 08:30 (WT01)	06:21 18:58	06:09 20:54	05:17 21:44	05:06 22:06
28	08:26 17:07	09:05 (WT02) 09:25 (WT02)	07:25 18:07	08:13 (WT01) 08:28 (WT01)	06:18 19:00	06:07 20:56	05:16 21:45	05:06 22:06
29	08:24 17:09	09:06 (WT02) 09:25 (WT02)			07:16 20:01	06:05 20:58	05:15 21:46	05:07 22:05
30	08:23 17:11	09:07 (WT02) 09:25 (WT02)			07:14 20:03	06:03 20:59	05:14 21:48	05:08 22:05
31	08:21 17:13	09:08 (WT02) 09:23 (WT02)			07:11 20:05		05:13 21:49	
Potential sun hours	252	274	367	419	492	508		
Total, worst case	313	326	11					
Sun reduction	0,19	0,26	0,30					
Oper. time red.	0,96	0,96	0,96					
Wind dir. red.	0,56	0,59	0,59					
Total reduction	0,10	0,15	0,17					
Total, real	31	48	2					

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 23 - Oostpolder 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December
1	05:08	05:47	06:41	07:33	07:30	08:24
	22:05	21:30	20:25	19:12	17:02	16:19
2	05:09	05:49	06:42	07:35	07:32	08:26
	22:05	21:29	20:22	19:10	17:00	16:18
3	05:10	05:51	06:44	07:37	07:34	08:27
	22:04	21:27	20:20	19:07	16:59	16:18
4	05:11	05:52	06:46	07:38	07:36	08:29
	22:04	21:25	20:18	19:05	16:57	16:17
5	05:11	05:54	06:48	07:40	07:38	08:30
	22:03	21:23	20:15	19:02	16:55	16:16
6	05:12	05:56	06:49	07:42	07:40	08:32
	22:03	21:21	20:13	19:00	16:53	16:16
7	05:13	05:57	06:51	07:44	07:42	08:33
	22:02	21:19	20:11	18:58	16:51	16:15
8	05:14	05:59	06:53	07:46	07:44	08:34
	22:01	21:17	20:08	18:55	16:49	16:15
9	05:15	06:01	06:55	07:47	07:46	08:35
	22:00	21:15	20:06	18:53	16:48	16:15
10	05:16	06:02	06:56	07:49	07:47	08:37
	22:00	21:13	20:03	18:51	16:46	16:14
11	05:17	06:04	06:58	07:51	07:49	08:38
	21:59	21:11	20:01	18:48	16:44	16:14
12	05:19	06:06	07:00	07:53	08:50 (WT01)	07:51
	21:58	21:09	19:58	18:46	6 08:56 (WT01)	16:42
13	05:20	06:08	07:01	07:55	08:46 (WT01)	07:53
	21:57	21:07	19:56	18:44	13 08:59 (WT01)	16:41
14	05:21	06:09	07:03	07:56	08:44 (WT01)	07:55
	21:56	21:05	19:54	18:41	17 09:01 (WT01)	16:39
15	05:22	06:11	07:05	07:58	08:43 (WT01)	07:57
	21:55	21:03	19:51	18:39	20 09:03 (WT01)	16:38
16	05:24	06:13	07:07	08:00	08:42 (WT01)	07:59
	21:54	21:01	19:49	18:37	22 09:04 (WT01)	16:36
17	05:25	06:15	07:08	08:02	08:41 (WT01)	08:00
	21:53	20:59	19:46	18:34	24 09:05 (WT01)	16:35
18	05:26	06:16	07:10	08:04	08:40 (WT01)	08:02
	21:51	20:57	19:44	18:32	25 09:05 (WT01)	16:33
19	05:28	06:18	07:12	08:06	08:40 (WT01)	08:04
	21:50	20:55	19:41	18:30	25 09:05 (WT01)	16:32
20	05:29	06:20	07:14	08:08	08:39 (WT01)	08:06
	21:49	20:52	19:39	18:28	26 09:05 (WT01)	16:31
21	05:30	06:21	07:15	08:09	08:39 (WT01)	08:08
	21:48	20:50	19:36	18:25	26 09:05 (WT01)	16:29
22	05:32	06:23	07:17	08:11	08:39 (WT01)	08:09
	21:46	20:48	19:34	18:23	26 09:05 (WT01)	16:28
23	05:33	06:25	07:19	08:13	08:41 (WT01)	08:11
	21:45	20:46	19:31	18:21	23 09:04 (WT01)	16:27
24	05:35	06:27	07:21	08:15	08:43 (WT01)	08:13
	21:43	20:43	19:29	18:19	21 09:04 (WT01)	16:26
25	05:36	06:28	07:22	07:17	07:45 (WT01)	08:15
	21:42	20:41	19:27	17:17	18 08:03 (WT01)	16:25
26	05:38	06:30	07:24	07:19	07:47 (WT01)	08:16
	21:40	20:39	19:24	17:15	15 08:02 (WT01)	16:23
27	05:39	06:32	07:26	07:21	07:49 (WT01)	08:18
	21:39	20:36	19:22	17:13	11 08:00 (WT01)	16:22
28	05:41	06:34	07:28	07:23	07:51 (WT01)	08:20
	21:37	20:34	19:19	17:10	7 07:58 (WT01)	16:22
29	05:43	06:35	07:29	07:25	07:53 (WT01)	08:21
	21:35	20:32	19:17	17:08	3 07:56 (WT01)	16:21
30	05:44	06:37	07:31	07:26		08:23
	21:34	20:30	19:14	17:06		16:20
31	05:46	06:39		07:28		
	21:32	20:27		17:04		
Potential sun hours	510	458	382	329	261	236
Total, worst case				328		333
Sun reduction				0,30		0,22
Oper. time red.				0,96		0,96
Wind dir. red.				0,59		0,56
Total reduction				0,17		0,12
Total, real				56		38

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 24 - Oostpolder 2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	08:19 17:14	09:12 (WT02) 08:29 (WT02)	07:23 18:09	08:06 (WT01) 08:32 (WT01)	07:09 20:07
2	08:49 16:25	08:18 17:16	09:14 (WT02) 09:27 (WT02)	07:21 18:11	08:07 (WT01) 08:31 (WT01)	07:06 20:09
3	08:49 16:26	08:16 17:18	09:16 (WT02) 09:24 (WT02)	07:18 18:13	08:09 (WT01) 08:29 (WT01)	07:04 20:10
4	08:48 16:27	08:14 17:20		07:16 18:15	08:09 (WT01) 08:26 (WT01)	07:02 20:12
5	08:48 16:29	08:13 17:22		07:14 18:17	08:12 (WT01) 08:24 (WT01)	06:59 20:14
6	08:48 16:30	08:11 17:24		07:11 18:19		06:57 20:16
7	08:47 16:31	08:09 17:26		07:09 18:21		06:54 20:18
8	08:47 16:33	08:07 17:28		07:07 18:23		06:52 20:20
9	08:46 16:34	08:05 17:30		07:04 18:24		06:50 20:21
10	08:46 16:36	09:17 (WT02) 09:20 (WT02)	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17
11	08:45 16:37	09:17 (WT02) 09:22 (WT02)	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19
12	08:44 16:39	09:16 (WT02) 09:23 (WT02)	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20
13	08:43 16:40	09:15 (WT02) 09:25 (WT02)	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22
14	08:43 16:42	09:14 (WT02) 09:26 (WT02)	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24
15	08:42 16:43	09:12 (WT02) 09:26 (WT02)	07:53 17:42	08:19 (WT01) 08:25 (WT01)	06:50 18:36	05:34 21:25
16	08:41 16:45	09:11 (WT02) 09:27 (WT02)	07:51 17:44	08:17 (WT01) 08:28 (WT01)	06:48 18:38	05:33 21:27
17	08:40 16:47	09:10 (WT02) 09:28 (WT02)	07:49 17:46	08:15 (WT01) 08:30 (WT01)	06:45 18:39	05:31 21:29
18	08:39 16:48	09:09 (WT02) 09:29 (WT02)	07:47 17:48	08:12 (WT01) 08:31 (WT01)	06:43 18:41	05:30 21:30
19	08:38 16:50	09:08 (WT02) 09:30 (WT02)	07:45 17:50	08:10 (WT01) 08:32 (WT01)	06:40 18:43	05:28 21:32
20	08:37 16:52	09:06 (WT02) 09:30 (WT02)	07:43 17:52	08:08 (WT01) 08:33 (WT01)	06:38 18:45	05:27 21:33
21	08:35 16:54	09:06 (WT02) 09:31 (WT02)	07:41 17:54	08:07 (WT01) 08:34 (WT01)	06:35 18:47	05:25 21:35
22	08:34 16:56	09:05 (WT02) 09:31 (WT02)	07:39 17:56	08:06 (WT01) 08:34 (WT01)	06:33 18:49	05:24 21:37
23	08:33 16:57	09:06 (WT02) 09:31 (WT02)	07:36 17:58	08:05 (WT01) 08:34 (WT01)	06:31 18:50	05:22 21:38
24	08:32 16:59	09:06 (WT02) 09:31 (WT02)	07:34 18:00	08:05 (WT01) 08:35 (WT01)	06:28 18:52	05:21 21:40
25	08:30 17:01	09:07 (WT02) 09:32 (WT02)	07:32 18:02	08:06 (WT01) 08:35 (WT01)	06:26 18:54	05:20 21:41
26	08:29 17:03	09:07 (WT02) 09:32 (WT02)	07:30 18:04	08:05 (WT01) 08:34 (WT01)	06:23 18:56	05:19 21:42
27	08:27 17:05	09:08 (WT02) 09:32 (WT02)	07:27 18:05	08:05 (WT01) 08:34 (WT01)	06:21 18:58	05:17 21:44
28	08:26 17:07	09:08 (WT02) 09:32 (WT02)	07:25 18:07	08:06 (WT01) 08:33 (WT01)	06:18 19:00	05:16 21:45
29	08:24 17:09	09:09 (WT02) 09:31 (WT02)		07:16 20:01	06:05 20:58	05:15 21:46
30	08:23 17:11	09:10 (WT02) 09:31 (WT02)		07:14 20:03	06:03 20:59	05:14 21:48
31	08:21 17:13	09:11 (WT02) 09:30 (WT02)		07:11 20:05		05:13 21:49
Potential sun hours	252	274	367	419	492	508
Total, worst case	412	364	99			
Sun reduction	0,19	0,26	0,30			
Oper. time red.	0,96	0,96	0,96			
Wind dir. red.	0,55	0,59	0,59			
Total reduction	0,10	0,15	0,17			
Total, real	41	54	17			

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 24 - Oostpolder 2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December	
1	05:08	05:47	06:41	07:33	07:30	08:24	08:58 (WT02)
	22:05	21:30	20:25	19:12	17:02	16:19	5 09:03 (WT02)
2	05:09	05:49	06:42	07:35	07:32	08:26	09:00 (WT02)
	22:05	21:29	20:22	19:10	17:00	16:18	3 09:03 (WT02)
3	05:10	05:51	06:44	07:37	07:34	08:27	
	22:04	21:27	20:20	19:07	16:59	16:18	
4	05:11	05:52	06:46	07:38	07:36	08:29	
	22:04	21:25	20:18	19:05	16:57	16:17	
5	05:11	05:54	06:48	07:40	07:38	08:30	
	22:03	21:23	20:15	19:02	16:55	16:16	
6	05:12	05:56	06:49	07:42	07:40	08:32	
	22:02	21:21	20:13	19:00	16:53	16:16	
7	05:13	05:57	06:51	07:44	07:42	08:33	
	22:02	21:19	20:10	18:58	16:51	16:15	
8	05:14	05:59	06:53	07:46	08:49 (WT01)	07:44	08:47 (WT02)
	22:01	21:17	20:08	18:55	8 08:57 (WT01)	16:49	8 08:55 (WT02)
9	05:15	06:01	06:55	07:47	08:46 (WT01)	07:46	08:44 (WT02)
	22:00	21:15	20:06	18:53	14 09:00 (WT01)	16:48	14 08:58 (WT02)
10	05:16	06:02	06:56	07:49	08:44 (WT01)	07:47	08:43 (WT02)
	22:00	21:13	20:03	18:51	18 09:02 (WT01)	16:46	17 09:00 (WT02)
11	05:17	06:04	06:58	07:51	08:42 (WT01)	07:49	08:42 (WT02)
	21:59	21:11	20:01	18:48	22 09:04 (WT01)	16:44	19 09:01 (WT02)
12	05:19	06:06	07:00	07:53	08:40 (WT01)	07:51	08:41 (WT02)
	21:58	21:09	19:58	18:46	24 09:04 (WT01)	16:42	21 09:02 (WT02)
13	05:20	06:08	07:01	07:55	08:39 (WT01)	07:53	08:41 (WT02)
	21:57	21:07	19:56	18:44	26 09:05 (WT01)	16:41	22 09:03 (WT02)
14	05:21	06:09	07:03	07:56	08:38 (WT01)	07:55	08:40 (WT02)
	21:56	21:05	19:54	18:41	28 09:06 (WT01)	16:39	24 09:04 (WT02)
15	05:22	06:11	07:05	07:58	08:37 (WT01)	07:57	08:40 (WT02)
	21:55	21:03	19:51	18:39	29 09:06 (WT01)	16:38	24 09:04 (WT02)
16	05:24	06:13	07:07	08:00	08:37 (WT01)	07:59	08:40 (WT02)
	21:54	21:01	19:49	18:37	29 09:06 (WT01)	16:36	25 09:05 (WT02)
17	05:25	06:15	07:08	08:02	08:37 (WT01)	08:00	08:40 (WT02)
	21:53	20:59	19:46	18:34	29 09:06 (WT01)	16:35	25 09:05 (WT02)
18	05:26	06:16	07:10	08:04	08:37 (WT01)	08:02	08:40 (WT02)
	21:51	20:57	19:44	18:32	29 09:06 (WT01)	16:33	25 09:05 (WT02)
19	05:28	06:18	07:12	08:06	08:37 (WT01)	08:04	08:40 (WT02)
	21:50	20:54	19:41	18:30	28 09:05 (WT01)	16:32	25 09:05 (WT02)
20	05:29	06:20	07:14	08:08	08:37 (WT01)	08:06	08:40 (WT02)
	21:49	20:52	19:39	18:28	28 09:05 (WT01)	16:31	26 09:06 (WT02)
21	05:30	06:21	07:15	08:09	08:38 (WT01)	08:08	08:41 (WT02)
	21:48	20:50	19:36	18:25	26 09:04 (WT01)	16:29	25 09:06 (WT02)
22	05:32	06:23	07:17	08:11	08:39 (WT01)	08:09	08:42 (WT02)
	21:46	20:48	19:34	18:23	24 09:03 (WT01)	16:28	24 09:06 (WT02)
23	05:33	06:25	07:19	08:13	08:41 (WT01)	08:11	08:44 (WT02)
	21:45	20:46	19:31	18:21	21 09:02 (WT01)	16:27	22 09:06 (WT02)
24	05:35	06:27	07:21	08:15	08:43 (WT01)	08:13	08:46 (WT02)
	21:43	20:43	19:29	18:19	18 09:01 (WT01)	16:26	20 09:06 (WT02)
25	05:36	06:28	07:22	07:17	07:45 (WT01)	08:15	08:48 (WT02)
	21:42	20:41	19:27	17:17	14 07:59 (WT01)	16:25	18 09:06 (WT02)
26	05:38	06:30	07:24	07:19	07:47 (WT01)	08:16	08:50 (WT02)
	21:40	20:39	19:24	17:15	10 07:57 (WT01)	16:23	16 09:06 (WT02)
27	05:39	06:32	07:26	07:21	07:49 (WT01)	08:18	08:52 (WT02)
	21:39	20:36	19:22	17:13	4 07:53 (WT01)	16:22	14 09:06 (WT02)
28	05:41	06:34	07:28	07:23		08:20	08:53 (WT02)
	21:37	20:34	19:19	17:10		16:22	12 09:05 (WT02)
29	05:43	06:35	07:29	07:25		08:21	08:55 (WT02)
	21:35	20:32	19:17	17:08		16:21	10 09:05 (WT02)
30	05:44	06:37	07:31	07:26		08:23	08:57 (WT02)
	21:34	20:30	19:14	17:06		16:20	7 09:04 (WT02)
31	05:46	06:39		07:28			08:49
	21:32	20:27		17:04			16:23
Potential sun hours	510	458	382	329	261		236
Total, worst case				429		443	8
Sun reduction				0,30		0,22	0,17
Oper. time red.				0,96		0,96	0,96
Wind dir. red.				0,59		0,55	0,55
Total reduction				0,17		0,11	0,09
Total, real				73		51	1

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 25 - Oostpolder 6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June
1	08:49 16:24	10:38 (WT01) 11:36 (WT01)	08:19 17:14	11:02 (WT01) 18:09	07:23 20:07	06:01 21:01
2	08:49 16:25	10:39 (WT01) 11:37 (WT01)	08:18 17:16	11:04 (WT01) 18:11	07:21 20:09	05:59 21:03
3	08:49 16:26	10:39 (WT01) 11:38 (WT01)	08:16 17:18	11:08 (WT01) 18:13	07:18 20:10	05:56 21:05
4	08:48 16:27	10:39 (WT01) 11:38 (WT01)	08:14 17:20	11:23 (WT01) 18:15	07:16 20:12	05:55 21:06
5	08:48 16:29	10:40 (WT01) 11:39 (WT01)	08:13 17:22	11:31 (WT01) 18:17	07:14 20:14	06:59 21:08
6	08:48 16:30	10:40 (WT01) 11:39 (WT01)	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10
7	08:47 16:31	10:41 (WT01) 11:40 (WT01)	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12
8	08:47 16:33	10:42 (WT01) 11:40 (WT01)	08:07 17:28	07:07 18:23	06:52 20:19	05:47 21:14
9	08:46 16:34	10:42 (WT01) 11:40 (WT01)	08:05 17:30	07:04 18:24	06:50 20:21	05:45 21:15
10	08:46 16:36	10:42 (WT01) 11:40 (WT01)	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17
11	08:45 16:37	10:42 (WT01) 11:40 (WT01)	08:01 17:34	06:59 18:28	06:45 20:25	05:41 21:19
12	08:44 16:39	10:44 (WT01) 11:41 (WT01)	07:59 17:36	06:57 18:30	06:43 20:27	05:40 21:20
13	08:43 16:40	10:44 (WT01) 11:42 (WT01)	07:57 17:38	06:55 18:32	06:40 20:29	05:38 21:22
14	08:43 16:42	10:45 (WT01) 11:42 (WT01)	07:55 17:40	06:52 18:34	06:38 20:30	05:36 21:24
15	08:42 16:43	10:45 (WT01) 11:41 (WT01)	07:53 17:42	06:50 18:36	06:36 20:32	05:34 21:25
16	08:41 16:45	10:45 (WT01) 11:41 (WT01)	07:51 17:44	06:48 18:37	06:33 20:34	05:33 21:27
17	08:40 16:47	10:46 (WT01) 11:42 (WT01)	07:49 17:46	06:45 18:39	06:31 20:36	05:31 21:29
18	08:39 16:48	10:47 (WT01) 11:42 (WT01)	07:47 17:48	06:43 18:41	06:29 20:38	05:30 21:30
19	08:38 16:50	10:48 (WT01) 11:42 (WT01)	07:45 17:50	06:40 18:43	06:26 20:39	05:28 21:32
20	08:36 16:52	10:48 (WT01) 11:42 (WT01)	07:43 17:52	06:38 18:45	06:24 20:41	05:27 21:33
21	08:35 16:54	10:49 (WT01) 11:42 (WT01)	07:41 17:54	06:35 18:47	06:22 20:43	05:25 21:35
22	08:34 16:55	10:49 (WT01) 11:41 (WT01)	07:39 17:56	06:33 18:49	06:20 20:45	05:24 21:36
23	08:33 16:57	10:50 (WT01) 11:41 (WT01)	07:36 17:58	06:31 18:50	06:18 20:47	05:22 21:38
24	08:31 16:59	10:51 (WT01) 11:40 (WT01)	07:34 18:00	06:28 18:52	06:15 20:49	05:21 21:39
25	08:30 17:01	10:52 (WT01) 11:40 (WT01)	07:32 18:02	06:26 18:54	06:13 20:50	05:20 21:41
26	08:29 17:03	10:53 (WT01) 11:39 (WT01)	07:30 18:03	06:23 18:56	06:11 20:52	05:18 21:42
27	08:27 17:05	10:55 (WT01) 11:39 (WT01)	07:27 18:05	06:21 18:58	06:09 20:54	05:17 21:44
28	08:26 17:07	10:55 (WT01) 11:38 (WT01)	07:25 18:07	06:18 18:59	06:07 20:56	05:16 21:45
29	08:24 17:09	10:56 (WT01) 11:36 (WT01)		07:16 20:01	06:05 20:58	05:15 21:46
30	08:23 17:11	10:59 (WT01) 11:36 (WT01)		07:14 20:03	06:03 20:59	05:14 21:48
31	08:21 17:12	11:00 (WT01) 11:34 (WT01)		07:11 20:05		05:13 21:49
Potential sun hours	252	274	367	419	492	508
Total, worst case	1643	68				
Sun reduction	0,19	0,26				
Oper. time red.	0,96	0,96				
Wind dir. red.	0,59	0,59				
Total reduction	0,11	0,15				
Total, real	174	10				

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 25 - Oostpolder 6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December
1	05:08	05:47	06:41	07:33	07:30	08:24
	22:05	21:30	20:25	19:12	17:02	16:19
2	05:09	05:49	06:42	07:35	07:32	08:26
	22:04	21:29	20:22	19:10	17:00	16:18
3	05:10	05:51	06:44	07:36	07:34	08:27
	22:04	21:27	20:20	19:07	16:58	16:17
4	05:11	05:52	06:46	07:38	07:36	08:29
	22:04	21:25	20:18	19:05	16:57	16:17
5	05:11	05:54	06:48	07:40	07:38	08:30
	22:03	21:23	20:15	19:02	16:55	16:16
6	05:12	05:56	06:49	07:42	07:40	08:31
	22:02	21:21	20:13	19:00	16:53	16:16
7	05:13	05:57	06:51	07:44	07:42	08:33
	22:02	21:19	20:10	18:58	16:51	16:15
8	05:14	05:59	06:53	07:45	07:44	10:38 (WT01)
	22:01	21:17	20:08	18:55	16:49	17 10:55 (WT01)
9	05:15	06:01	06:55	07:47	07:45	10:35 (WT01)
	22:00	21:15	20:06	18:53	16:47	24 10:59 (WT01)
10	05:16	06:02	06:56	07:49	07:47	10:33 (WT01)
	22:00	21:13	20:03	18:50	16:46	29 11:02 (WT01)
11	05:17	06:04	06:58	07:51	07:49	10:31 (WT01)
	21:59	21:11	20:01	18:48	16:44	34 11:05 (WT01)
12	05:19	06:06	07:00	07:53	07:51	10:29 (WT01)
	21:58	21:09	19:58	18:46	16:42	38 11:07 (WT01)
13	05:20	06:08	07:01	07:55	07:53	10:28 (WT01)
	21:57	21:07	19:56	18:43	16:41	40 11:08 (WT01)
14	05:21	06:09	07:03	07:56	07:55	10:27 (WT01)
	21:56	21:05	19:53	18:41	16:39	43 11:10 (WT01)
15	05:22	06:11	07:05	07:58	07:57	10:26 (WT01)
	21:55	21:03	19:51	18:39	16:38	45 11:11 (WT01)
16	05:23	06:13	07:07	08:00	07:59	10:26 (WT01)
	21:54	21:01	19:49	18:37	16:36	46 11:12 (WT01)
17	05:25	06:14	07:08	08:02	08:00	10:25 (WT01)
	21:53	20:59	19:46	18:34	16:35	48 11:13 (WT01)
18	05:26	06:16	07:10	08:04	08:02	10:25 (WT01)
	21:51	20:57	19:44	18:32	16:33	49 11:14 (WT01)
19	05:27	06:18	07:12	08:06	08:04	10:24 (WT01)
	21:50	20:54	19:41	18:30	16:32	51 11:15 (WT01)
20	05:29	06:20	07:14	08:07	08:06	10:24 (WT01)
	21:49	20:52	19:39	18:28	16:31	52 11:16 (WT01)
21	05:30	06:21	07:15	08:09	08:08	10:24 (WT01)
	21:47	20:50	19:36	18:25	16:29	53 11:17 (WT01)
22	05:32	06:23	07:17	08:11	08:09	10:24 (WT01)
	21:46	20:48	19:34	18:23	16:28	54 11:18 (WT01)
23	05:33	06:25	07:19	08:13	08:11	10:24 (WT01)
	21:45	20:46	19:31	18:21	16:27	54 11:18 (WT01)
24	05:35	06:27	07:21	08:15	08:13	10:24 (WT01)
	21:43	20:43	19:29	18:19	16:26	55 11:19 (WT01)
25	05:36	06:28	07:22	07:17	08:15	10:24 (WT01)
	21:42	20:41	19:27	17:17	16:25	56 11:20 (WT01)
26	05:38	06:30	07:24	07:19	08:16	10:25 (WT01)
	21:40	20:39	19:24	17:15	16:23	56 11:21 (WT01)
27	05:39	06:32	07:26	07:21	08:18	10:25 (WT01)
	21:39	20:36	19:22	17:13	16:22	56 11:21 (WT01)
28	05:41	06:34	07:28	07:23	08:20	10:24 (WT01)
	21:37	20:34	19:19	17:10	16:21	57 11:21 (WT01)
29	05:42	06:35	07:29	07:24	08:21	10:25 (WT01)
	21:35	20:32	19:17	17:08	16:21	57 11:22 (WT01)
30	05:44	06:37	07:31	07:26	08:23	10:25 (WT01)
	21:34	20:29	19:14	17:06	16:20	58 11:23 (WT01)
31	05:46	06:39		07:28		08:49
	21:32	20:27		17:04		16:23
Potential sun hours	510	458	382	329	261	236
Total, worst case					1072	1805
Sun reduction					0,22	0,17
Oper. time red.					0,96	0,96
Wind dir. red.					0,59	0,59
Total reduction					0,12	0,10
Total, real					132	172

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

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



### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 26 - Oostpolder 7  
 Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

Operational time  
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:49	09:39 (WT03)	08:19	08:48 (WT02)	07:23	07:09
	16:24	29 10:08 (WT03)	17:14	25 09:13 (WT02)	18:09	20:07 41 08:36 (WT01)
2	08:49	09:40 (WT03)	08:18	08:47 (WT02)	07:21	07:06 08:36 (WT01)
	16:25	28 10:08 (WT03)	17:16	27 09:14 (WT02)	18:11	20:09 40 08:36 (WT01)
3	08:49	09:41 (WT03)	08:16	08:45 (WT02)	07:18	07:04 07:55 (WT01)
	16:26	28 10:09 (WT03)	17:18	30 09:15 (WT02)	18:13	20:10 39 08:34 (WT01)
4	08:48	09:41 (WT03)	08:14	08:45 (WT02)	07:16	07:02 07:56 (WT01)
	16:27	28 10:09 (WT03)	17:20	31 09:16 (WT02)	18:15	20:12 37 08:33 (WT01)
5	08:48	09:42 (WT03)	08:13	08:44 (WT02)	07:14	06:59 07:57 (WT01)
	16:29	28 10:10 (WT03)	17:22	32 09:16 (WT02)	18:17	20:14 36 08:33 (WT01)
6	08:48	09:42 (WT03)	08:11	08:44 (WT02)	07:11	06:57 07:57 (WT01)
	16:30	27 10:09 (WT03)	17:24	34 09:18 (WT02)	18:19	20:16 33 08:30 (WT01)
7	08:47	09:43 (WT03)	08:09	08:44 (WT02)	07:09	06:54 07:58 (WT01)
	16:31	27 10:10 (WT03)	17:26	35 09:19 (WT02)	18:21	20:18 31 08:29 (WT01)
8	08:47	09:44 (WT03)	08:07	08:44 (WT02)	07:07	06:52 07:59 (WT01)
	16:33	26 10:10 (WT03)	17:28	35 09:19 (WT02)	18:23	20:20 28 08:27 (WT01)
9	08:46	09:44 (WT03)	08:05	08:43 (WT02)	07:04	06:50 08:00 (WT01)
	16:34	26 10:10 (WT03)	17:30	37 09:20 (WT02)	18:24	20:21 24 08:24 (WT01)
10	08:46	09:45 (WT03)	08:03	08:42 (WT02)	07:02	06:47 08:02 (WT01)
	16:36	25 10:10 (WT03)	17:32	37 09:19 (WT02)	18:26	20:23 20 08:22 (WT01)
11	08:45	09:45 (WT03)	08:01	08:42 (WT02)	07:00	06:45 08:05 (WT01)
	16:37	25 10:10 (WT03)	17:34	37 09:19 (WT02)	18:28	20:25 14 08:19 (WT01)
12	08:44	09:47 (WT03)	07:59	08:43 (WT02)	06:57	06:43 05:40
	16:39	23 10:10 (WT03)	17:36	36 09:19 (WT02)	18:30	20:27 21:20
13	08:43	09:48 (WT03)	07:57	08:43 (WT02)	06:55	06:40 05:38
	16:40	22 10:10 (WT03)	17:38	36 09:19 (WT02)	18:32	20:29 21:22
14	08:43	09:49 (WT03)	07:55	08:43 (WT02)	06:52	06:38 05:36
	16:42	21 10:10 (WT03)	17:40	36 09:19 (WT02)	18:34	20:30 21:24
15	08:42	09:49 (WT03)	07:53	08:44 (WT02)	06:50	06:36 05:34
	16:43	19 10:08 (WT03)	17:42	34 09:18 (WT02)	18:36	20:32 21:25
16	08:41	09:51 (WT03)	07:51	08:45 (WT02)	06:48	06:33 05:33
	16:45	17 10:08 (WT03)	17:44	33 09:18 (WT02)	18:38	20:34 21:27
17	08:40	09:53 (WT03)	07:49	08:45 (WT02)	06:45	07:14 (WT01) 06:31
	16:47	13 10:06 (WT03)	17:46	32 09:17 (WT02)	18:39	15 07:29 (WT01) 20:36
18	08:39	09:55 (WT03)	07:47	08:45 (WT02)	06:43	07:10 (WT01) 06:29
	16:48	10 10:05 (WT03)	17:48	31 09:16 (WT02)	18:41	21 07:31 (WT01) 20:38
19	08:38	09:59 (WT03)	07:45	08:47 (WT02)	06:40	07:08 (WT01) 06:26
	16:50	3 10:02 (WT03)	17:50	28 09:15 (WT02)	18:43	26 07:34 (WT01) 20:39
20	08:36		07:43	08:48 (WT02)	06:38	07:05 (WT01) 06:24
	16:52		17:52	25 09:13 (WT02)	18:45	29 07:34 (WT01) 20:41
21	08:35		07:41	08:50 (WT02)	06:35	07:04 (WT01) 06:22
	16:54		17:54	21 09:11 (WT02)	18:47	32 07:36 (WT01) 20:43
22	08:34		07:39	08:51 (WT02)	06:33	07:02 (WT01) 06:20
	16:56		17:56	17 09:08 (WT02)	18:49	34 07:36 (WT01) 20:45
23	08:33		07:36	08:54 (WT02)	06:31	07:01 (WT01) 06:18
	16:57		17:58	11 09:05 (WT02)	18:50	36 07:37 (WT01) 20:47
24	08:31		07:34		06:28	07:00 (WT01) 06:15
	16:59		18:00		18:52	38 07:38 (WT01) 20:49
25	08:30		07:32		06:26	06:58 (WT01) 06:13
	17:01		18:02		18:54	40 07:38 (WT01) 20:50
26	08:29		07:30		06:23	06:58 (WT01) 06:11
	17:03		18:04		18:56	41 07:39 (WT01) 20:52
27	08:27		07:27		06:21	06:57 (WT01) 06:09
	17:05		18:05		18:58	41 07:38 (WT01) 20:54
28	08:26		08:55 (WT02)		06:18	06:56 (WT01) 06:07
	17:07	10 09:05 (WT02)	18:07		18:59	42 07:38 (WT01) 20:56
29	08:24		08:53 (WT02)		07:16	07:55 (WT01) 06:05
	17:09	14 09:07 (WT02)			20:01	42 08:37 (WT01) 20:58
30	08:23		08:51 (WT02)		07:14	07:56 (WT01) 06:03
	17:11	19 09:10 (WT02)			20:03	41 08:37 (WT01) 20:59
31	08:21		08:49 (WT02)		07:11	07:56 (WT01)
	17:13	23 09:12 (WT02)			20:05	41 08:37 (WT01)
Potential sun hours	252	274	367	419	492	508
Total, worst case	491	700	519	343		
Sun reduction	0,19	0,26	0,30	0,37		
Oper. time red.	0,96	0,96	0,96	0,96		
Wind dir. red.	0,58	0,58	0,62	0,62		
Total reduction	0,10	0,14	0,18	0,22		
Total, real	51	101	91	76		

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

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

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 26 - Oostpolder 7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December
1	05:08	05:47	06:41	08:04 (WT01)	07:33	07:30
	22:05	21:30	20:25	14 08:18 (WT01)	19:12	08:12 (WT02)
2	05:09	05:49	06:42	08:00 (WT01)	07:35	17:02 36 08:48 (WT02)
	22:04	21:29	20:22	20 08:20 (WT01)	19:10	07:32 08:12 (WT02)
3	05:10	05:51	06:44	07:58 (WT01)	07:37	17:00 36 08:48 (WT02)
	22:04	21:27	20:20	24 08:22 (WT01)	19:07	07:34 08:12 (WT02)
4	05:11	05:52	06:46	07:56 (WT01)	07:38	16:59 36 08:48 (WT02)
	22:04	21:25	20:18	28 08:24 (WT01)	19:05	07:36 08:14 (WT02)
5	05:11	05:54	06:48	07:54 (WT01)	07:40	16:57 34 08:48 (WT02)
	22:03	21:23	20:15	31 08:25 (WT01)	19:02	07:38 08:14 (WT02)
6	05:12	05:56	06:49	07:53 (WT01)	07:42	16:55 34 08:48 (WT02)
	22:02	21:21	20:13	33 08:26 (WT01)	19:00	07:40 08:15 (WT02)
7	05:13	05:57	06:51	07:52 (WT01)	07:44	16:53 32 08:47 (WT02)
	22:02	21:19	20:10	36 08:28 (WT01)	18:58	07:42 08:15 (WT02)
8	05:14	05:59	06:53	07:50 (WT01)	07:45	16:51 31 08:46 (WT02)
	22:01	21:17	20:08	38 08:28 (WT01)	18:55	07:44 08:16 (WT02)
9	05:15	06:01	06:55	07:49 (WT01)	07:47	16:49 30 08:46 (WT02)
	22:00	21:15	20:06	39 08:28 (WT01)	18:53	07:45 08:17 (WT02)
10	05:16	06:02	06:56	07:49 (WT01)	07:49	16:48 28 08:45 (WT02)
	22:00	21:13	20:03	40 08:29 (WT01)	18:51	07:47 08:19 (WT02)
11	05:17	06:04	06:58	07:47 (WT01)	07:51	16:46 25 08:44 (WT02)
	21:59	21:11	20:01	41 08:28 (WT01)	18:48	07:49 08:20 (WT02)
12	05:19	06:06	07:00	07:47 (WT01)	07:53	16:44 23 08:43 (WT02)
	21:58	21:09	19:58	42 08:29 (WT01)	18:46	07:51 08:22 (WT02)
13	05:20	06:08	07:01	07:47 (WT01)	07:55	16:42 19 08:41 (WT02)
	21:57	21:07	19:56	42 08:29 (WT01)	18:44	16:42 19 08:41 (WT02)
14	05:21	06:09	07:03	07:47 (WT01)	07:56	16:41 14 08:39 (WT02)
	21:56	21:05	19:53	42 08:29 (WT01)	18:41	16:41 14 08:39 (WT02)
15	05:22	06:11	07:05	07:46 (WT01)	07:58	16:41 8 08:36 (WT02)
	21:55	21:03	19:51	42 08:28 (WT01)	18:39	16:41 29 10:00 (WT03)
16	05:24	06:13	07:07	07:46 (WT01)	08:00	16:38 08:42 09:32 (WT03)
	21:54	21:01	19:49	41 08:27 (WT01)	18:37	16:14 28 10:00 (WT03)
17	05:25	06:15	07:08	07:46 (WT01)	08:02	16:36 08:43 09:32 (WT03)
	21:53	20:59	19:46	41 08:27 (WT01)	18:34	16:14 29 10:01 (WT03)
18	05:26	06:16	07:10	07:46 (WT01)	08:04	16:35 08:43 09:32 (WT03)
	21:51	20:57	19:44	40 08:26 (WT01)	18:32	16:14 29 10:01 (WT03)
19	05:28	06:18	07:12	07:46 (WT01)	08:06	16:33 08:04 09:24 (WT02)
	21:50	20:54	19:41	39 08:25 (WT01)	18:30	16:33 08:04 09:24 (WT02)
20	05:29	06:20	07:14	07:47 (WT01)	08:08	16:32 13 09:21 (WT02)
	21:49	20:52	19:39	37 08:24 (WT01)	18:28	16:32 13 09:21 (WT02)
21	05:30	06:21	07:15	07:47 (WT01)	08:09	16:31 19 09:40 (WT02)
	21:48	20:50	19:36	35 08:22 (WT01)	18:25	16:31 19 09:40 (WT02)
22	05:32	06:23	07:17	07:48 (WT01)	08:11	16:29 23 09:42 (WT02)
	21:46	20:48	19:34	33 08:21 (WT01)	18:23	16:29 23 09:42 (WT02)
23	05:33	06:25	07:19	07:49 (WT01)	08:13	16:28 26 09:44 (WT02)
	21:45	20:46	19:31	30 08:19 (WT01)	18:21	16:28 26 09:44 (WT02)
24	05:35	06:27	07:21	07:51 (WT01)	08:15	16:27 3 09:38 (WT03)
	21:43	20:43	19:29	27 08:18 (WT01)	18:19	16:27 3 09:38 (WT03)
25	05:36	06:28	07:22	07:52 (WT01)	07:17	16:26 10 09:42 (WT03)
	21:42	20:41	19:27	23 08:15 (WT01)	17:17	16:26 10 09:42 (WT03)
26	05:38	06:30	07:24	07:55 (WT01)	07:19	16:25 13 09:44 (WT03)
	21:40	20:39	19:24	17 08:12 (WT01)	17:15	16:25 13 09:44 (WT03)
27	05:39	06:32	07:26	07:59 (WT01)	07:21	16:24 17 09:47 (WT03)
	21:39	20:36	19:22	9 08:08 (WT01)	17:13	16:24 17 09:47 (WT03)
28	05:41	06:34	07:28	07:23	08:13 (WT02)	16:23 34 08:48 (WT02)
	21:37	20:34	19:19	35 08:48 (WT02)	16:22	16:23 34 08:48 (WT02)
29	05:43	06:35	07:29	07:25	08:12 (WT02)	16:22 19 09:48 (WT03)
	21:35	20:32	19:17	37 08:49 (WT02)	16:21	16:22 19 09:48 (WT03)
30	05:44	06:37	07:31	07:26	08:12 (WT02)	16:21 22 09:50 (WT03)
	21:34	20:29	19:14	37 08:49 (WT02)	16:20	16:21 22 09:50 (WT03)
31	05:46	06:39		07:28	08:12 (WT02)	16:20 23 09:51 (WT03)
	21:32	20:27		37 08:49 (WT02)		16:20 23 09:51 (WT03)
Potential sun hours	510	458	382	329	261	236
Total, worst case			884	386	514	872
Sun reduction			0,34	0,30	0,22	0,17
Oper. time red.			0,96	0,96	0,96	0,96
Wind dir. red.			0,62	0,58	0,58	0,58
Total reduction			0,20	0,16	0,12	0,09
Total, real			177	64	61	81

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

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

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 27 - Polen 3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	
1	08:49 16:24	08:19 17:15	07:23 18:09	07:09 20:07	06:01 21:01	05:12 21:50	
2	08:49 16:25	08:18 17:16	07:21 18:11	07:06 20:09	05:59 21:03	05:11 21:51	
3	08:49 16:26	08:16 17:18	07:18 18:13	07:04 20:10	05:57 21:05	05:10 21:53	
4	08:48 16:27	08:14 17:20	07:16 18:15	07:02 20:12	05:55 21:07	05:10 21:54	
5	08:48 16:29	08:13 17:22	07:14 18:17	06:59 20:14	05:53 21:08	05:09 21:55	
6	08:48 16:30	08:11 17:24	07:11 18:19	06:57 20:16	05:51 21:10	05:08 21:56	
7	08:47 16:31	08:09 17:26	07:09 18:21	06:54 20:18	05:49 21:12	05:07 21:57	
8	08:47 16:33	08:07 17:28	07:07 18:23	06:52 20:20	05:47 21:14	05:07 21:58	
9	08:46 16:34	08:05 17:30	07:04 18:25	06:50 20:21	05:45 21:15	05:06 21:59	
10	08:46 16:36	08:03 17:32	07:02 18:26	06:47 20:23	05:43 21:17	05:06 21:59	
11	08:45 16:37	08:01 17:34	07:00 18:28	06:45 20:25	05:41 21:19	05:05 22:00	
12	08:44 16:39	07:59 17:36	06:57 18:30	06:43 20:27	07:06 (WT02) 07:11 (WT02)	05:40 21:20	05:05 22:01
13	08:43 16:40	07:57 17:38	06:55 18:32	06:40 20:29	07:04 (WT02) 07:12 (WT02)	05:38 21:22	05:05 22:02
14	08:43 16:42	07:55 17:40	06:52 18:34	06:38 20:30	07:02 (WT02) 07:14 (WT02)	05:36 21:24	05:04 22:02
15	08:42 16:43	07:53 17:42	06:50 18:36	06:36 20:32	07:00 (WT02) 07:15 (WT02)	05:35 21:25	05:04 22:03
16	08:41 16:45	07:51 17:44	06:48 18:38	07:11 (WT03) 07:15 (WT03)	06:33 20:34	05:33 21:27	05:04 22:03
17	08:40 16:47	07:49 17:46	06:45 18:39	07:09 (WT03) 07:17 (WT03)	06:31 20:36	05:31 21:29	05:04 22:04
18	08:39 16:49	07:47 17:48	06:43 18:41	07:06 (WT03) 07:18 (WT03)	06:29 20:38	05:30 21:30	05:04 22:04
19	08:38 16:50	07:45 17:50	06:40 18:43	07:04 (WT03) 07:19 (WT03)	06:27 20:40	05:28 21:32	05:04 22:05
20	08:36 16:52	07:43 17:52	06:38 18:45	07:01 (WT03) 07:19 (WT03)	06:24 20:41	05:27 21:33	05:04 22:05
21	08:35 16:54	07:41 17:54	06:35 18:47	06:59 (WT03) 07:19 (WT03)	06:22 20:43	05:25 21:35	05:04 22:05
22	08:34 16:56	07:39 17:56	06:33 18:49	06:56 (WT03) 07:19 (WT03)	06:20 20:45	05:24 21:37	05:04 22:06
23	08:33 16:57	07:36 17:58	06:31 18:50	06:57 (WT03) 07:19 (WT03)	06:18 20:47	05:22 21:38	05:04 22:06
24	08:31 16:59	07:34 18:00	06:28 18:52	06:57 (WT03) 07:18 (WT03)	06:15 20:49	05:21 21:39	05:05 22:06
25	08:30 17:01	07:32 18:02	06:26 18:54	06:57 (WT03) 07:17 (WT03)	06:13 20:50	05:20 21:41	05:05 22:06
26	08:29 17:03	07:30 18:04	06:23 18:56	06:58 (WT03) 07:16 (WT03)	06:11 20:52	05:19 21:42	05:06 22:06
27	08:27 17:05	07:27 18:05	06:21 18:58	06:58 (WT03) 07:14 (WT03)	06:09 20:54	05:17 21:44	05:06 22:06
28	08:26 17:07	07:25 18:07	06:19 19:00	07:00 (WT03) 07:12 (WT03)	06:07 20:56	05:16 21:45	05:07 22:06
29	08:24 17:09		07:16 20:01	08:02 (WT03) 08:07 (WT03)	06:05 20:58	05:15 21:46	05:07 22:05
30	08:23 17:11		07:14 20:03		06:03 20:59	05:14 21:48	05:08 22:05
31	08:21 17:13		07:11 20:05			05:13 21:49	
Potential sun hours	252	274	367	419	492	508	
Total, worst case			214			230	
Sun reduction			0,30			0,37	
Oper. time red.			0,96			0,96	
Wind dir. red.			0,62			0,66	
Total reduction			0,18			0,23	
Total, real			38			54	

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

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

## SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines Shadow receptor: 27 - Polen 3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	July	August	September	October	November	December
1	05:08 22:05	05:47 21:30	06:41 20:25	07:33 19:12	07:30 17:02	08:24 16:19
2	05:09 22:04	05:49 21:29	06:42 20:22	07:35 19:10	07:32 17:00	08:26 16:18
3	05:10 22:04	05:51 21:27	06:44 20:20	07:37 19:07	07:34 16:59	08:27 16:18
4	05:11 22:04	05:52 21:25	06:46 20:18	07:38 19:05	07:36 16:57	08:29 16:17
5	05:11 22:03	05:54 21:23	06:48 20:15	07:40 19:02	07:38 16:55	08:30 16:16
6	05:12 22:02	05:56 21:21	06:49 20:13	07:42 19:00	07:40 16:53	08:32 16:16
7	05:13 22:02	05:57 21:19	06:51 20:11	07:44 18:58	07:42 16:51	08:33 16:15
8	05:14 22:01	05:59 21:17	06:53 20:08	07:46 18:55	07:44 16:49	08:34 16:15
9	05:15 22:00	06:01 21:15	06:55 20:06	07:47 18:53	07:46 16:48	08:35 16:15
10	05:16 22:00	06:03 21:13	06:56 20:03	07:49 18:51	07:47 16:46	08:37 16:14
11	05:18 21:59	06:04 21:11	06:58 20:01	07:51 18:48	07:49 16:44	08:38 16:14
12	05:19 21:58	06:06 21:09	07:00 19:58	07:53 18:46	07:51 16:43	08:39 16:14
13	05:20 21:57	06:08 21:07	07:02 19:56	07:55 18:44	07:53 16:41	08:40 16:14
14	05:21 21:56	06:09 21:05	07:03 19:54	07:55 (WT03) 07:57 (WT03)	07:56 18:41	07:55 16:39
15	05:22 21:55	06:11 21:03	07:05 19:51	07:50 (WT03) 08:01 (WT03)	07:58 18:39	07:57 16:38
16	05:24 21:54	06:13 21:01	07:07 19:49	07:48 (WT03) 08:03 (WT03)	08:00 18:37	07:59 16:36
17	05:25 21:53	06:15 20:59	07:08 19:46	07:46 (WT03) 08:04 (WT03)	08:02 18:34	08:00 16:35
18	05:26 21:51	06:16 20:57	07:10 19:44	07:44 (WT03) 08:04 (WT03)	08:04 18:32	08:02 16:33
19	05:28 21:50	06:18 20:54	07:12 19:41	07:44 (WT03) 08:05 (WT03)	08:06 18:30	08:04 16:32
20	05:29 21:49	06:20 20:52	07:14 19:39	07:43 (WT03) 08:05 (WT03)	08:08 18:28	08:06 16:31
21	05:30 21:48	06:22 20:50	07:15 19:36	07:42 (WT03) 08:04 (WT03)	08:09 18:25	08:08 16:29
22	05:32 21:46	06:23 20:48	07:17 19:34	07:43 (WT03) 08:04 (WT03)	08:11 18:23	08:09 16:28
23	05:33 21:45	06:25 20:46	07:19 19:32	07:45 (WT03) 08:04 (WT03)	08:13 18:21	08:11 16:27
24	05:35 21:43	06:27 20:43	07:21 19:29	07:47 (WT03) 08:03 (WT03)	08:15 18:19	08:13 16:26
25	05:36 21:42	06:28 20:41	07:22 19:27	07:48 (WT03) 08:01 (WT03)	07:17 17:17	08:15 16:25
26	05:38 21:40	06:30 20:39	07:24 19:24	07:50 (WT03) 08:00 (WT03)	07:19 17:15	08:16 16:24
27	05:39 21:39	06:32 20:36	07:26 19:22	07:52 (WT03) 07:58 (WT03)	07:21 17:13	08:18 16:23
28	05:41 21:37	06:34 20:34	07:28 19:19	07:23 17:11	08:20 16:22	08:49 16:20
29	05:43 21:35	06:35 20:32	07:29 19:17	07:25 17:08	08:21 16:21	08:49 16:21
30	05:44 21:34	06:37 20:30	07:31 19:14	07:26 17:06	08:23 16:20	08:49 16:22
31	05:46 21:32	06:39 20:27	07:06 (WT02) 07:11 (WT02)	07:28 17:04	08:49 16:23	08:49 16:23
Potential sun hours	510	458	382	329	261	236
Total, worst case		232	216			
Sun reduction		0,41	0,34			
Oper. time red.		0,96	0,96			
Wind dir. red.		0,66	0,62			
Total reduction		0,26	0,20			
Total, real		60	43			

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

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

### SHADOW - Calendar

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbinesShadow receptor: 28 - Vierhuizerweg 4a  
 Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:49	08:19	07:23	07:09	06:01	05:12	05:08	05:47	06:41	07:33	07:30	08:24
	16:24	17:15	18:09	20:07	21:01	21:50	22:05	21:30	20:25	19:12	17:02	16:19
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	17:07	18:07	18:59	20:56	21:45	22:06	21:37	20:34	19:19	18:11	16:22	16:20
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	17:11	18:11	19:03	20:59	21:48	22:05	21:34	20:29	19:14	18:06	17:00	16:22
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	17:13	18:13	19:05	21:01	21:49	22:06	21:32	20:27	19:12	18:04	17:01	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbinesShadow receptor: 29 - Vierhuizerweg 4  
 Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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

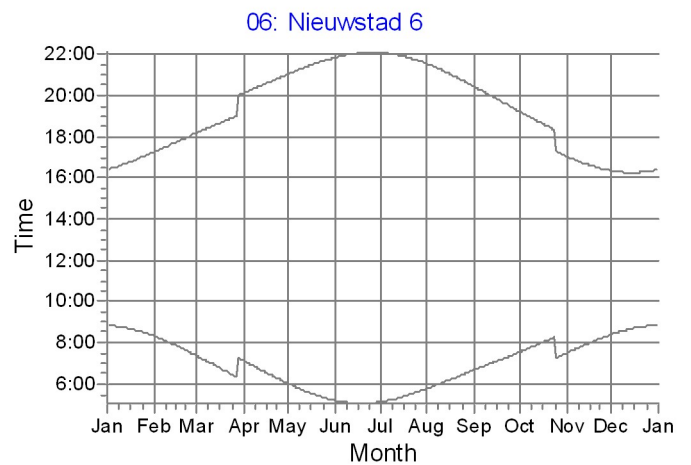
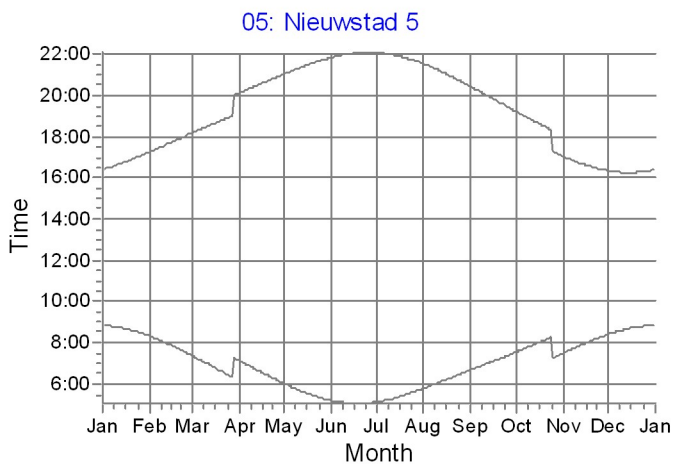
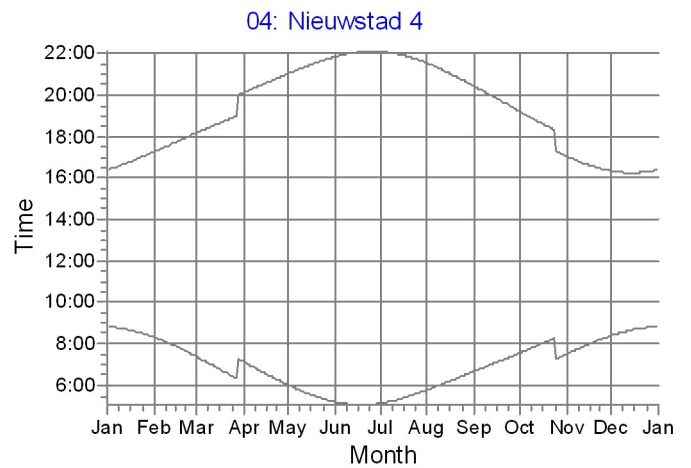
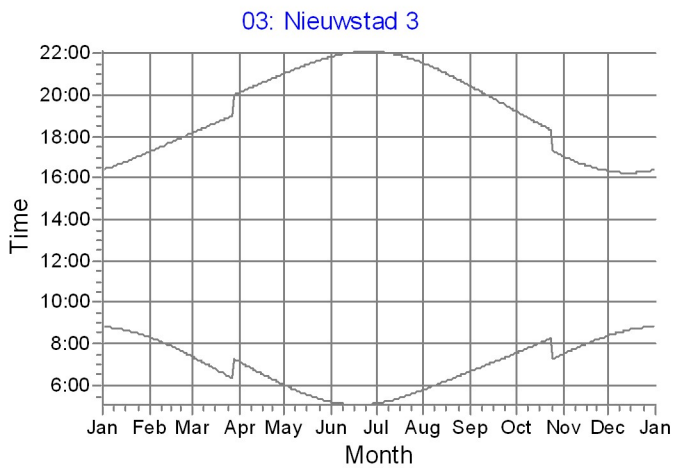
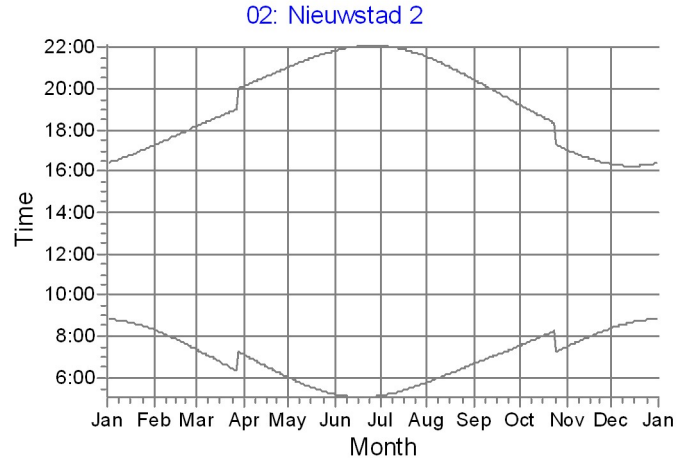
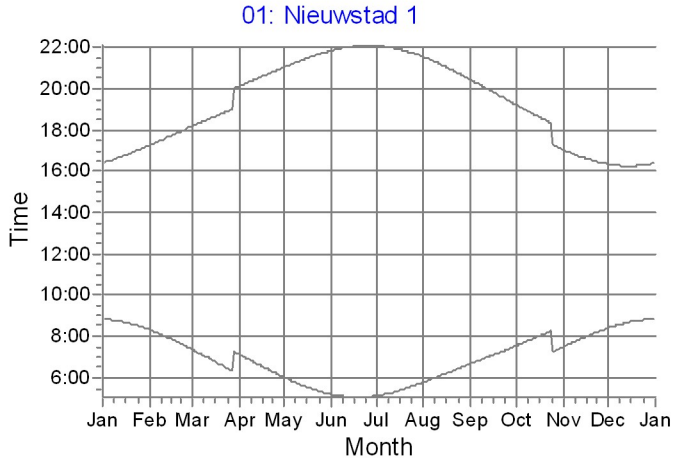
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2	08:49	08:18	07:21	07:06	05:59	05:11	05:09	05:49	06:42	07:35	07:32	08:26
	16:25	17:16	18:11	20:09	21:03	21:51	22:04	21:29	20:22	19:10	17:01	16:18
3	08:49	08:16	07:18	07:04	05:57	05:10	05:10	05:51	06:44	07:37	07:34	08:27
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	17:13	18:13	19:06	20:55	21:44	22:01	21:32	20:27	19:12	18:04	17:04	16:23
Potential sun hours	252	274	367	419	492	507	510	458	382	329	261	236
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

## SHADOW - Calendar, graphical

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines

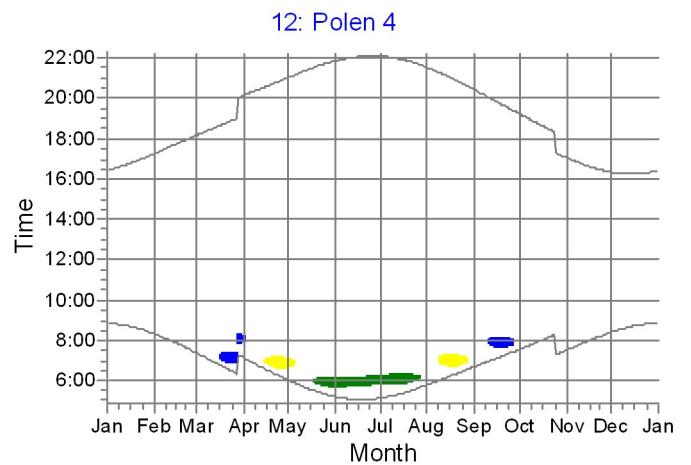
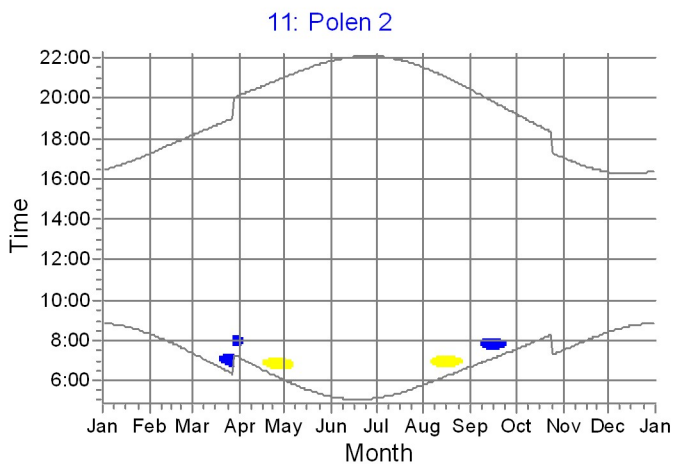
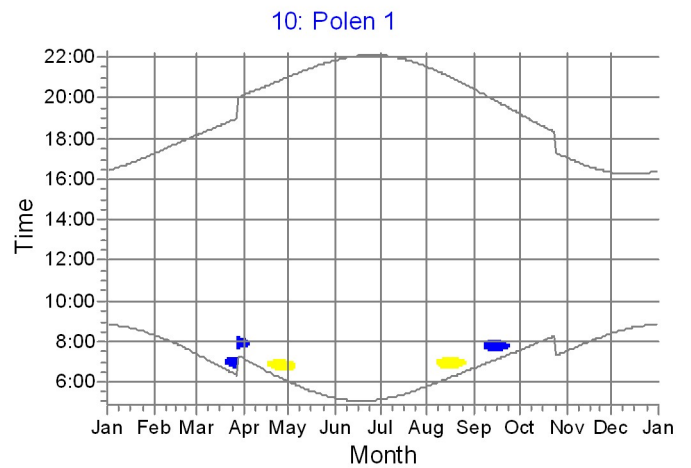
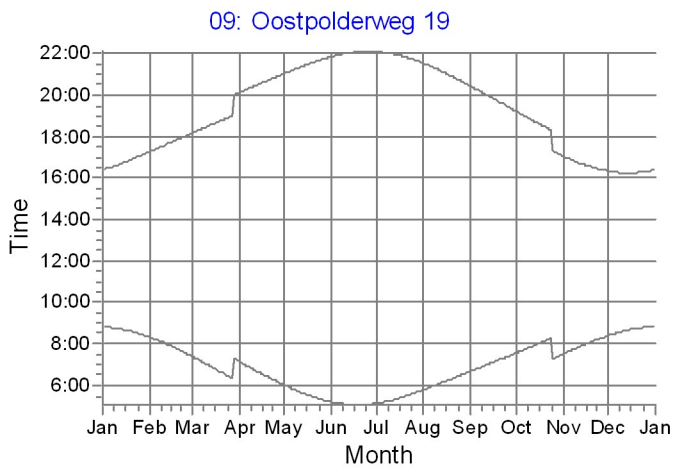
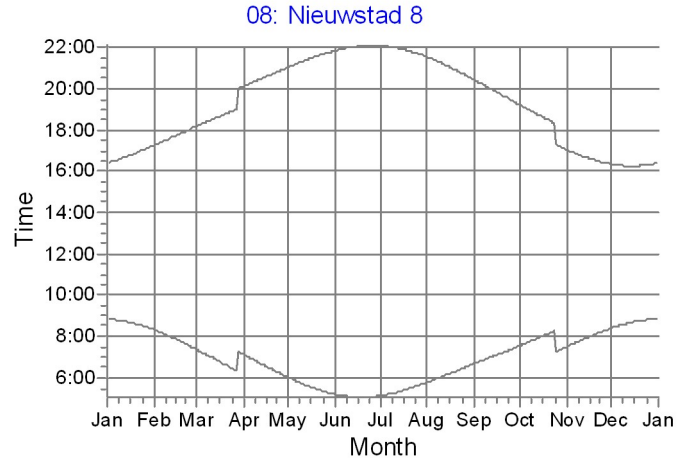
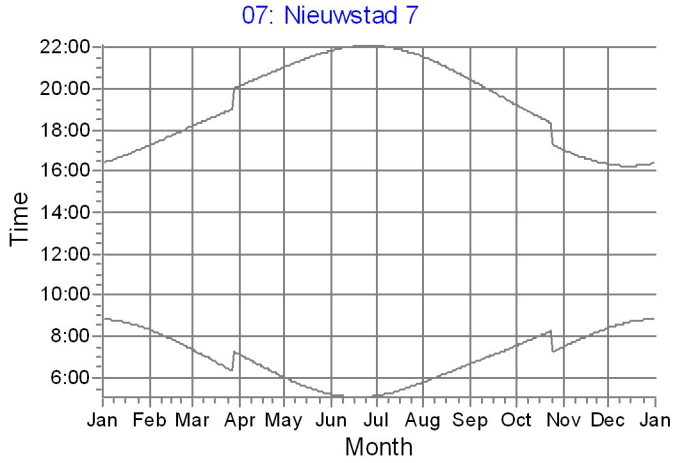


WTGs



## SHADOW - Calendar, graphical

Calculation: Windpark Oostpolderdijk - klasse 3 MW turbines

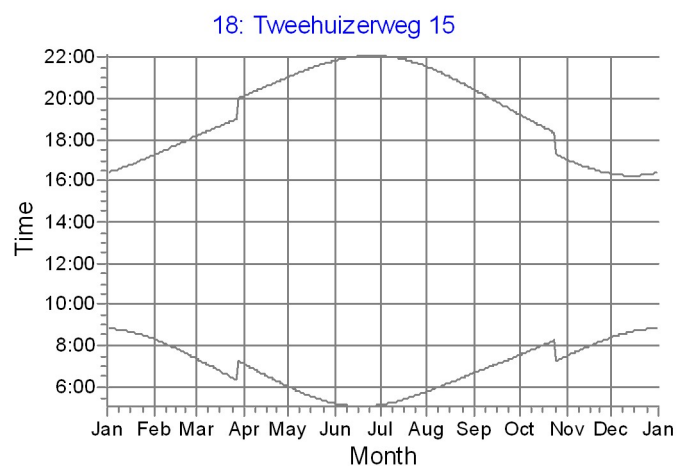
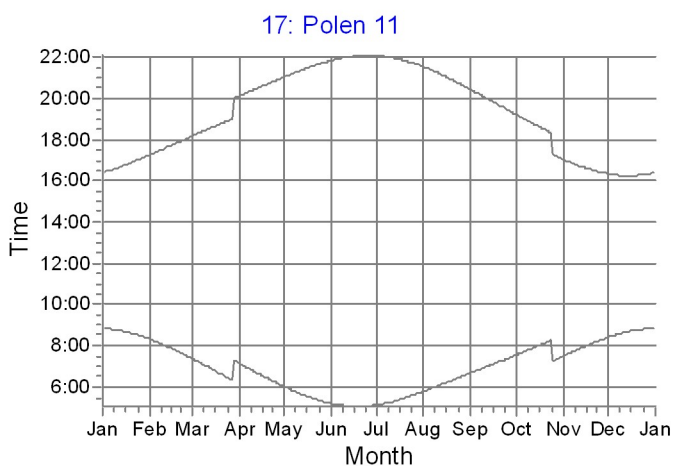
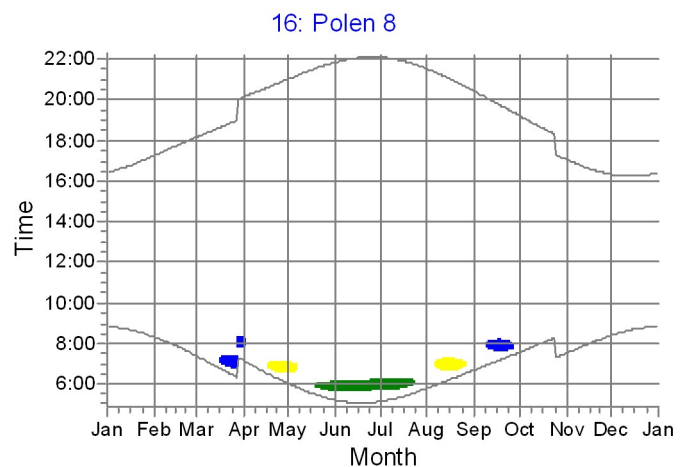
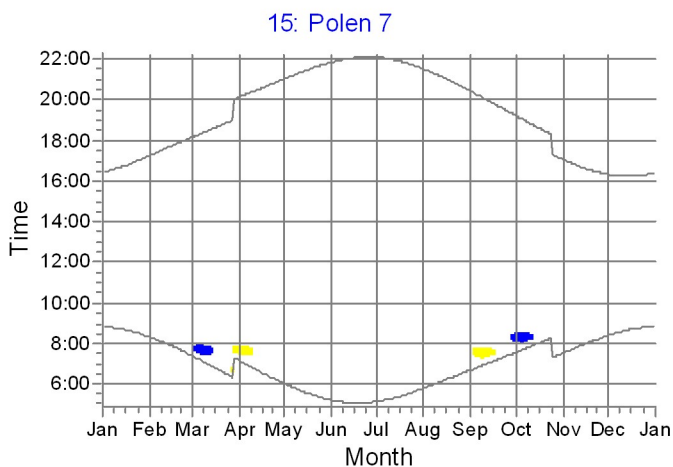
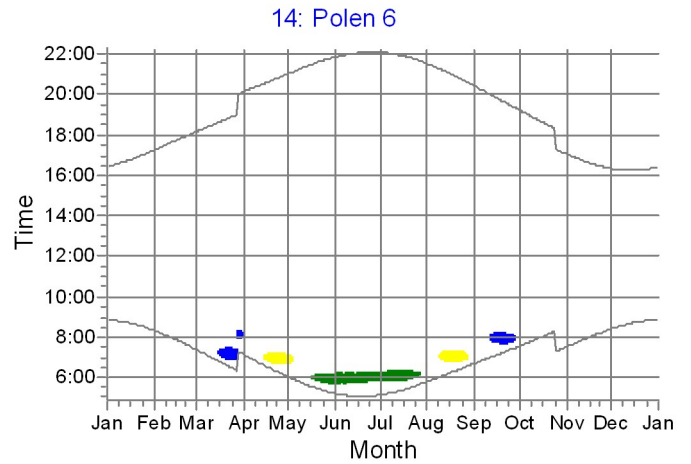
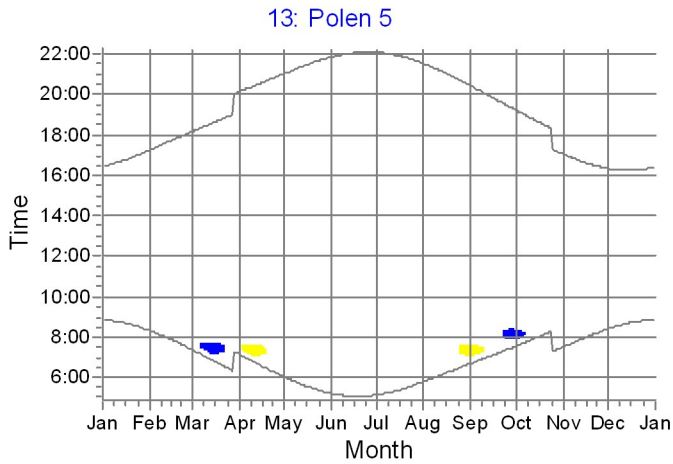


WTGs




- WT01: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (13)
- WT02: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (14)
- WT03: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (15)

## SHADOW - Calendar, graphical

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbines

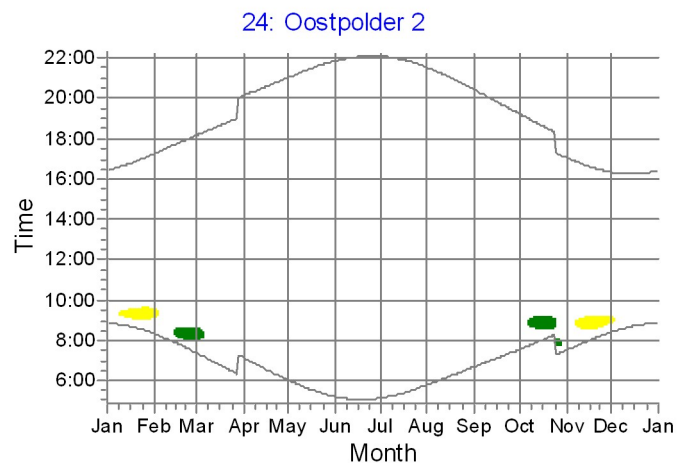
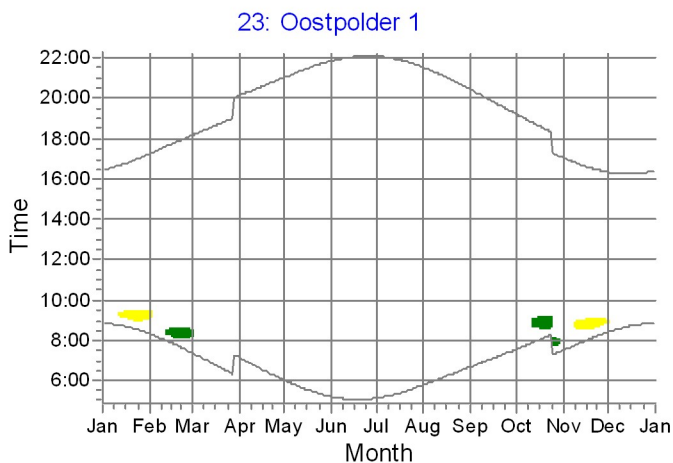
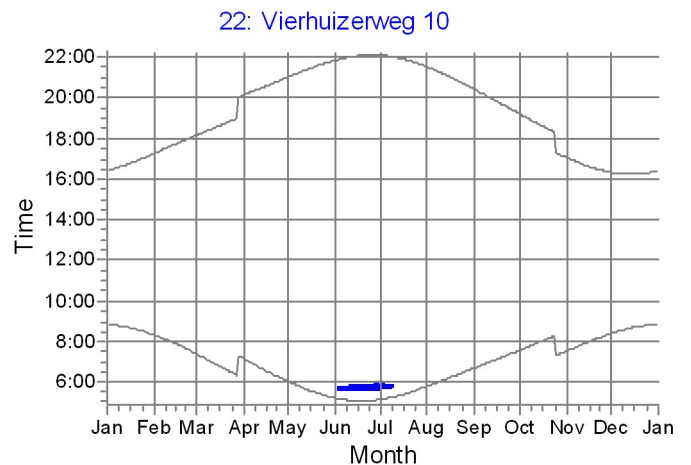
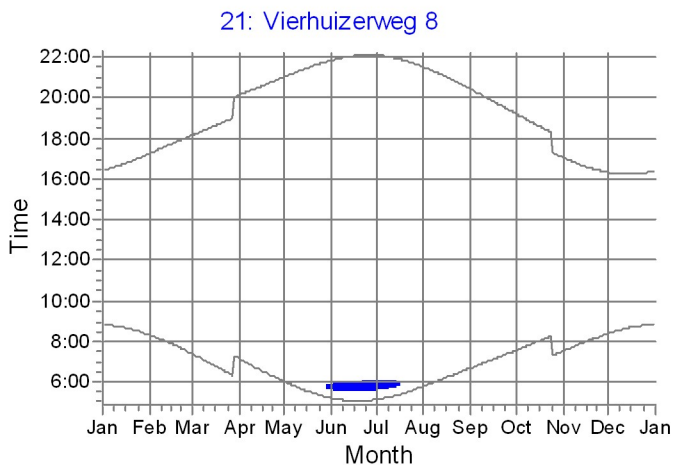
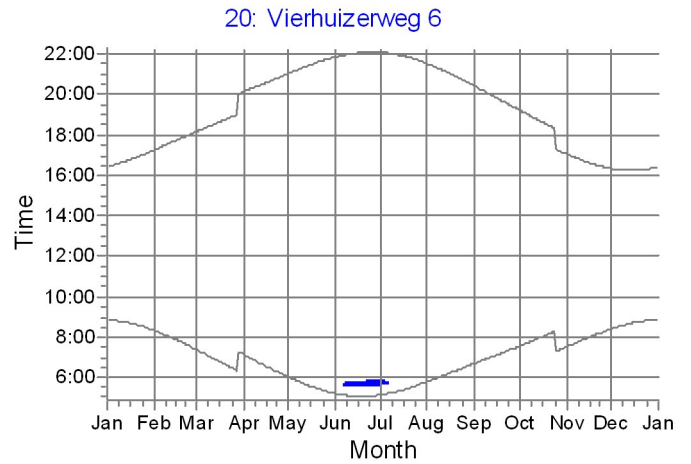
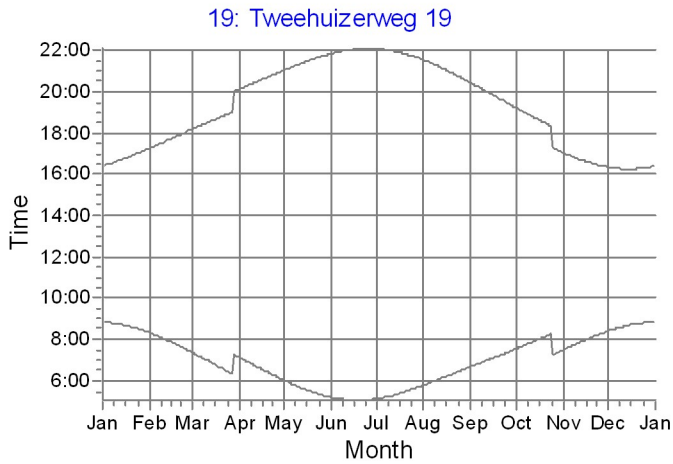


WTGs

-  WT01: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (13)
-  WT02: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (14)
-  WT03: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (15)

## SHADOW - Calendar, graphical

Calculation: Windpark Oosterspolderdijk - klasse 3 MW turbines



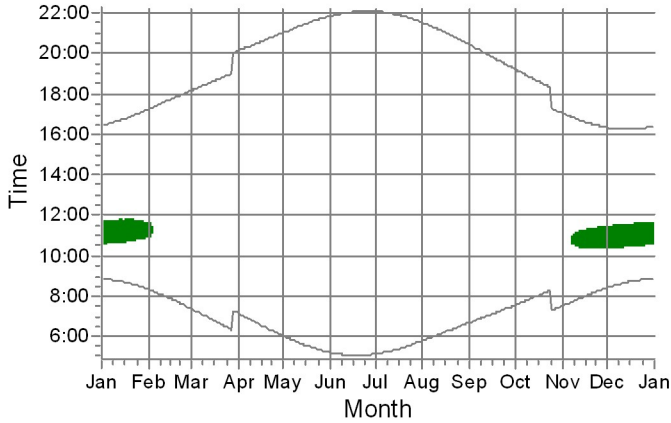
WTGs

- WT01: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (13)
- WT02: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (14)
- WT03: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (15)

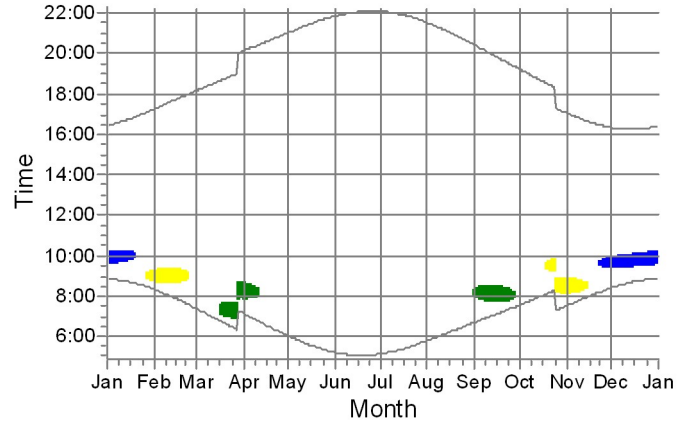
## SHADOW - Calendar, graphical

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines

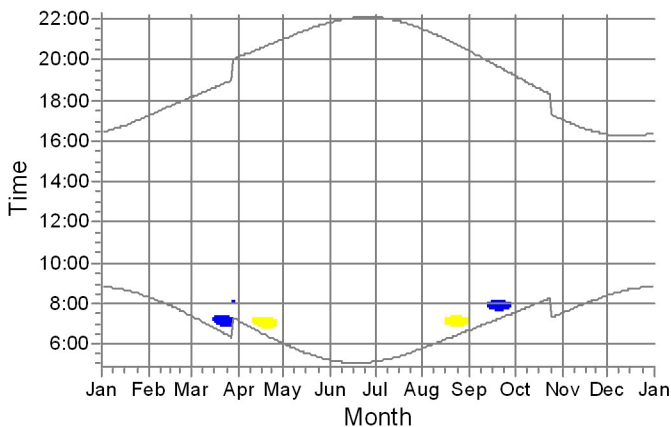
25: Oostpolder 6



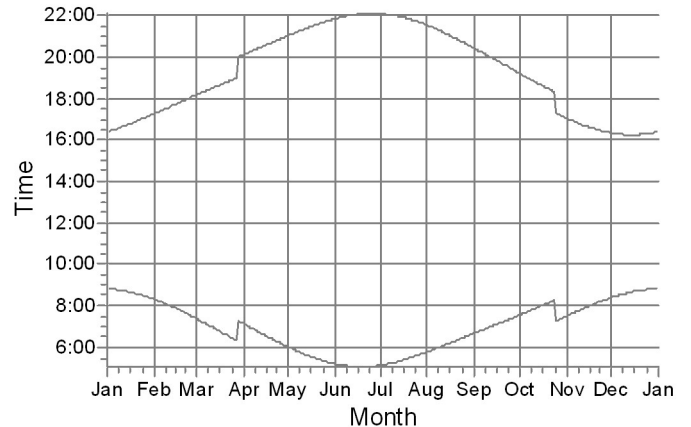
26: Oostpolder 7



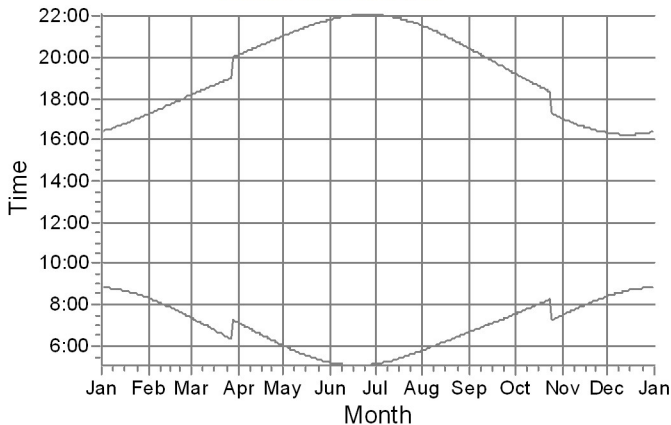
27: Polen 3






28: Vierhuizerweg 4a



29: Vierhuizerweg 4



### WTGs

-  WT01: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (13)
-  WT02: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (14)
-  WT03: SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (15)

## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT01 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (13)  
 Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:49 10:38-11:36/58 16:24	08:19 11:02-11:31/29 17:14	07:23 08:06-08:32/26 18:09	07:09 07:55-08:36/41 20:07	06:01 21:01	05:12 05:42-06:06/24 21:50 06:05-06:08/3
2	08:49 10:39-11:37/58 16:25	08:18 11:04-11:28/24 17:16	07:21 08:07-08:31/24 18:11	07:06 07:56-08:36/40 20:09	05:59 21:03	05:11 05:42-06:07/25 21:51 06:06-06:09/3
3	08:49 10:39-11:38/59 16:26	08:16 11:08-11:23/15 17:18	07:18 08:09-08:29/20 18:13	07:04 07:55-08:34/39 20:10	05:56 21:05	05:10 05:41-06:07/26 21:53 06:06-06:09/3
4	08:48 10:39-11:38/59 16:27	08:14 11:20 17:20	07:16 08:09-08:26/17 18:15	07:02 07:56-08:33/37 20:12	05:55 21:06	05:09 05:41-06:07/26 21:54 06:06-06:08/2
5	08:48 10:40-11:39/59 16:29	08:13 11:22 17:22	07:14 08:12-08:24/12 18:17	06:59 07:57-08:33/36 20:14	05:53 21:08	05:09 05:42-06:07/25 21:55 06:06-06:09/3
6	08:48 10:40-11:39/59 16:30	08:11 11:24 17:24	07:11 11:19 18:19	06:57 07:57-08:30/33 20:16	05:51 21:10	05:08 05:42-06:07/25 21:56 06:06-06:08/2
7	08:47 10:41-11:40/59 16:31	08:09 11:26 17:26	07:09 11:21 18:21	06:54 07:58-08:29/31 20:18	05:49 21:12	05:07 05:42-06:07/25 21:57 06:06-06:08/2
8	08:47 10:42-11:40/58 16:33	08:07 11:28 17:28	07:07 11:23 18:23	06:52 07:59-08:27/28 20:19	05:47 21:13	05:07 05:42-06:07/25 21:58 06:06-06:08/2
9	08:46 10:42-11:40/58 16:34	08:05 11:30 17:30	07:04 11:24 18:24	06:50 08:00-08:24/24 20:21	05:45 21:15	05:06 05:43-06:08/25 21:59 06:07-06:09/2
10	08:46 10:42-11:40/58 16:36	08:03 11:32 17:32	07:02 11:26 18:26	06:47 08:02-08:22/20 20:23	05:43 21:17	05:06 05:43-06:07/24 21:59 06:06-06:08/2
11	08:45 10:42-11:40/58 16:37	08:01 11:34 17:34	06:59 11:28 18:28	06:45 08:05-08:19/14 20:25	05:41 21:19	05:05 05:43-06:08/25 22:00 06:07-06:09/2
12	08:44 10:44-11:41/57 16:39	07:59 11:36 17:36	06:57 11:30 18:30	06:43 20:27 18:30	05:40 21:20	05:05 05:44-06:08/24 22:01 06:07-06:09/2
13	08:43 10:44-11:42/58 16:40	07:57 08:23-08:27/4 17:38	06:55 11:32 18:32	06:40 20:29 18:32	05:38 21:22	05:05 05:43-06:07/24 22:02 06:07-06:08/1
14	08:43 10:45-11:42/57 16:42	07:55 08:21-08:29/8 17:40	06:52 11:34 18:34	06:38 20:30 18:34	05:36 21:24	05:04 05:44-06:08/24 22:02 06:07-06:08/1
15	08:42 10:45-11:41/56 16:43	07:53 08:19-08:26/7 17:42	06:50 08:26-08:31/5 18:36	06:36 20:32 18:36	05:34 21:25	05:04 05:44-06:08/24 22:03 06:07-06:08/1
16	08:41 10:45-11:41/56 16:45	07:51 08:17-08:29/12 17:44	06:48 08:29-08:33/1 18:37	06:33 20:34 18:37	05:33 21:27	05:04 05:44-06:08/24 22:03 06:07-06:09/2
17	08:40 10:46-11:42/56 16:47	07:49 08:15-08:31/16 17:46	06:45 07:14-07:29/15 18:39	06:31 20:36 18:39	05:31 05:59-06:00/1 21:29	05:04 05:45-06:08/23 22:04 06:07-06:09/2
18	08:39 10:47-11:42/55 16:48	07:47 08:12-08:32/20 17:48	06:43 07:10-07:31/21 18:41	06:29 20:38 18:41	05:30 05:58-06:02/4 21:30	05:04 05:45-06:08/23 22:04 06:08-06:09/1
19	08:38 10:48-11:42/54 16:50	07:45 08:10-08:33/23 17:50	06:40 07:08-07:34/26 18:43	06:26 20:39 18:43	05:28 05:56-06:03/7 21:32	05:04 05:45-06:08/23 22:05 06:08-06:09/1
20	08:36 10:48-11:42/54 16:52	07:43 08:08-08:34/26 17:52	06:38 07:05-07:34/29 18:45	06:24 20:41 18:45	05:27 05:55-05:58/3 21:33	05:04 05:45-06:08/23 22:05 06:08-06:09/1
21	08:35 10:49-11:42/53 16:54	07:41 08:07-08:35/28 17:54	06:35 07:04-07:36/32 18:47	06:22 20:43 18:47	05:25 05:54-06:00/6 21:35	05:04 05:45-06:08/23 22:05 06:08-06:09/1
22	08:34 10:49-11:41/52 16:56	07:39 08:06-08:34/28 17:56	06:33 07:02-07:36/34 18:48	06:20 20:45 18:48	05:24 05:52-06:01/9 21:36	05:04 05:46-06:09/23 22:05 06:09-06:10/1
23	08:33 10:50-11:41/51 16:57	07:36 08:05-08:34/29 17:58	06:31 07:01-07:37/36 18:50	06:18 20:47 18:50	05:22 05:51-06:02/11 21:38	05:04 05:46-06:09/23 22:06 06:09-06:10/1
24	08:31 10:51-11:40/49 16:59	07:34 08:05-08:35/30 18:00	06:28 07:00-07:38/38 18:52	06:15 20:49 18:52	05:21 05:50-06:03/13 21:39	05:05 05:46-06:09/23 22:06 06:09-06:10/1
25	08:30 10:52-11:40/48 17:01	07:32 08:06-08:35/29 18:02	06:26 06:58-07:38/40 18:54	06:13 20:50 18:54	05:20 05:49-06:03/14 21:41	05:05 05:47-06:10/23 22:06 06:10-06:11/1
26	08:29 10:53-11:39/46 17:03	07:30 08:05-08:34/29 18:03	06:23 06:58-07:39/41 18:56	06:11 20:52 18:56	05:18 05:48-06:04/16 21:42	05:05 05:47-06:10/23 22:06 06:09-06:11/2
27	08:27 10:55-11:39/44 17:05	07:27 08:05-08:34/29 18:05	06:21 06:57-07:38/41 18:58	06:09 20:54 18:58	05:17 05:47-06:05/18 21:44	05:06 05:47-06:11/24 22:06 06:10-06:12/2
28	08:26 10:55-11:38/43 17:07	07:25 08:06-08:33/27 18:07	06:18 06:56-07:38/42 18:59	06:07 20:56 18:59	05:16 05:46-06:05/19 21:45	05:06 05:47-06:11/24 22:06 06:10-06:11/1
29	08:24 10:56-11:36/40 17:09		07:16 07:55-08:37/42 20:01	06:05 20:58 20:01	05:15 05:45-06:05/20 21:46	05:07 05:47-06:11/24 22:05 06:11-06:12/1
30	08:23 10:59-11:36/37 17:11		07:14 07:56-08:37/41 20:03	06:03 20:59 20:03	05:14 05:44-06:06/22 21:48	05:08 05:47-06:11/24 22:05 06:10-06:12/2
31	08:21 11:00-11:34/34 17:12		07:11 07:56-08:37/41 20:05		05:13 05:43-06:06/23 21:49	
Potential sun hours	252	274	367	419	492	508
Sum of minutes with flicker	1643	425	618	343	229	753

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT01 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (13)  
 Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:08 05:47-06:12/25 22:05 06:11-06:13/2	05:47 21:30	06:41 08:04-08:18/14 20:25	07:33 19:12	07:30 17:02	08:24 10:25-11:22/57 16:19
2	05:09 05:48-06:13/25 22:04 06:12-06:13/1	05:49 21:29	06:42 08:00-08:20/20 20:22	07:35 19:10	07:32 17:00	08:26 10:25-11:23/58 16:18
3	05:10 05:47-06:12/25 22:04 06:11-06:13/2	05:51 21:27	06:44 07:58-08:22/24 20:20	07:36 19:07	07:34 16:58	08:27 10:26-11:24/58 16:17
4	05:11 05:48-06:13/25 22:04 06:12-06:14/2	05:52 21:25	06:46 07:56-08:24/28 20:18	07:38 19:05	07:36 16:57	08:29 10:26-11:24/58 16:17
5	05:11 05:48-06:13/25 22:03 06:12-06:14/2	05:54 21:23	06:48 07:54-08:25/31 20:15	07:40 19:02	07:38 16:55	08:30 10:26-11:25/59 16:16
6	05:12 05:48-06:13/25 22:02 06:12-06:15/3	05:56 21:21	06:49 07:53-08:26/33 20:13	07:42 19:00	07:40 16:53	08:31 10:26-11:25/59 16:16
7	05:13 05:48-06:14/26 22:02 06:13-06:15/2	05:57 21:19	06:51 07:52-08:28/36 20:10	07:44 18:58	07:42 16:51	08:33 10:27-11:26/59 16:15
8	05:14 05:49-06:14/25 22:01 06:13-06:15/2	05:59 21:17	06:53 07:50-08:28/38 20:08	07:45 08:49-08:57/8 18:55	07:44 10:38-10:55/17 16:49	08:34 10:27-11:26/59 16:15
9	05:15 05:49-06:14/25 22:00 06:13-06:16/3	06:01 21:15	06:54 07:49-08:28/39 20:06	07:47 08:46-09:00/14 18:53	07:45 10:35-10:59/24 16:47	08:35 10:28-11:26/58 16:15
10	05:16 05:49-06:14/25 22:00 06:13-06:16/3	06:02 21:13	06:56 07:49-08:29/40 20:03	07:49 08:44-09:02/18 18:50	07:47 10:33-11:02/29 16:46	08:36 10:28-11:26/58 16:14
11	05:17 05:50-06:14/24 21:59 06:13-06:16/3	06:04 21:11	06:58 07:47-08:28/41 20:01	07:51 08:42-09:04/22 18:48	07:49 10:31-11:05/34 16:44	08:38 10:29-11:27/58 16:14
12	05:19 05:51-06:14/23 21:58 06:13-06:16/3	06:06 21:09	07:00 07:47-08:29/42 19:58	07:53 08:40-09:04/24 18:46	07:51 10:29-11:07/38 16:42	08:39 10:29-11:28/59 16:14
13	05:20 05:52-06:14/22 21:57 06:13-06:16/3	06:08 21:07	07:01 07:47-08:29/42 19:56	07:55 08:39-09:05/26 18:43	07:53 10:28-11:08/40 16:41	08:40 10:30-11:28/58 16:14
14	05:21 05:53-06:14/21 21:56 06:13-06:16/3	06:09 21:05	07:03 07:47-08:29/42 19:53	07:56 08:38-09:06/28 18:41	07:55 10:27-11:10/43 16:39	08:41 10:30-11:28/58 16:14
15	05:22 05:54-06:14/20 21:55 06:13-06:16/3	06:11 21:03	07:05 07:46-08:28/42 19:51	07:58 08:37-09:06/29 18:39	07:57 10:26-11:11/45 16:38	08:42 10:31-11:29/58 16:14
16	05:23 05:55-06:13/18 21:54 06:12-06:16/4	06:13 21:01	07:07 07:46-08:27/41 19:49	08:00 08:37-09:06/29 18:37	07:59 10:26-11:12/46 16:36	08:43 10:31-11:29/58 16:14
17	05:25 05:57-06:14/17 21:53 06:13-06:17/4	06:15 20:59	07:08 07:46-08:27/41 19:46	08:02 08:37-09:06/29 18:34	08:00 10:25-11:13/48 16:35	08:43 10:31-11:29/58 16:14
18	05:26 05:58-06:13/15 21:51 06:12-06:17/5	06:16 20:57	07:10 07:46-08:26/40 19:44	08:04 08:37-09:06/29 18:32	08:02 10:25-11:14/49 16:33	08:44 10:32-11:30/58 16:14
19	05:28 05:59-06:13/14 21:50 06:12-06:16/4	06:18 20:54	07:12 07:46-08:25/39 19:41	08:06 08:37-09:05/28 18:30	08:04 10:24-11:15/51 16:32	08:45 10:32-11:30/58 16:15
20	05:29 06:00-06:12/12 21:49 06:11-06:16/5	06:20 20:52	07:14 07:47-08:24/37 19:39	08:07 08:37-09:05/28 18:28	08:06 10:24-11:16/52 16:31	08:46 10:33-11:31/58 16:15
21	05:30 06:02-06:12/10 21:47 06:11-06:16/5	06:21 20:50	07:15 07:47-08:22/35 19:36	08:09 08:38-09:05/27 18:25	08:08 10:24-11:17/53 16:29	08:46 10:33-11:31/58 16:15
22	05:32 06:03-06:10/7 21:46 06:09-06:15/6	06:23 20:48	07:17 07:48-08:21/33 19:34	08:11 08:39-09:04/25 18:23	08:09 10:24-11:18/54 16:28	08:47 10:34-11:32/58 16:16
23	05:33 06:04-06:09/5 21:45 06:08-06:14/6	06:25 20:46	07:19 07:49-08:19/30 19:31	08:13 08:41-09:03/22 18:21	08:11 10:24-11:18/54 16:27	08:47 10:34-11:32/58 16:16
24	05:35 06:06-06:14/8 21:43 05:36 06:07-06:13/6	06:27 20:43 20:41	07:21 07:51-08:18/27 19:29	08:15 08:43-09:02/19 18:19	08:13 10:24-11:19/55 16:26	08:48 10:34-11:32/58 16:17
25	05:36 06:07-06:13/6 21:42	06:28 20:41	07:22 07:52-08:15/23 19:27	07:17 07:45-08:00/15 17:17	08:15 10:24-11:20/56 16:25	08:48 10:35-11:34/59 16:18
26	05:38 06:09-06:12/3 21:40	06:30 20:39	07:24 07:55-08:12/17 19:24	07:19 07:47-07:58/11 17:15	08:16 10:25-11:21/56 16:23	08:48 10:36-11:34/58 16:18
27	05:39 21:39	06:32 20:36	07:26 07:59-08:08/9 19:22	07:21 07:49-07:54/5 17:13	08:18 10:25-11:21/56 16:22	08:49 10:36-11:34/58 16:19
28	05:41 21:37	06:34 20:34	07:28 19:19	07:23 07:51-07:58/7 17:10	08:20 10:24-11:21/57 16:21	08:49 10:36-11:35/59 16:20
29	05:42 21:35	06:35 20:32	07:29 19:17	07:24 07:53-07:56/3 17:08	08:21 10:25-11:22/57 16:21	08:49 10:37-11:35/58 16:21
30	05:44 21:34	06:37 20:29	07:31 19:14	07:26 17:06	08:23 10:25-11:23/58 16:20	08:49 10:37-11:36/59 16:22
31	05:46 21:32	06:39 20:27		07:28 17:04		08:49 10:38-11:36/58 16:23
Potential sun hours	510	458	382	329	261	236
Sum of minutes with flicker	530	0	884	463	1072	1805

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker



## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT02 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (14) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:49 16:24	08:19 08:48-09:15/27 17:14 09:14-09:29/15	07:23 18:09	07:09 07:32-07:50/18 20:07	06:01 06:38-07:03/25 21:01	05:12 21:50
2	08:49 16:25	08:18 08:47-09:16/29 17:16 09:15-09:27/12	07:21 18:11	07:06 07:30-07:50/20 20:09	05:59 06:39-07:01/22 21:03	05:11 21:51
3	08:49 16:26	08:16 08:45-09:15/30 17:18 09:16-09:24/8	07:18 18:13	07:04 07:28-07:49/21 20:10	05:57 06:40-06:59/19 21:05	05:10 21:52
4	08:48 16:27	08:14 08:45-09:16/31 17:20	07:16 18:15	07:02 07:25-07:49/24 20:12	05:55 06:41-06:58/17 21:06	05:09 21:54
5	08:48 16:29	08:13 08:44-09:16/32 17:22	07:14 18:17	06:59 07:23-07:48/25 20:14	05:53 06:44-06:57/13 21:08	05:09 21:55
6	08:48 16:30	08:11 08:44-09:18/34 17:24	07:11 18:19	06:57 07:20-07:47/27 20:16	05:51 06:46-06:54/8 21:10	05:08 21:56
7	08:47 16:31	08:09 08:44-09:19/35 17:26	07:09 18:21	06:54 07:18-07:46/28 20:18	05:49 21:12	05:07 21:57
8	08:47 16:33	08:07 08:44-09:19/35 17:28	07:07 18:23	06:52 07:16-07:44/28 20:19	05:47 21:13	05:07 21:58
9	08:46 16:34	08:05 08:43-09:20/37 17:30	07:04 18:24	06:50 07:13-07:40/27 20:21	05:45 21:15	05:06 21:59
10	08:46 09:17-09:20/3 16:36	08:03 08:42-09:19/37 17:32	07:02 18:26	06:47 07:11-07:33/22 20:23	05:43 21:17	05:06 21:59
11	08:45 09:17-09:22/5 16:37	08:01 08:42-09:19/37 17:34	06:59 18:28	06:45 07:10-07:33/23 20:25	05:41 21:19	05:05 22:00
12	08:44 09:16-09:23/7 16:39	07:59 08:43-09:19/36 17:36	06:57 18:30	06:43 07:06-07:12/6 20:27	05:40 21:20	05:05 22:01
13	08:43 09:15-09:25/10 16:40	07:57 08:43-09:19/36 17:38	06:55 18:32	06:40 07:04-07:13/9 20:29	05:38 21:22	05:05 22:02
14	08:43 09:14-09:26/12 16:42	07:55 08:43-09:19/36 17:40	06:52 18:34	06:38 07:02-07:15/13 20:30	05:36 21:24	05:04 22:02
15	08:42 09:12-09:26/14 16:43	07:53 08:44-09:18/34 17:42	06:50 18:36	06:36 07:00-07:16/16 20:32	05:34 21:25	05:04 22:03
16	08:41 09:11-09:27/16 16:45	07:51 08:45-09:18/33 17:44	06:48 18:37	06:33 06:57-07:15/18 20:34	05:33 21:27	05:04 22:03
17	08:40 09:10-09:28/18 16:47	07:49 08:45-09:17/32 17:46	06:45 18:39	06:31 06:55-07:15/20 20:36	05:31 21:29	05:04 22:04
18	08:39 09:09-09:29/20 16:48	07:47 08:45-09:16/31 17:48	06:43 18:41	06:29 06:53-07:15/22 20:38	05:30 21:30	05:04 22:04
19	08:38 09:08-09:30/22 16:50	07:45 08:47-09:15/28 17:50	06:40 18:43	06:26 06:51-07:15/24 20:39	05:28 21:32	05:04 22:05
20	08:36 09:06-09:30/24 16:52	07:43 08:48-09:13/25 17:52	06:38 18:45	06:24 06:49-07:14/25 20:41	05:27 21:33	05:04 22:05
21	08:35 09:05-09:31/26 16:54	07:41 08:50-09:11/21 17:54	06:35 18:47	06:22 06:46-07:13/27 20:43	05:25 21:35	05:04 22:05
22	08:34 09:03-09:31/28 16:56	07:39 08:51-09:08/17 17:56	06:33 18:48	06:20 06:44-07:12/28 20:45	05:24 21:36	05:04 22:05
23	08:33 09:03-09:31/28 16:57	07:36 08:54-09:05/11 17:58	06:31 18:50	06:18 06:42-07:11/29 20:47	05:22 21:38	05:04 22:06
24	08:31 09:02-09:31/29 16:59	07:34 18:00	06:28 18:52	06:15 06:40-07:09/29 20:48	05:21 21:39	05:05 22:06
25	08:30 09:03-09:32/29 17:01	07:32 18:02	06:26 18:54	06:13 06:38-07:08/30 20:50	05:20 21:41	05:05 22:06
26	08:29 09:03-09:32/29 17:03	07:30 18:03	06:23 18:56	06:11 06:38-07:06/28 20:52	05:19 21:42	05:05 22:06
27	08:27 09:05-09:32/27 17:05	07:27 18:05	06:21 18:58	06:09 06:37-07:06/29 20:54	05:17 21:44	05:06 22:06
28	08:26 08:55-09:06/11 17:07	07:25 18:07	06:18 06:42-06:47/5 18:59	06:07 06:37-07:05/28 20:56	05:16 21:45	05:06 22:06
29	08:24 08:53-09:08/15 17:09	07:23 18:09	06:16 07:39-07:48/9 20:01	06:05 06:38-07:04/26 20:58	05:15 21:46	05:07 22:05
30	08:23 08:51-09:12/21 17:11	07:21 18:11	06:14 07:37-07:49/12 20:03	06:03 06:38-07:04/26 20:59	05:14 21:48	05:08 22:05
31	08:21 08:49-09:14/25 17:12	07:19 18:13	06:12 07:35-07:50/15 20:05		05:13 21:49	
Potential sun hours	252	274	367	419	492	508
Sum of minutes with flicker	504	737	41	794	104	0

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-Last time (hh:mm) with flicker/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT02 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (14) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:08 22:05	05:47 21:30	06:41 07:09-07:32/23 20:25	07:33 19:12	07:30 08:12-08:48/36 17:02	08:24 08:58-09:03/5 16:19
2	05:09 22:04	05:49 21:29	06:42 07:09-07:31/22 20:22	07:35 19:10	07:32 08:12-08:48/36 17:00	08:26 09:00-09:03/3 16:18
3	05:10 22:04	05:51 21:27	06:44 07:11-07:38/27 20:20	07:36 19:07	07:34 08:12-08:48/36 16:58	08:27 16:18
4	05:11 22:04	05:52 21:25	06:46 07:13-07:41/28 20:18	07:38 19:05	07:36 08:14-08:48/34 16:57	08:29 16:17
5	05:11 22:03	05:54 21:23	06:48 07:14-07:42/28 20:15	07:40 19:02	07:38 08:14-08:48/34 16:55	08:30 16:16
6	05:12 22:02	05:56 21:21	06:49 07:16-07:43/27 20:13	07:42 19:00	07:40 08:15-08:47/32 16:53	08:31 16:16
7	05:13 22:02	05:57 06:55-07:04/9 21:19	06:51 07:18-07:44/26 20:10	07:44 18:58	07:42 08:15-08:46/31 16:51	08:33 16:15
8	05:14 22:01	05:59 06:52-07:07/15 21:17	06:53 07:19-07:43/24 20:08	07:45 18:55	07:44 08:16-08:46/30 16:49 08:47-08:55/8	08:34 16:15
9	05:15 22:00	06:01 06:50-07:08/18 21:15	06:55 07:22-07:43/21 20:06	07:47 18:53	07:45 08:17-08:47/30 16:48 08:46-08:58/12	08:35 16:15
10	05:16 22:00	06:02 06:49-07:09/20 21:13	06:56 07:23-07:43/20 20:03	07:49 18:50	07:47 08:19-08:46/27 16:46 08:45-09:00/15	08:36 16:14
11	05:17 21:59	06:04 06:47-07:10/23 21:11	06:58 07:24-07:42/18 20:01	07:51 18:48	07:49 08:20-08:45/25 16:44 08:44-09:01/17	08:38 16:14
12	05:19 21:58	06:06 06:47-07:12/25 21:09	07:00 07:26-07:41/15 19:58	07:53 18:46	07:51 08:22-08:43/21 16:42 08:42-09:02/20	08:39 16:14
13	05:20 21:57	06:08 06:46-07:12/26 21:07 07:12-07:13/1	07:01 07:28-07:41/13 19:56	07:55 18:43	07:53 08:25-08:40/15 16:41 08:40-09:03/23	08:40 16:14
14	05:21 21:56	06:09 06:45-07:12/27 21:05 07:12-07:13/1	07:03 07:30-07:39/9 19:53	07:56 18:41	07:55 08:28-08:36/8 16:39 08:37-09:04/27	08:41 16:14
15	05:22 21:55	06:11 06:45-07:13/28 21:03 07:13-07:14/1	07:05 07:31-07:37/6 19:51	07:58 18:39	07:57 08:37-09:04/27 16:38	08:42 16:14
16	05:24 21:54	06:13 06:44-07:12/28 21:01 07:12-07:14/2	07:07 07:33-07:34/1 19:49	08:00 18:37	07:59 08:36-09:05/29 16:36	08:43 16:14
17	05:25 21:52	06:15 06:44-07:13/29 20:59 07:13-07:14/1	07:08 19:46	08:02 18:34	08:00 08:36-09:05/29 16:35	08:43 16:14
18	05:26 21:51	06:16 06:45-07:15/30 20:57	07:10 19:44	08:04 18:32	08:02 08:36-09:05/29 16:33	08:44 16:14
19	05:28 21:50	06:18 06:46-07:15/29 20:54	07:12 19:41	08:06 09:24-09:37/13 18:30	08:04 08:37-09:05/28 16:32	08:45 16:15
20	05:29 21:49	06:20 06:48-07:17/29 20:52	07:14 19:39	08:07 09:21-09:40/19 18:28	08:06 08:38-09:06/28 16:31	08:46 16:15
21	05:30 21:47	06:21 06:50-07:18/28 20:50	07:15 19:36	08:09 09:19-09:42/23 18:25	08:08 08:40-09:06/26 16:29	08:46 16:15
22	05:32 21:46	06:23 06:51-07:17/26 20:48	07:17 19:34	08:11 09:18-09:44/26 18:23	08:09 08:42-09:06/24 16:28	08:47 16:16
23	05:33 21:45	06:25 06:53-07:18/25 20:46	07:19 19:31	08:13 09:17-09:45/28 18:21	08:11 08:44-09:06/22 16:27	08:47 16:16
24	05:35 21:43	06:27 06:55-07:18/23 20:43	07:21 19:29	08:15 09:16-09:46/30 18:19	08:13 08:46-09:06/20 16:26	08:48 16:17
25	05:36 21:42	06:28 06:56-07:17/21 20:41 07:18-07:25/7	07:22 19:27	07:17 08:15-08:47/32 17:17	08:15 08:48-09:06/18 16:25	08:48 16:18
26	05:38 21:40	06:30 06:58-07:18/20 20:39 07:18-07:28/10	07:24 19:24	07:19 08:14-08:48/34 17:15	08:16 08:50-09:06/16 16:23	08:48 16:18
27	05:39 21:39	06:32 06:59-07:17/18 20:36 07:17-07:29/12	07:26 19:22	07:21 08:13-08:48/35 17:13	08:18 08:52-09:06/14 16:22	08:49 16:19
28	05:41 21:37	06:34 07:01-07:16/15 20:34 07:16-07:30/14	07:28 19:19	07:23 08:13-08:48/35 17:10	08:20 08:53-09:05/12 16:22	08:49 16:20
29	05:43 21:35	06:35 07:03-07:15/12 20:32 07:15-07:31/16	07:29 19:17	07:24 08:12-08:49/37 17:08	08:21 08:55-09:05/10 16:21	08:49 16:21
30	05:44 21:34	06:37 07:04-07:13/9 20:29 07:13-07:31/18	07:31 19:14	07:26 08:12-08:49/37 17:06	08:23 08:57-09:04/7 16:20	08:49 16:22
31	05:46 21:32	06:39 07:06-07:12/6 20:27 07:12-07:31/19		07:28 08:12-08:49/37 17:04		08:49 16:23
Potential sun hours	510	458	382	329	261	236
Sum of minutes with flicker	0	641	308	386	852	8

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT03 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (15) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:49 09:39-10:08/29 16:24	08:19 17:14	07:23 18:09	07:09 07:46-08:10/24 20:07	06:01 21:01	05:12 05:42-05:50/8 21:50
2	08:49 09:40-10:08/28 16:25	08:18 17:16	07:21 07:45-07:46/1 18:11	07:06 07:47-08:07/20 20:09	05:59 21:03	05:11 05:42-05:51/9 21:51
3	08:49 09:41-10:09/28 16:26	08:16 17:18	07:18 07:43-07:49/6 18:13	07:04 07:48-08:02/14 20:10	05:57 21:05	05:10 05:41-05:52/11 21:52
4	08:48 09:41-10:09/28 16:27	08:14 17:20	07:16 07:40-07:49/9 18:15	07:02 07:51-07:56/5 20:12	05:55 21:06	05:09 05:40-05:43/3 21:54 05:43-05:52/9
5	08:48 09:42-10:10/28 16:29	08:13 17:22	07:14 07:38-07:51/13 18:17	06:59 20:14	05:53 21:08	05:09 05:40-05:45/5 21:55 05:45-05:53/8
6	08:48 09:42-10:09/27 16:30	08:11 17:24	07:11 07:35-07:51/16 18:19	06:57 20:16	05:51 21:10	05:08 05:39-05:45/6 21:56 05:45-05:53/8
7	08:47 09:43-10:10/27 16:31	08:09 17:26	07:09 07:33-07:51/18 18:21	06:54 20:18	05:49 21:12	05:07 05:38-05:45/7 21:57 05:45-05:53/8
8	08:47 09:44-10:10/26 16:33	08:07 17:28	07:07 07:31-07:51/20 18:23	06:52 20:19	05:47 21:13	05:07 05:38-05:46/8 21:58 05:46-05:54/8
9	08:46 09:44-10:10/26 16:34	08:05 17:30	07:04 07:28-07:50/22 18:24	06:50 20:21	05:45 21:15	05:06 05:38-05:47/9 21:58 05:47-05:55/8
10	08:46 09:45-10:10/25 16:36	08:03 17:32	07:02 07:26-07:50/24 18:26	06:47 20:23	05:43 21:17	05:06 05:37-05:47/10 21:59 05:47-05:54/7
11	08:45 09:45-10:10/25 16:37	08:01 17:34	06:59 07:23-07:49/26 18:28	06:45 20:25	05:41 21:19	05:05 05:37-05:48/11 22:00 05:48-05:55/7
12	08:44 09:47-10:10/23 16:39	07:59 17:36	06:57 07:21-07:48/27 18:30	06:43 20:27	05:40 21:20	05:05 05:37-05:49/12 22:01 05:49-05:56/7
13	08:43 09:48-10:10/22 16:40	07:57 17:38	06:55 07:18-07:45/27 18:32	06:40 20:29	05:38 21:22	05:05 05:36-05:48/12 22:02 05:48-05:55/7
14	08:43 09:49-10:10/21 16:42	07:55 17:40	06:52 07:16-07:43/27 18:34	06:38 20:30	05:36 21:24	05:04 05:36-05:49/13 22:02 05:49-05:56/7
15	08:42 09:49-10:08/19 16:43	07:53 17:42	06:50 07:16-07:39/23 18:36	06:36 20:32	05:34 21:25	05:04 05:36-05:50/14 22:03 05:50-05:56/6
16	08:41 09:51-10:08/17 16:45	07:51 17:44	06:48 07:11-07:17/6 18:37 07:17-07:37/20	06:33 20:34	05:33 21:27	05:04 05:36-05:50/14 22:03 05:50-05:56/6
17	08:40 09:53-10:06/13 16:47	07:49 17:46	06:45 07:09-07:19/10 18:39 07:18-07:37/19	06:31 20:36	05:31 21:29	05:04 05:36-05:50/14 22:04 05:50-05:57/7
18	08:39 09:55-10:05/10 16:48	07:47 17:48	06:43 07:06-07:20/14 18:41 07:19-07:35/16	06:29 20:38	05:30 21:30	05:04 05:36-05:50/14 22:04 05:50-05:57/7
19	08:38 09:59-10:02/3 16:50	07:45 17:50	06:40 07:04-07:21/17 18:43 07:20-07:34/14	06:26 20:39	05:28 21:32	05:04 05:36-05:51/15 22:05 05:51-05:57/6
20	08:36 16:52	07:43 17:52	06:38 07:01-07:21/20 18:45 07:20-07:31/11	06:24 20:41	05:27 21:33	05:04 05:36-05:51/15 22:05 05:51-05:57/6
21	08:35 16:54	07:41 17:54	06:35 06:59-07:20/21 18:47 07:20-07:28/8	06:22 20:43	05:25 21:35	05:04 05:36-05:51/15 22:05 05:51-05:57/6
22	08:34 16:56	07:39 17:56	06:33 06:56-07:20/24 18:48 07:20-07:22/2	06:20 20:45	05:24 21:36	05:04 05:37-05:52/15 22:05 05:52-05:58/6
23	08:33 16:57	07:36 17:58	06:31 06:54-07:21/27 18:50 07:21-07:22/1	06:18 20:47	05:22 21:38	05:04 05:37-05:52/15 22:06 05:52-05:58/6
24	08:31 16:59	07:34 18:00	06:28 06:52-07:20/28 18:52 07:19-07:23/4	06:15 20:48	05:21 21:39	05:05 05:37-05:52/15 22:06 05:52-05:58/6
25	08:30 17:01	07:32 18:02	06:26 06:49-07:19/30 18:54 07:18-07:21/3	06:13 20:50	05:20 21:41	05:05 05:38-05:52/14 22:06 05:52-05:59/7
26	08:29 17:03	07:30 18:03	06:23 06:47-07:19/32 18:56 07:17-07:21/4	06:11 20:52	05:19 21:42	05:05 05:38-05:52/14 22:06 05:52-05:59/7
27	08:27 17:05	07:27 18:05	06:21 06:45-07:17/32 18:58 07:15-07:19/4	06:09 20:54	05:17 21:44	05:06 05:39-05:53/14 22:06 05:53-05:59/6
28	08:26 17:07	07:25 18:07	06:18 06:45-07:15/30 18:59 07:13-07:19/6	06:07 20:56	05:16 21:45	05:06 05:39-05:52/13 22:05 05:52-05:59/7
29	08:24 17:09		07:16 07:44-08:10/26 20:01 08:08-08:16/8	06:05 20:58	05:15 05:45-05:47/2 21:46	05:07 05:40-05:53/13 22:05 05:53-05:59/6
30	08:23 17:11		07:14 07:45-08:15/30 20:03	06:03 20:59	05:14 05:44-05:48/4 21:48	05:08 05:40-05:52/12 22:05 05:52-05:59/7
31	08:21 17:13		07:11 07:46-08:13/27 20:05		05:13 05:43-05:49/6 21:49	
Potential sun hours	252	274	367	419	492	508
Sum of minutes with flicker	425	0	741	63	12	536

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

## SHADOW - Calendar per WTG

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines WTG: WT03 - SENVION 3.4M104 3400 104.0 !OI hub: 100,0 m (TOT: 152,0 m) (15) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,51 2,58 3,50 5,20 6,57 6,07 6,12 6,11 4,30 3,18 1,88 1,27

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 468 547 656 738 600 479 740 1.042 1.213 830 600 496 8.409  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:08 05:41-05:52/11 22:05 05:52-05:59/7	05:47 21:30	06:41 20:25	07:33 07:59-08:26/27 19:12	07:30 17:02	08:24 09:28-09:52/24 16:19
2	05:09 05:42-05:53/11 22:04 05:53-06:00/7	05:49 21:29	06:42 20:22	07:35 08:01-08:27/26 19:10	07:32 17:00	08:26 09:28-09:53/25 16:18
3	05:10 05:42-05:52/10 22:04 05:52-05:59/7	05:51 21:27	06:44 20:20	07:36 08:03-08:28/25 19:07	07:34 16:59	08:27 09:28-09:54/26 16:18
4	05:11 05:43-05:52/9 22:04 05:52-05:59/7	05:52 21:25	06:46 20:18	07:38 08:05-08:28/23 19:05	07:36 16:57	08:29 09:28-09:54/26 16:17
5	05:11 05:44-05:52/8 22:03 05:52-05:59/7	05:54 21:23	06:48 20:15	07:40 08:06-08:27/21 19:02	07:38 16:55	08:30 09:29-09:55/26 16:16
6	05:12 05:45-05:52/7 22:02 05:52-05:59/7	05:56 21:21	06:49 20:13	07:42 08:08-08:27/19 19:00	07:40 16:53	08:31 09:28-09:55/27 16:16
7	05:13 05:46-05:51/5 22:02 05:51-05:59/8	05:57 21:19	06:51 20:10	07:44 08:10-08:27/17 18:58	07:42 16:51	08:33 09:29-09:57/28 16:15
8	05:14 05:47-05:51/4 22:01 05:51-05:59/8	05:59 21:17	06:53 07:46-07:50/4 20:08	07:45 08:12-08:26/14 18:55	07:44 16:49	08:34 09:29-09:57/28 16:15
9	05:15 05:48-05:50/2 22:00 05:50-05:59/9	06:01 21:15	06:55 07:42-07:55/13 20:06	07:47 08:14-08:25/11 18:53	07:45 16:48	08:35 09:29-09:57/28 16:15
10	05:16 05:49-05:59/10 22:00	06:02 21:13	06:56 07:40-08:00/20 20:03	07:49 08:16-08:24/8 18:50	07:47 16:46	08:36 09:29-09:57/28 16:14
11	05:17 05:50-05:58/8 21:59	06:04 21:11	06:58 07:38-08:02/24 20:01	07:51 08:18-08:22/4 18:48	07:49 16:44	08:38 09:30-09:59/29 16:14
12	05:19 05:51-05:58/7 21:58	06:06 21:09	07:00 07:37-08:04/27 19:58	07:53 18:46	07:51 16:42	08:39 09:30-09:59/29 16:14
13	05:20 05:52-05:57/5 21:57	06:08 21:07	07:01 07:36-08:06/30 19:56	07:55 18:43	07:53 16:41	08:40 09:31-09:59/28 16:14
14	05:21 05:53-05:56/3 21:56	06:09 21:05	07:03 07:36-08:01/25 19:53 07:58-08:07/9	07:56 18:41	07:55 16:39	08:41 09:31-10:00/29 16:14
15	05:22 05:54-05:55/1 21:55	06:11 21:03	07:05 07:34-08:04/30 19:51 08:02-08:08/6	07:58 18:39	07:57 16:38	08:42 09:32-10:00/28 16:14
16	05:24 21:54	06:13 21:01	07:07 07:34-08:06/32 19:49 08:04-08:09/5	08:00 18:37	07:59 16:36	08:43 09:32-10:01/29 16:14
17	05:25 21:52	06:15 20:59	07:08 07:35-08:07/32 19:46 08:05-08:09/4	08:02 18:34	08:00 16:35	08:43 09:32-10:01/29 16:14
18	05:26 21:51	06:16 20:57	07:10 07:36-08:07/31 19:44 08:05-08:09/4	08:04 18:32	08:02 16:33	08:44 09:32-10:01/29 16:14
19	05:28 21:50	06:18 20:54	07:12 07:38-08:07/29 19:41 08:06-08:09/3	08:06 18:30	08:04 16:32	08:45 09:33-10:02/29 16:15
20	05:29 21:49	06:20 20:52	07:14 07:40-08:07/27 19:39 08:07-08:09/2	08:07 18:28	08:06 16:31	08:46 09:34-10:03/29 16:15
21	05:30 21:47	06:21 20:50	07:15 07:41-08:06/25 19:36 08:06-08:08/2	08:09 18:25	08:08 16:29	08:46 09:34-10:03/29 16:15
22	05:32 21:46	06:23 20:48	07:17 07:43-08:05/22 19:34 08:05-08:07/2	08:11 18:23	08:09 16:28	08:47 09:35-10:04/29 16:16
23	05:33 21:45	06:25 20:46	07:19 07:45-08:06/21 19:31 08:05-08:15/10	08:13 18:21	08:11 09:35-09:38/3 16:27	08:47 09:35-10:04/29 16:16
24	05:35 21:43	06:27 20:43	07:21 07:47-08:05/18 19:29 08:04-08:17/13	08:15 18:19	08:13 09:32-09:42/10 16:26	08:48 09:35-10:04/29 16:17
25	05:36 21:42	06:28 20:41	07:22 07:48-08:03/15 19:27 08:02-08:17/15	07:17 17:17	08:15 09:31-09:44/13 16:25	08:48 09:36-10:05/29 16:18
26	05:38 21:40	06:30 20:39	07:24 07:50-08:02/12 19:24 08:01-08:18/17	07:19 17:15	08:16 09:30-09:47/17 16:23	08:48 09:37-10:06/29 16:18
27	05:39 21:39	06:32 20:36	07:26 07:52-08:00/8 19:22 08:00-08:19/19	07:21 17:13	08:18 09:29-09:48/19 16:22	08:49 09:37-10:06/29 16:19
28	05:41 21:37	06:34 20:34	07:28 07:57-08:19/22 19:19	07:23 17:10	08:20 09:28-09:49/21 16:22	08:49 09:37-10:06/29 16:20
29	05:43 21:35	06:35 20:32	07:29 07:57-08:23/26 19:17	07:24 17:08	08:21 09:28-09:50/22 16:21	08:49 09:38-10:07/29 16:21
30	05:44 21:34	06:37 20:29	07:31 07:57-08:24/27 19:14	07:26 17:06	08:23 09:28-09:51/23 16:20	08:49 09:39-10:07/28 16:22
31	05:46 21:32	06:39 20:27		07:28 17:04		08:49 09:39-10:08/29 16:23
Potential sun hours	510	458	382	329	261	236
Sum of minutes with flicker	168	0	615	195	128	872

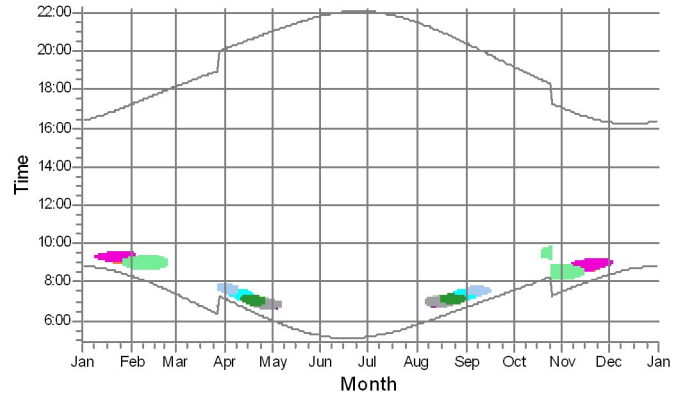
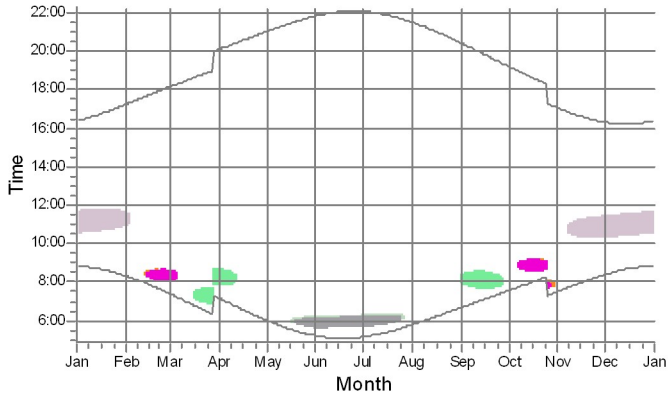
Table layout: For each day in each month the following matrix apply

Day in month Sun rise (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

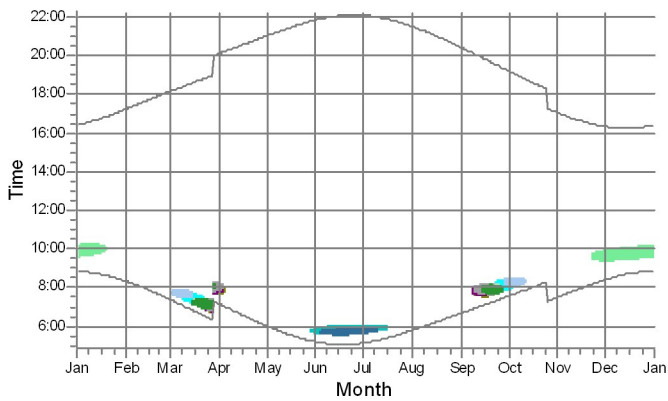
## SHADOW - Calendar per WTG, graphical

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines
















SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 | SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 |



SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 |



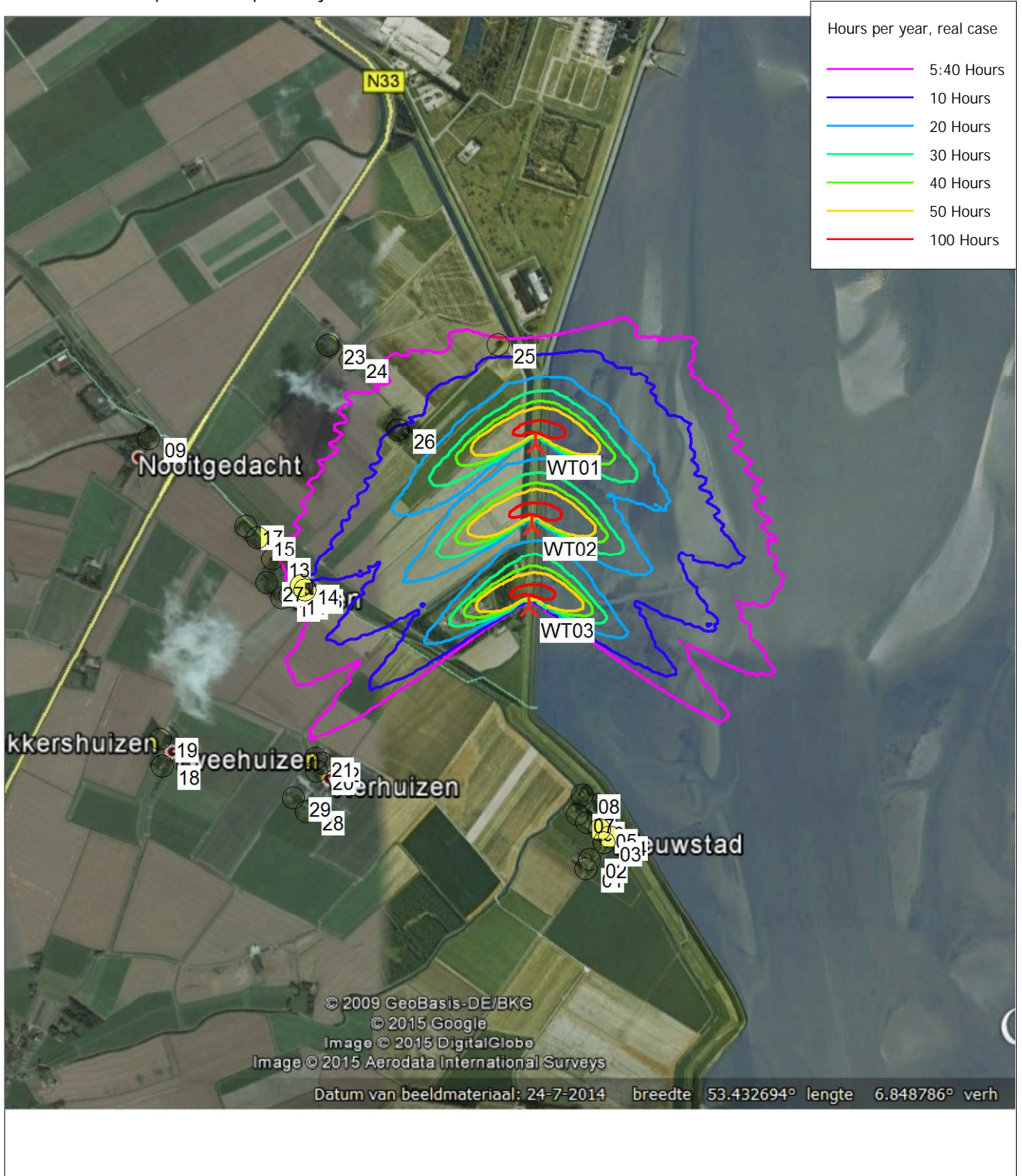
### Shadow receptors

 10: Polen 1	 14: Polen 6	 21: Vierhuizerweg 8	 25: Oostpolder 6
 11: Polen 2	 15: Polen 7	 22: Vierhuizerweg 10	 26: Oostpolder 7
 12: Polen 4	 16: Polen 8	 23: Oostpolder 1	 27: Polen 3
 13: Polen 5	 20: Vierhuizerweg 6	 24: Oostpolder 2	



## SHADOW - Map

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines



Map: Bitmap map: Eemshaven.jpg , Print scale 1:25.000, Map center Dutch Stereo-RD/NAP 2000 East: 253.840 North: 603.980

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE\_ONLINEDATA\_1.wpo (3)



## SHADOW - Main Result

Calculation: Windpark Oosterpolderdijk - klasse 3 MW turbines - exclusief woningen Oostpolder 2 en 6

### Assumptions for shadow calculations

Maximum distance for influence 1. WTG distance circle radius  
 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
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data: NL Eelde, 1970-76

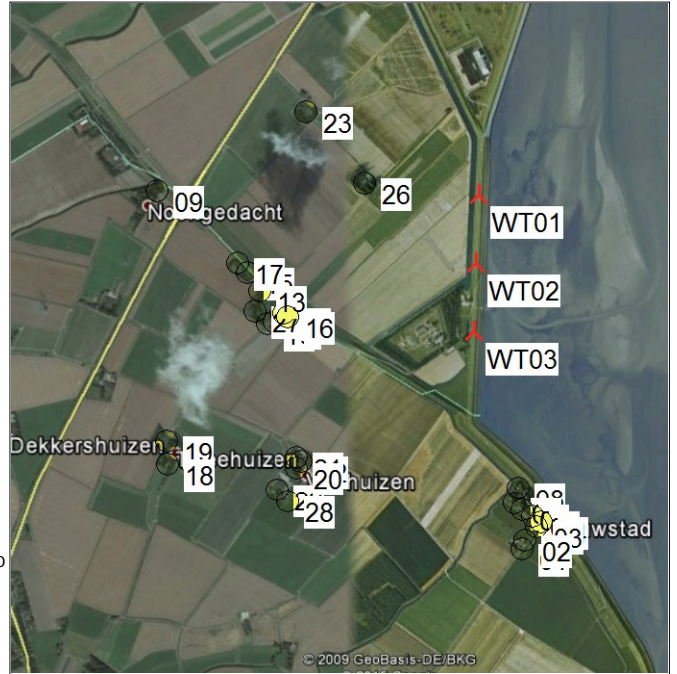
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
468	547	656	738	600	479	740	1.042	1.213	830	600	496	8.409

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: CONTOURLINE\_ONLINEDATA\_1.wpo  
 Obstacles not used in calculation  
 Eye height: 1,5 m  
 Grid resolution: 20,0 m

All coordinates are in Dutch Stereo-RD/NAP 2000



Scale 1:40.000  
 New WTG (red triangle icon)  
 Shadow receptor (yellow circle icon)

### WTGs

	X (east)	Y (north)	Z [m]	Row data/Description	WTG type				Shadow data			
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
WT01	253.864	604.596	0,0	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8
WT02	253.855	604.236	0,0	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8
WT03	253.850	603.877	0,1	SENVION 3.4M104 3400 104.0 !O! h... Yes	Yes	SENVION	3.4M104-3.400	3.400	104,0	100,0	1.248	13,8

### Shadow receptor-Input

No.	Name	X (east)	Y (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]	
01	Nieuwstad 1	254.125	602.733	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
02	Nieuwstad 2	254.140	602.775	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
03	Nieuwstad 3	254.202	602.849	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
04	Nieuwstad 4	254.225	602.875	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
05	Nieuwstad 5	254.181	602.906	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
06	Nieuwstad 6	254.124	602.938	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
07	Nieuwstad 7	254.080	602.971	0,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
08	Nieuwstad 8	254.100	603.057	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
09	Oostpolderweg 19	252.158	604.583	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
10	Polen 1	252.758	603.895	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
11	Polen 2	252.794	603.905	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
12	Polen 4	252.832	603.940	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
13	Polen 5	252.713	604.065	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
14	Polen 6	252.843	603.951	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
15	Polen 7	252.645	604.159	0,3	8,0	5,0	0,5	0,0	90,0	"Green house mode"
16	Polen 8	252.861	603.934	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
17	Polen 11	252.593	604.208	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
18	Tweehuizerweg 15	252.245	603.144	1,1	8,0	5,0	0,5	0,0	90,0	"Green house mode"
19	Tweehuizerweg 19	252.235	603.264	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
20	Vierhuizerweg 6	252.926	603.138	2,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
21	Vierhuizerweg 8	252.923	603.193	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
22	Vierhuizerweg 10	252.950	603.174	2,4	8,0	5,0	0,5	0,0	90,0	"Green house mode"
23	Oostpolder 1	252.941	605.012	4,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"

To be continued on next page...

## SHADOW - Main Result

Calculation: Windpark Oostpolderdijk - klasse 3 MW turbines - exclusief woningen Oostpolder 2 en 6

...continued from previous page

No.	Name	X (east)	Y (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
26	Oostpolder 7	253.255	604.646	3,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
27	Polen 3	252.690	603.961	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
28	Vierhuizerweg 4a	252.885	602.958	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
29	Vierhuizerweg 4	252.826	603.017	1,6	8,0	5,0	0,5	0,0	90,0	"Green house mode"

## Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
01	Nieuwstad 1	0:00	0	0:00	0:00
02	Nieuwstad 2	0:00	0	0:00	0:00
03	Nieuwstad 3	0:00	0	0:00	0:00
04	Nieuwstad 4	0:00	0	0:00	0:00
05	Nieuwstad 5	0:00	0	0:00	0:00
06	Nieuwstad 6	0:00	0	0:00	0:00
07	Nieuwstad 7	0:00	0	0:00	0:00
08	Nieuwstad 8	0:00	0	0:00	0:00
09	Oostpolderweg 19	0:00	0	0:00	0:00
10	Polen 1	17:53	66	0:24	4:00
11	Polen 2	19:24	67	0:25	4:21
12	Polen 4	42:04	140	0:26	9:52
13	Polen 5	14:57	58	0:23	3:05
14	Polen 6	43:00	140	0:26	10:05
15	Polen 7	12:45	53	0:21	2:27
16	Polen 8	43:20	137	0:26	10:08
17	Polen 11	0:00	0	0:00	0:00
18	Tweehuizerweg 15	0:00	0	0:00	0:00
19	Tweehuizerweg 19	0:00	0	0:00	0:00
20	Vierhuizerweg 6	3:26	29	0:10	0:49
21	Vierhuizerweg 8	11:56	48	0:21	2:54
22	Vierhuizerweg 10	5:53	36	0:14	1:25
23	Oostpolder 1	21:51	79	0:26	2:55
26	Oostpolder 7	78:29	165	0:42	11:41
27	Polen 3	14:52	58	0:23	3:15
28	Vierhuizerweg 4a	0:00	0	0:00	0:00
29	Vierhuizerweg 4	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
WT01	SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (13)	65:02	13:44
WT02	SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (14)	67:42	12:19
WT03	SENVION 3.4M104 3400 104.0 !O! hub: 100,0 m (TOT: 152,0 m) (15)	62:33	10:16

**BIJLAGE 3 WINDPRO RAPPORT BESTAANDE WINDTURBINES  
IN OMGEVING WINDPARK OOSTPOLDERDIJK**

## SHADOW - Main Result

Calculation: Bestaande turbines

### Assumptions for shadow calculations

Maximum distance for influence 1. WTG distance circle radius  
 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
1,51	2,58	3,50	5,20	6,57	6,07	6,12	6,11	4,30	3,18	1,88	1,27

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data: NL Eelde, 1970-76

### Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
465	545	649	732	582	468	739	1.037	1.200	844	615	500	8.376

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: CONTOURLINE\_ONLINEDATA\_1.wpo  
 Obstacles not used in calculation  
 Eye height: 1,5 m  
 Grid resolution: 20,0 m

All coordinates are in Dutch Stereo-RD/NAP 2000



Scale 1:40.000  
 \* Existing WTG      ● Shadow receptor

### WTGs

WTG ID	X (east)	Y (north)	Z [m]	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
14	253.792	603.854	1,7	VESTAS V52 850 52.0 !...	Yes	VESTAS	V52-850	850	52,0	40,0	624	26,0
24	251.918	604.799	0,0	VESTAS V47 660 47.0 !...	No	VESTAS	V47-660	660	47,0	40,0	564	28,5
25	251.400	603.813	0,0	VESTAS V47 660 47.0 !...	No	VESTAS	V47-660	660	47,0	40,0	564	28,5
26	249.693	602.239	-1,6	VESTAS V44 600 44.0 !...	No	VESTAS	V44-600	600	44,0	40,0	528	28,0
27	253.530	601.303	-1,6	VESTAS V47 660 47.0 !...	No	VESTAS	V47-660	660	47,0	40,0	564	28,5
71	251.691	608.611	1,1	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
72	252.325	608.423	1,2	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
73	252.642	608.296	1,8	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
74	252.952	608.132	2,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
75	253.251	607.912	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
76	253.547	607.637	0,6	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
77	253.756	607.438	1,7	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
78	253.416	607.203	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
79	253.302	606.732	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
80	249.412	608.052	3,9	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
81	249.023	608.155	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
82	248.609	608.251	1,9	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
83	249.242	608.904	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
84	249.672	609.314	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
85	250.005	609.324	3,1	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
86	250.335	609.195	4,6	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
87	250.665	609.061	1,5	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
88	250.997	608.936	3,3	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
89	253.344	605.929	1,5	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
90	253.172	606.215	4,7	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
91	252.882	606.382	0,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
92	252.578	606.570	1,8	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
93	252.263	606.723	-1,4	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
94	251.933	606.803	-2,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
95	251.603	606.884	0,2	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
96	251.273	606.964	-2,0	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
97	250.916	607.050	1,5	ENERCON E-82 E3 3000 ...	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5

To be continued on next page...

## SHADOW - Main Result

Calculation: Bestaande turbines

...continued from previous page

	X (east)	Y (north)	Z [m]	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
98	250.559	607.137	1,5	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
99	250.212	607.201	-1,1	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
100	249.862	607.252	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
101	249.510	607.302	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
102	249.207	607.349	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
103	248.841	607.404	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
104	248.444	607.404	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
105	248.127	608.372	-2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
106	245.283	609.076	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
107	245.591	609.036	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
108	245.888	608.987	-0,1	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
109	246.175	608.900	-2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
110	246.462	608.812	-2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
111	246.750	608.723	1,2	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
112	247.037	608.633	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
113	247.316	608.511	-2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
114	247.592	608.379	-1,3	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
115	247.874	608.263	-0,5	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
116	248.146	608.111	-1,1	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
117	246.045	608.353	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
118	246.336	608.279	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
119	246.622	608.188	1,5	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
120	246.907	608.088	-0,2	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
121	247.190	607.981	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
122	247.472	607.870	1,1	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
123	245.161	608.566	0,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
124	245.463	608.501	0,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
125	245.754	608.427	-1,6	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
126	249.554	608.828	0,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
127	249.866	608.752	0,4	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
128	250.209	608.669	0,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
129	250.550	608.586	1,1	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
130	250.892	608.503	2,2	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
131	251.566	608.173	4,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
132	251.793	607.668	1,7	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
133	252.219	607.987	0,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
134	252.852	607.716	1,9	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
135	252.144	607.676	2,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
136	252.765	607.355	2,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
137	251.347	607.247	2,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
138	251.676	607.186	1,1	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
139	252.006	607.106	1,2	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
140	252.338	607.035	2,3	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
141	252.652	606.888	0,8	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
142	252.956	606.705	1,4	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
143	253.830	604.980	0,2	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
144	253.634	605.359	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
145	253.487	605.644	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
146	253.662	606.943	-0,8	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
147	253.548	606.476	0,4	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
148	254.026	607.172	1,2	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
149	253.954	606.875	2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
150	253.843	606.417	2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
151	253.758	606.067	-1,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
152	254.272	606.915	0,1	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
153	254.151	605.985	2,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
154	253.996	605.473	0,0	ENERCON E-82 E3 3000 ...Yes	Yes	ENERCON	E-82 E3-3.000	3.000	82,0	98,4	984	17,5
155	248.340	607.818	-1,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
156	248.736	607.792	-2,0	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
157	248.899	608.577	1,5	2B Energy (estimate)	Yes	ENERCON	E-141 EP4-4.200	4.200	141,0	105,0	1.692	10,6
158	249.631	607.787	2,8	VESTAS V90 3000 90.0 !...Yes	Yes	VESTAS	V90-3.000	3.000	90,0	100,0	1.080	16,1
159	250.257	607.896	2,4	REpower 6.2 M 6200 12... No	No	REpower	6.2 M-6.200	6.200	126,0	117,0	1.512	12,1
160	250.779	607.769	4,0	REpower 6.2 M 6200 12... No	No	REpower	6.2 M-6.200	6.200	126,0	117,0	1.512	12,1

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## SHADOW - Main Result

Calculation: Bestaande turbines

...continued from previous page

	X (east)	Y (north)	Z [m]	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
161	252.008	608.545	2,0	VESTAS V117-3.3 GridSt...	Yes	VESTAS	V117-3.3 GridStreame-3.300	3.300	117,0	91,5	1.404	13,1
162	243.719	605.290	-1,1	VESTAS V52 850 52.0 !...	Yes	VESTAS	V52-850	850	52,0	40,0	624	26,0
163	244.583	607.295	-0,1	VESTAS V52 850 52.0 !...	Yes	VESTAS	V52-850	850	52,0	40,0	624	26,0
164	242.303	607.429	0,0	VESTAS V52 850 52.0 !...	Yes	VESTAS	V52-850	850	52,0	40,0	624	26,0
168	253.794	603.479	0,5	VESTAS V117-3.6 3600 ...	Yes	VESTAS	V117-3.6-3.600	3.600	117,0	121,0	1.404	14,0

## Shadow receptor-Input

No.	Name	X (east)	Y (north)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]	
01	Nieuwstad 1	254.125	602.733	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
02	Nieuwstad 2	254.140	602.775	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
03	Nieuwstad 3	254.202	602.849	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
04	Nieuwstad 4	254.225	602.875	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
05	Nieuwstad 5	254.181	602.906	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
06	Nieuwstad 6	254.124	602.938	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
07	Nieuwstad 7	254.080	602.971	0,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
08	Nieuwstad 8	254.100	603.057	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
09	Oostpolderweg 19	252.158	604.583	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
10	Polen 1	252.758	603.895	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
11	Polen 2	252.794	603.905	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
12	Polen 4	252.832	603.940	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
13	Polen 5	252.713	604.065	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
14	Polen 6	252.843	603.951	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
15	Polen 7	252.645	604.159	0,3	8,0	5,0	0,5	0,0	90,0	"Green house mode"
16	Polen 8	252.861	603.934	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
17	Polen 11	252.593	604.208	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
18	Tweehuizerweg 15	252.245	603.144	1,1	8,0	5,0	0,5	0,0	90,0	"Green house mode"
19	Tweehuizerweg 19	252.235	603.264	2,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
20	Vierhuizerweg 6	252.926	603.138	2,7	8,0	5,0	0,5	0,0	90,0	"Green house mode"
21	Vierhuizerweg 8	252.923	603.193	1,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
22	Vierhuizerweg 10	252.950	603.174	2,4	8,0	5,0	0,5	0,0	90,0	"Green house mode"
23	Oostpolder 1	252.941	605.012	4,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
24	Oostpolder 2	253.041	604.951	1,6	8,0	5,0	0,5	0,0	90,0	"Green house mode"
25	Oostpolder 6	253.690	605.033	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
26	Oostpolder 7	253.255	604.646	3,8	8,0	5,0	0,5	0,0	90,0	"Green house mode"
27	Polen 3	252.690	603.961	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
28	Vierhuizerweg 4a	252.885	602.958	0,0	8,0	5,0	0,5	0,0	90,0	"Green house mode"
29	Vierhuizerweg 4	252.826	603.017	1,6	8,0	5,0	0,5	0,0	90,0	"Green house mode"

## Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
01	Nieuwstad 1	0:00	0	0:00	0:00	
02	Nieuwstad 2	0:00	0	0:00	0:00	
03	Nieuwstad 3	0:00	0	0:00	0:00	
04	Nieuwstad 4	0:00	0	0:00	0:00	
05	Nieuwstad 5	0:00	0	0:00	0:00	
06	Nieuwstad 6	0:00	0	0:00	0:00	
07	Nieuwstad 7	0:00	0	0:00	0:00	
08	Nieuwstad 8	0:00	0	0:00	0:00	
09	Oostpolderweg 19	0:00	0	0:00	0:00	
10	Polen 1	11:31	34	0:26	1:52	
11	Polen 2	12:20	35	0:27	2:00	
12	Polen 4	13:10	37	0:28	2:06	
13	Polen 5	10:10	34	0:24	1:34	
14	Polen 6	13:23	37	0:28	2:08	
15	Polen 7	8:52	33	0:23	1:18	

To be continued on next page...



## SHADOW - Main Result

Calculation: Bestaande turbines

...continued from previous page

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
16	Polen 8	13:53	39	0:29	2:13	
17	Polen 11	0:00	0	0:00	0:00	
18	Tweehuizerweg 15	0:00	0	0:00	0:00	
19	Tweehuizerweg 19	0:00	0	0:00	0:00	
20	Vierhuizerweg 6	25:38	62	0:32	6:35	
21	Vierhuizerweg 8	23:09	56	0:33	5:51	
22	Vierhuizerweg 10	26:01	62	0:34	6:38	
23	Oostpolder 1	39:28	119	0:29	9:23	
24	Oostpolder 2	26:59	78	0:26	6:12	
25	Oostpolder 6	282:21	186	1:57	61:02	
26	Oostpolder 7	33:55	69	0:34	8:21	
27	Polen 3	9:58	33	0:25	1:36	
28	Vierhuizerweg 4a	33:24	77	0:30	8:17	
29	Vierhuizerweg 4	23:27	66	0:29	6:02	

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

No.	Name	Worst case [h/year]	Expected [h/year]
14	VESTAS V52 850 52.0 !O! hub: 40,0 m (TOT: 66,0 m) (89)	0:00	0:00
24	VESTAS V47 660 47.0 !O! hub: 40,0 m (TOT: 63,5 m) (90)	0:00	0:00
25	VESTAS V47 660 47.0 !O! hub: 40,0 m (TOT: 63,5 m) (91)	0:00	0:00
26	VESTAS V44 600 44.0 !O! hub: 40,0 m (TOT: 62,0 m) (92)	0:00	0:00
27	VESTAS V47 660 47.0 !O! hub: 40,0 m (TOT: 63,5 m) (93)	0:00	0:00
71	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (96)	0:00	0:00
72	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (97)	0:00	0:00
73	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (98)	0:00	0:00
74	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (99)	0:00	0:00
75	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (100)	0:00	0:00
76	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (101)	0:00	0:00
77	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (102)	0:00	0:00
78	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (103)	0:00	0:00
79	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (104)	0:00	0:00
80	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (105)	0:00	0:00
81	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (106)	0:00	0:00
82	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (107)	0:00	0:00
83	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (108)	0:00	0:00
84	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (109)	0:00	0:00
85	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (110)	0:00	0:00
86	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (111)	0:00	0:00
87	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (112)	0:00	0:00
88	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (113)	0:00	0:00
89	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (114)	0:00	0:00
90	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (115)	0:00	0:00
91	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (116)	0:00	0:00
92	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (117)	0:00	0:00
93	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (118)	0:00	0:00
94	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (119)	0:00	0:00
95	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (120)	0:00	0:00
96	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (121)	0:00	0:00
97	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (122)	0:00	0:00
98	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (123)	0:00	0:00
99	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (124)	0:00	0:00
100	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (125)	0:00	0:00
101	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (126)	0:00	0:00
102	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (127)	0:00	0:00
103	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (128)	0:00	0:00
104	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (129)	0:00	0:00
105	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (130)	0:00	0:00
106	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (131)	0:00	0:00
107	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (132)	0:00	0:00
108	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (133)	0:00	0:00
109	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (134)	0:00	0:00

To be continued on next page...

## SHADOW - Main Result

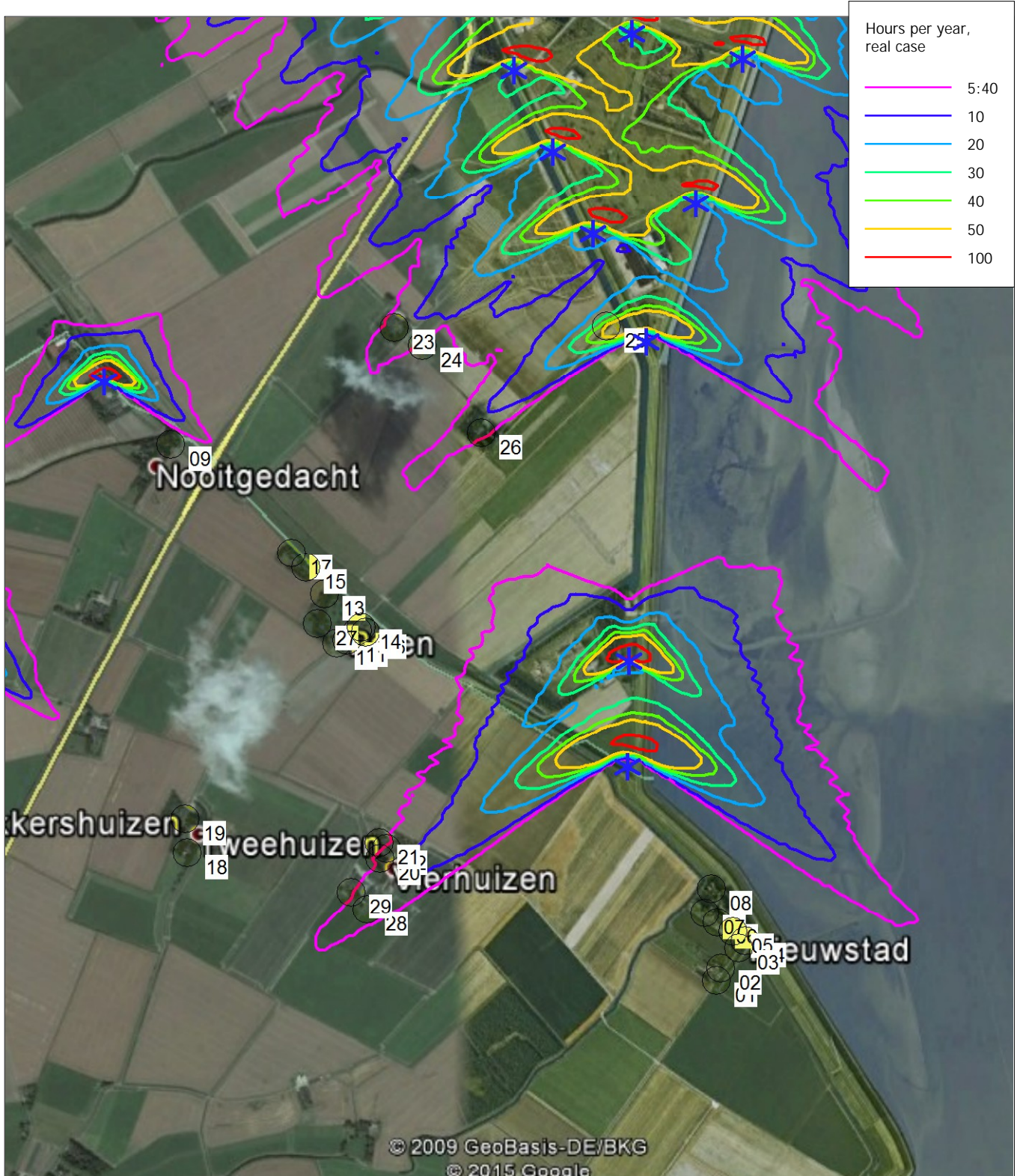
Calculation: Bestaande turbines

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
110	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (135)	0:00	0:00
111	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (136)	0:00	0:00
112	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (137)	0:00	0:00
113	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (138)	0:00	0:00
114	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (139)	0:00	0:00
115	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (140)	0:00	0:00
116	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (141)	0:00	0:00
117	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (142)	0:00	0:00
118	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (143)	0:00	0:00
119	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (144)	0:00	0:00
120	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (145)	0:00	0:00
121	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (146)	0:00	0:00
122	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (147)	0:00	0:00
123	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (148)	0:00	0:00
124	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (149)	0:00	0:00
125	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (150)	0:00	0:00
126	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (151)	0:00	0:00
127	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (152)	0:00	0:00
128	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (153)	0:00	0:00
129	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (154)	0:00	0:00
130	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (155)	0:00	0:00
131	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (156)	0:00	0:00
132	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (157)	0:00	0:00
133	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (158)	0:00	0:00
134	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (159)	0:00	0:00
135	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (160)	0:00	0:00
136	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (161)	0:00	0:00
137	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (162)	0:00	0:00
138	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (163)	0:00	0:00
139	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (164)	0:00	0:00
140	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (165)	0:00	0:00
141	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (166)	0:00	0:00
142	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (167)	0:00	0:00
143	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (168)	334:53	73:15
144	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (169)	45:47	11:21
145	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (170)	0:00	0:00
146	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (171)	0:00	0:00
147	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (172)	0:00	0:00
148	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (173)	0:00	0:00
149	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (174)	0:00	0:00
150	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (175)	0:00	0:00
151	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (176)	0:00	0:00
152	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (177)	0:00	0:00
153	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (178)	0:00	0:00
154	ENERCON E-82 E3 3000 82.0 !O! hub: 98,4 m (TOT: 139,4 m) (179)	0:00	0:00
155	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (180)	0:00	0:00
156	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (181)	0:00	0:00
157	2B Energy (estimate)	0:00	0:00
158	VESTAS V90 3000 90.0 !O! hub: 100,0 m (TOT: 145,0 m) (71)	0:00	0:00
159	REpower 6.2 M 6200 126.0 !O! hub: 117,0 m (TOT: 180,0 m) (184)	0:00	0:00
160	REpower 6.2 M 6200 126.0 !O! hub: 117,0 m (TOT: 180,0 m) (185)	0:00	0:00
161	VESTAS V117-3.3 GridStreame 3300 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (186)	0:00	0:00
162	VESTAS V52 850 52.0 !O! hub: 40,0 m (TOT: 66,0 m) (187)	0:00	0:00
163	VESTAS V52 850 52.0 !O! hub: 40,0 m (TOT: 66,0 m) (188)	0:00	0:00
164	VESTAS V52 850 52.0 !O! hub: 40,0 m (TOT: 66,0 m) (189)	0:00	0:00
168	VESTAS V117-3.6 3600 117.0 !O! hub: 121,0 m (TOT: 179,5 m) (191)	110:40	25:05

## SHADOW - Map

Calculation: Bestaande turbines



Map: Bitmap map: Eemshaven.jpg , Print scale 1:20.000, Map center Dutch Stereo-RD/NAP 2000 East: 253.425 North: 604.120  
 \* Existing WTG      Shadow receptor  
 Flicker map level: Height Contours: CONTOURLINE\_ONLINEDATA\_1.wpo (3)

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Onze referentie: 079417893 A





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# DELTA Test Report



 **DANAK**  
TEST Reg. no. 100

---

## Measurement of Noise Emission from a Vestas V90 3 MW wind turbine "Mode 0"

**Client: Vestas Wind Systems A/S**

AV 148/09

DANAK 100/2699 Rev.2

Project no.: A581149

Page 1 of 27

12 graph sheets and

6 annexes

5 May 2009 revised 10 December 2009

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**Title**

Measurement of Noise Emission from a Vestas V90 3 MW wind turbine

**Journal no.**

AV 148/09

DANAK 100/2699 Rev.2

**Project no.**

A581149

**Our ref.**

BSG/ugn

**Date of test**

5 March 2009

**Client**

Vestas Wind Systems A/S

Alsvej 21

8900 Randers

Denmark

**Client ref.**

Niels Christian Møller Nielsen, Vestas Wind Systems A/S

**Summary**

The noise emission from a Vestas V90 3 MW wind turbine "Mode 0", situated at Høvsøre, Denmark has been determined. The measurement results are shown below.

Wind speed	[m/s]	4	5	6	7	8	9	10
Power	[kW]	319	653	1151	1767	2376	2840	2979
LWA, Polynomial	[dB re 1 pW]	97.1	100.3	103.4	105.3	105.9	105.7	105.9
Uncertainty	[dB]	1.3	1.3	1.1	0.8	0.8	0.7	1.2
Tonal Audibility $\Delta L_a$	[dB]	-15.2	-12.0	-6.0	-10.6	-3.9	-3.3	-1.7
Directivity Front	[dB re 20 $\mu$ Pa]	-4.5	-1.6	-1.5	-2	-2.1	-2	-2.5
Directivity Right	[dB re 20 $\mu$ Pa]	0.4	-0.2	-0.1	0.1	0	-0.3	0

**Remark**

The test results apply only to the objects tested.

This report replaces previously issued reports AV 148/09 DANAK 2699 dated 31 March 2009 and AV 148/09 DANAK 2699 Rev. 1 dated 5 May 2009 respectively.

As consequence of an imperfect first revision following changes has been made in revision 2: Values for Power are changed in table in summary and in tables 8 and 11.

DELTA, 10 December 2009

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Bo Søndergaard  
Acoustics





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## 1. Test Situation

### 1.1 Test Object

The turbine is a Vestas V90 3 MW wind turbine with a hub height of 107 m above the surrounding ground. The turbine has a rotor diameter of 90 m. Specifications for the wind turbine is shown in Annex 4.

The noise from the turbine was dominated by broadband noise from the rotor. There was no significant noise from yawing or other single events during measurements.

### 1.2 Test Site

The wind turbine is situated in flat terrain at the Risoe test site at Høvsøre in Denmark.

The location of the wind turbine is shown in Annex 1. Photos from the site are shown in annex 2 and annex 3.

## 2. Measurement Conditions and Procedure

The measurements were performed on 5 March 2009 in the period from 11.30 p.m. to 19.00 a.m. under following meteorological conditions:

Date	5 March 2009
Wind speed	3 – 10 m/s
Average wind direction	Easterly 80° – 100°
Cloudiness	8/8
Air temperature	5 – 6°C
Barometric pressure	980 – 990 hPa
Relative Humidity	90% RH

The measurements were performed in accordance with IEC 61400-11:2002 “Wind turbine generator systems - Part 11: Acoustic noise measurement techniques” Edition 2.1.

The noise was measured at a distance of 150 m from the turbine in 3 directions as described in figure 3 of IEC 61400-11 at the positions 1 (Reference), 3 (Front) and 4 (Left). The measurement microphone was mounted with a cut-through windscreen which was placed directly on an 18 mm circular plywood board with a diameter of 1.2 m (+6 dB measurement).



The board was placed directly at the ground. A secondary wind shield type, DELTA H, was used during the measurements.

The wind speed and direction were measured in front of the turbine at a distance of approx. 100 m from the turbine, and the electrical power produced by the turbine, the nacelle wind speed, the rotor RPM and the pitch angles were registered through the wind turbine controller.

The data was registered on-line with the measurement program Wind Turbine 2.0 developed by DELTA.

The background noise was measured with the turbine parked. The background noise was primarily wind-induced noise in the surroundings. The nearest neighbouring wind turbines were parked during all measurements.

The noise from the turbine was primarily aerodynamic noise.

The measurements of the equivalent noise level in one-third octave bands, produced electrical power and wind speed were averaged synchronously over one-minute periods for the entire measurement period. 10 second FFT spectra were made as well.

From the power curve and a roughness length of  $z_0 = 0.05$  m, the produced electrical power data were converted into a wind speed at a height of 10 m. The power curve given by Vestas is shown in Annex 5.

Periods influenced by intruding intermittent background noise (cars, planes etc.) were discarded when analyzing the measurements.

### 3. Measurement Equipment

The measurement equipment is specified in Annex 6.

## 4. Measurement Results

### 4.1 Measured Wind Speed

A conversion factor  $\kappa$  is determined as the average value of the ratio of the calculated wind speed ( $v_{p,10}$ ) and the measured wind speed for simultaneous periods for the nacelle anemometer ( $v_{Nac,10}$ ) and for the 10 m anemometer ( $v_{Anem}$ ).

$$\kappa_{Anem} = v_{p,10}/v_{Anem}$$

$$\kappa_{Nac} = v_{p,10}/v_{Nac,10}$$



The normalized wind speed during background noise measurements is calculated as:

$$V_{\text{Anem,kor}} = \kappa_{\text{Anem}} \cdot V_{\text{Anem}}$$

The normalized wind speed used above 95% of rated power is calculated as:

$$V_{\text{Nac,kor}} = \kappa_{\text{Nac}} \cdot V_{\text{Nac,10}}$$

The  $\kappa_{\text{Anem}}$ -factor was determined to 1.05, and the  $\kappa_{\text{Nac}}$ -factor was determined to 0.99.

## 4.2 Sound Pressure Level

The total A-weighted sound pressure levels are calculated from the measured one-third octave band spectra corrected for the influence of the secondary wind shield. The results are shown in the Graph Sheets 1 – 3 together with the background noise as a function of the wind speed. A linear regression is applied to the background noise and used for background noise correction. All spectra in the report are A-weighted.

The A-weighted sound pressure levels generated by the wind turbine as well as the regression analysis are also shown in the Graph Sheets. The measurement results are corrected for background noise. A 4<sup>th</sup> order regression is applied to the measurement data. The measurement results in bins are shown in the tables for each measurement position.

95% of rated power is reached at approx. 9.1 m/s at 10 m height.

BIN Class	[m/s]	4	5	6	7	8	9	10
Number of measurements		9	22	22	45	27	15	4
Average wind speed	[m/s]	4.4	4.8	6.0	7.0	7.9	8.9	9.6
Average power	[kW]	426	570	1132	1790	2333	2764	2928
Average $L_{\text{Aeq,Total}}$	[dB re 20 $\mu$ Pa]	48.3	49.7	53.3	55.1	55.9	55.7	55.7
Rotor RPM	[s <sup>-1</sup> ]	11.0	12.4	15.1	16.0	16.1	16.1	16.1

Table 1 BIN-analysis of noise levels with wind turbine in operation.

BIN Class	[m/s]	4	5	6	7	8	9	10
Number of measurements		11	29	10	17	6	1	-
Average wind speed	[m/s]	4.3	5.0	6.0	7.0	7.9	8.7	-
Average $L_{\text{Aeq,Background}}$	[dB re 20 $\mu$ Pa]	37.3	37.6	40.2	41.7	42.1	41.5	-

Table 2 BIN-analysis of noise levels with the wind turbine parked.

The results corrected for background noise calculated from a 4<sup>th</sup> order polynomial regression are shown in Table 3

BIN Class	[m/s]	4	5	6	7	8	9	9
L <sub>Aeq,c</sub> Polynomial	[dB re 20µPa]	46.8	50.0	53.1	55.0	55.6	55.4	55.6

*Table 3 Measurement results corrected for background noise.*

The regression coefficients are shown in Table 4.

	4 <sup>th</sup> order	3 <sup>rd</sup> order	2 <sup>nd</sup> order	1 <sup>st</sup> order	Constant
Background noise data	-	-	-	1.53757	30.30695
Corrected measurement data	0.03039	-0.82518	7.6929	-26.863	76.17152

*Table 4 Regression analysis coefficients.*

The measurement results appear from Graph Sheet No. 1-3.

The average sound power levels, in one-third octave bands, are shown in Graph Sheet No. 4.

### 4.3 Directivity

The noise measurements were made simultaneously in all three measurement positions and at equal distances from the rotor centre. The results are given in Table 5 as background noise corrected bin centre values determined through a 4<sup>th</sup> order polynomial regression and in Table 6 as directivities.

BIN Class	[m/s]	4	5	6	7	8	9	10
Reference	[dB re 20µPa]	46.8	50.0	53.1	55.0	55.6	55.4	55.6
Front	[dB re 20µPa]	42.3	48.4	51.6	53.0	53.5	53.4	53.1
Right	[dB re 20µPa]	47.2	49.8	53.0	55.1	55.6	55.1	55.6

*Table 5 Measurement results from the 3 measurement positions*

BIN Class	[m/s]	4	5	6	7	8	9	10
Front	[dB re 20µPa]	-4.5	-1.6	-1.5	-2	-2.1	-2	-2.5
Right	[dB re 20µPa]	0.4	-0.2	-0.1	0.1	0	-0.3	0

*Table 6 Directivity*

### 4.4 Tonality

The audibility of tones in the noise was analyzed at the reference measurement position at a distance of 150 m from the turbine. The analysis showed possible tones at around 930 Hz and



in the area 1800 - 1900 Hz. The frequency spectra are shown in Graph Sheets 5 to 11. The corresponding audibility's are stated in Table 7.

BIN Class	[m/s]	4	5	6	7	8	9	10
Reference position		-15.2	-12.0	-6.0	-10.6	-3.9	-3.3	-1.7

Table 7 Tonal audibility  $\Delta L_a$  [dB]

The measurements were made close to the turbine (150 m), and the measured tonality is not directly applicable at larger distances.

## 5. Calculation of Sound Power Levels

### 5.1 Sound Power Level

The immission-relevant sound power level,  $L_{WA,ref}$ , of the turbine has been calculated according to DS/EN61400-11, based on the assumption that the noise is radiated from a point source at hub height

$$L_{WA} = L_{Aeq,c} + 10 \cdot \log(4\pi (R_i^2)) - 6 \text{ dB}$$

where:  $R_i$  = the slant distance from centre of rotor to microphone [m]

The sound power level from the reference position is shown in Table 8.

Wind speed	[m/s]	4	5	6	7	8	9	10
Power	[kW]	319	653	1151	1767	2376	2840	2979
$L_{WA, Polynomial}$	[dB re 1 pW]	97.1	100.3	103.4	105.3	105.9	105.7	105.9

Table 8 Sound power level  $L_{WA}$  [dB re 1 pW]

### 5.2 Other hub heights

The apparent Sound Power level is calculated for hub heights 105 m and 80 m. The calculation is made by recalculating the wind speed using a logarithmic wind speed profile and a roughness length of 0.05. The Sound Power levels are shown in Table 9.

Wind speed	[m/s]	4	5	6	7	8	9	10
$L_{WA, Polynomial}$ HH=105 m	[dB re 1 pW]	97.0	100.3	103.3	105.2	105.8	105.5	105.6
$L_{WA, Polynomial}$ HH=80 m	[dB re 1 pW]	96.6	99.7	102.8	105.0	105.9	105.9	105.9

Table 9 Sound Power levels calculated to other hub heights





## 6. Measurement Uncertainty

The standard uncertainty of  $L_{WA}$  calculated according to Annex D of DS/EN 61400-11:2002 “Wind turbine generator systems: Part 11: Acoustic noise measurement techniques” is listed in Table 10.

Wind speed [m/s]	4	5	6	7	8	9	10
Reference position	1.3	1.3	1.1	0.8	0.8	0.7	1.2
Front position	1.0	1.5	1.2	1.1	0.8	1.5	1.4
Right position	1.1	1.4	1.2	0.8	0.8	0.8	1.2

Table 10 Standard uncertainty [dB]

## 7. Conclusion

The noise emission from a Vestas V90 3 MW wind turbine “Mode 0”, situated at Høvsøre, Denmark has been determined. The measurement results are shown in Table 11.

Wind speed [m/s]	4	5	6	7	8	9	10
Power [kW]	319	653	1151	1767	2376	2840	2979
$L_{WA, Polynomial}$ [dB re 1 pW]	97.1	100.3	103.4	105.3	105.9	105.7	105.9
Tonal Audibility $\Delta L_a$ [dB]	-15.2	-12.0	-6.0	-10.6	-3.9	-3.3	-1.7
Directivity Front [dB re 20 $\mu$ Pa]	-4.5	-1.6	-1.5	-2	-2.1	-2	-2.5
Directivity Right [dB re 20 $\mu$ Pa]	0.4	-0.2	-0.1	0.1	0	-0.3	0

Table 11 Sound power level  $L_{WA}$  [dB re 1 pW] from Reference position.

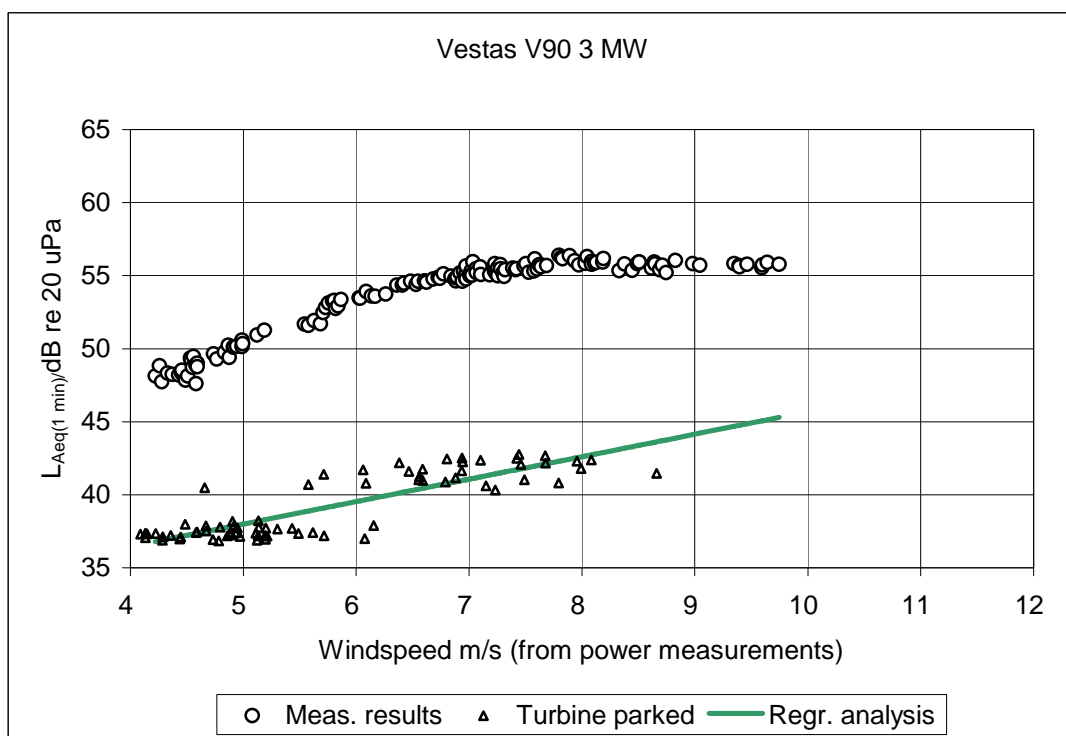
The results were obtained at 150 m distance from the turbine. At larger distances the tonality may be different.

There was no significant noise from yawing or other single events during measurements.

### Graph Sheet 1: Measurements results from Reference position

Measuring Object Vestas V90 3 MW  
Høvsøre

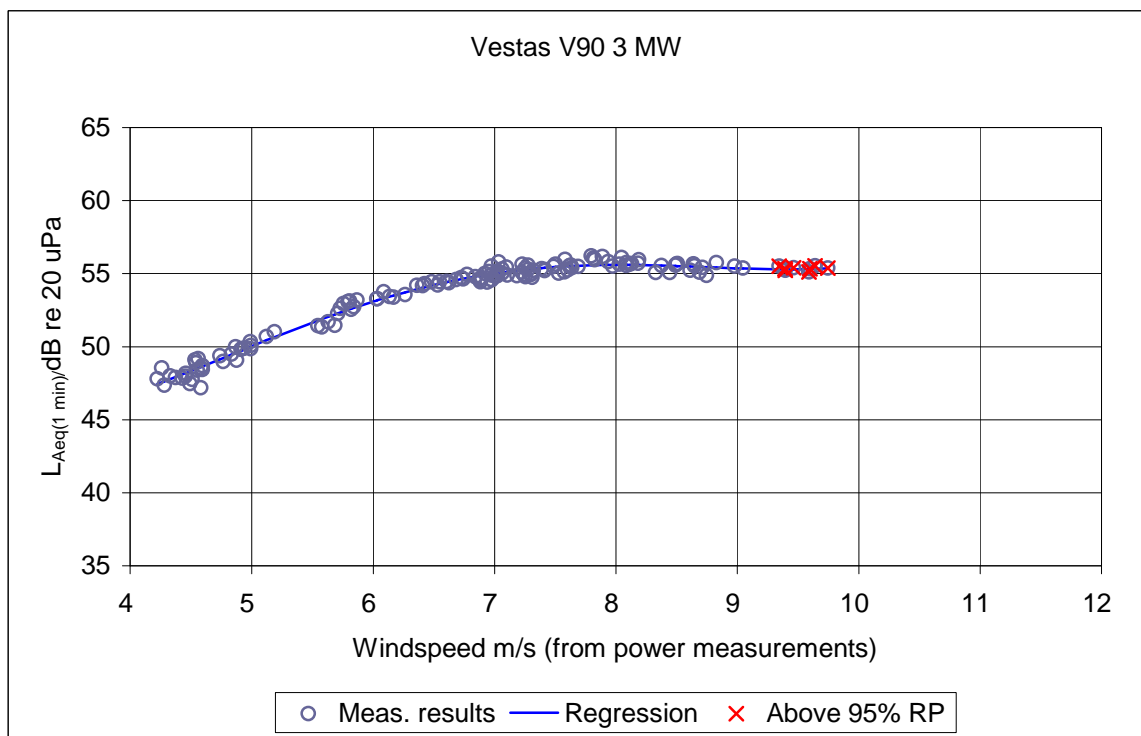
Test date 04/03/2009



**Graph Sheet 2: Measurements results corrected for background noise**

Measuring Object Vestas V90 3 MW  
 Høvsøre

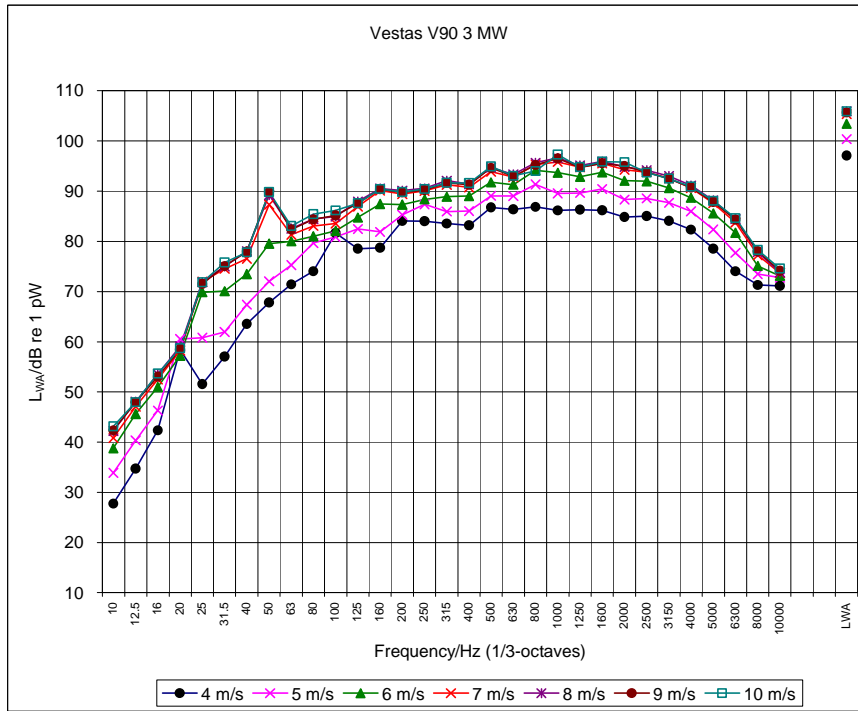
Test date 04/03/2009





**Graph Sheet 4: 1/3-octave bans spectra from Reference position**

Numbers in *Italic* indicates that the difference between total noise and background noise was less then 3 dB.

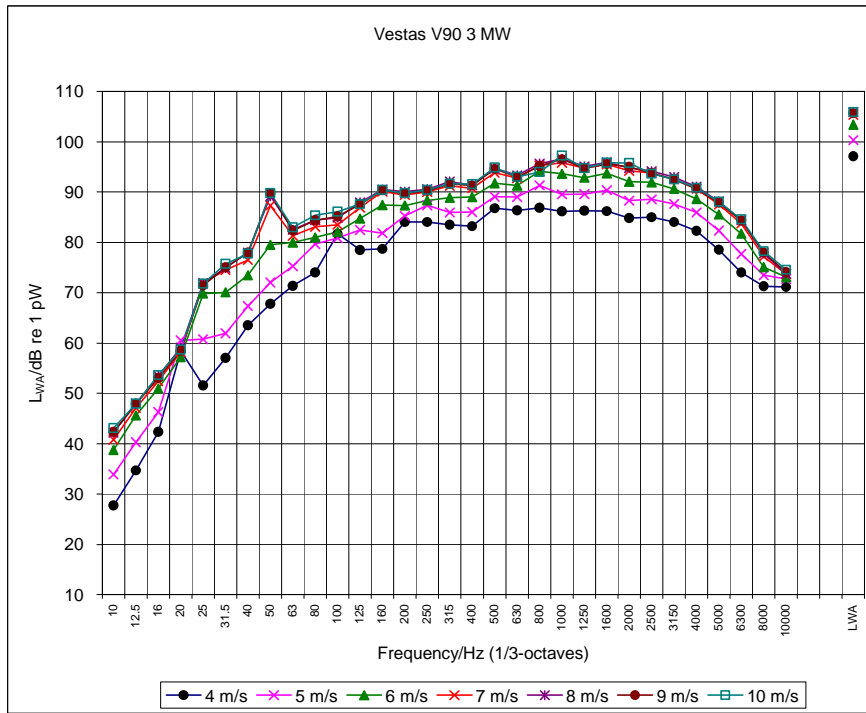


Frequency	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
10	27.7	33.9	38.8	40.8	42.2	42.4	43.1		
12.5	34.7	40.3	45.6	47.1	48.0	47.9	47.9		
16	42.4	46.3	51.0	52.5	53.5	53.0	53.6		
20	58.4	60.5	57.2	58.3	59.1	58.5	58.7		
25	51.6	60.8	69.8	71.9	71.8	71.5	71.8		
31.5	57.0	61.9	70.1	74.5	75.0	75.0	75.7		
40	63.5	67.4	73.5	76.5	78.0	78.0	77.8		
50	67.8	72.0	79.5	87.3	89.2	89.7	89.8		
63	71.4	75.2	80.0	81.3	82.5	82.3	83.0		
80	74.0	79.6	81.0	83.1	84.4	84.4	85.4		
100	81.7	80.9	82.1	83.5	84.9	85.1	86.1		
125	78.5	82.4	84.7	86.9	87.9	87.5	87.6		
160	78.7	81.8	87.4	90.1	90.5	90.4	90.4		
200	84.1	85.3	87.3	89.4	90.1	89.7	89.8		
250	84.0	87.3	88.3	90.0	90.5	90.2	90.4		
315	83.5	85.9	88.9	91.2	92.1	91.6	91.7		
400	83.2	86.0	89.0	90.7	91.4	91.3	91.6		
500	86.8	89.0	91.8	93.9	94.7	94.6	94.9		
630	86.3	89.0	91.3	92.8	93.3	92.9	93.0		
800	86.8	91.3	94.1	95.3	95.6	95.2	94.0		
1000	86.1	89.5	93.6	95.8	96.6	96.5	97.2		
1250	86.3	89.6	92.8	94.8	95.1	94.7	94.8		
1600	86.2	90.4	93.7	95.5	95.9	95.5	95.8		
2000	84.8	88.3	92.1	94.2	94.8	95.0	95.8		
2500	85.0	88.5	91.9	93.8	94.2	93.7	93.7		
3150	84.0	87.7	90.6	92.5	93.0	92.5	92.5		
4000	82.3	86.0	88.7	90.6	91.1	90.7	90.8		
5000	78.5	82.3	85.5	87.6	88.1	87.8	88.1		
6300	74.0	77.7	81.7	83.7	84.4	84.3	84.6		
8000	71.3	73.5	75.1	77.2	77.8	78.0	78.2		
10000	71.1	72.8	73.1	73.7	73.8	74.1	74.5		
L <sub>WA</sub>	97.1	100.3	103.4	105.3	105.9	105.7	105.9		



**Graph Sheet 5 1/3-octave bans spectra from Reference position for HH = 80 m**

Numbers in *Italic* indicates that the difference between total noise and background noise was less then 3 dB.



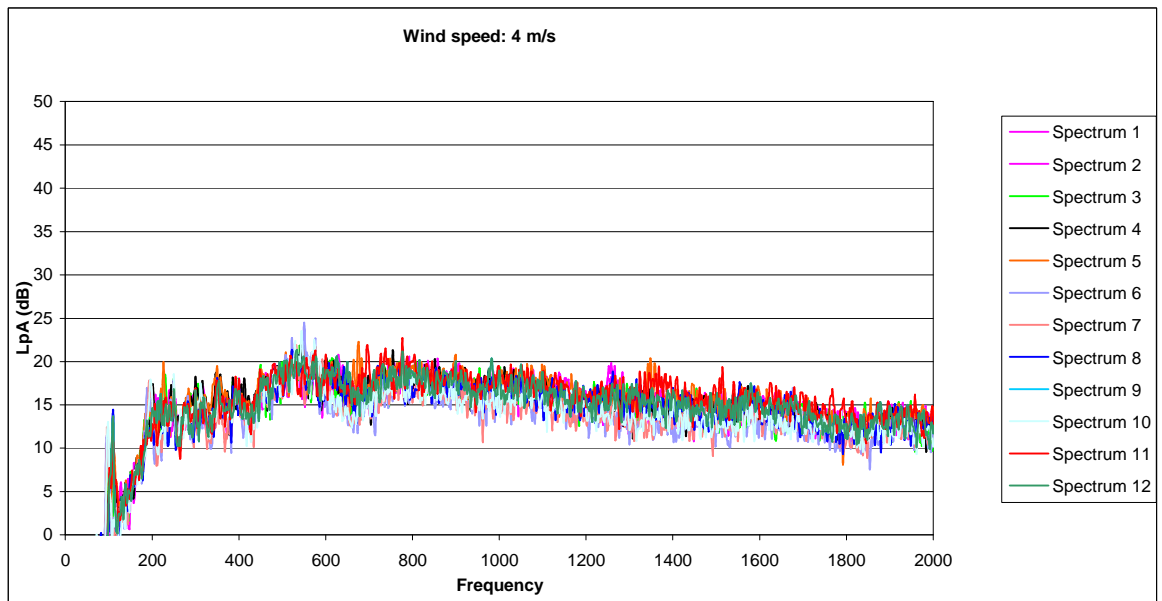
Frequency	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
10	27.3	33.3	38.2	40.5	42.3	42.6	43.2		
12.5	34.2	39.7	45.0	46.8	48.1	48.2	48.0		
16	41.9	45.7	50.4	52.1	53.5	53.3	53.7		
20	57.9	59.9	56.6	57.9	59.1	58.7	58.7		
25	51.1	60.2	69.3	71.6	71.9	71.7	71.8		
31.5	56.6	61.3	69.5	74.2	75.0	75.3	75.8		
40	63.1	66.8	72.9	76.2	78.0	78.2	77.8		
50	67.3	71.4	79.0	87.0	89.2	90.0	89.8		
63	70.9	74.6	79.4	81.0	82.6	82.6	83.0		
80	73.6	79.0	80.4	82.8	84.5	84.6	85.4		
100	81.2	80.3	81.5	83.2	85.0	85.4	86.2		
125	78.0	81.8	84.2	86.6	88.0	87.8	87.6		
160	78.3	81.2	86.9	89.8	90.5	90.6	90.4		
200	83.6	84.6	86.7	89.1	90.1	90.0	89.8		
250	83.6	86.7	87.8	89.7	90.6	90.5	90.4		
315	83.1	85.3	88.3	90.9	92.1	91.9	91.7		
400	82.7	85.4	88.4	90.4	91.4	91.6	91.6		
500	86.3	88.4	91.2	93.5	94.7	94.9	94.9		
630	85.9	88.4	90.7	92.5	93.3	93.2	93.1		
800	86.4	90.7	93.5	95.0	95.7	95.4	94.0		
1000	85.7	88.9	93.1	95.5	96.6	96.8	97.3		
1250	85.8	89.0	92.3	94.4	95.1	95.0	94.8		
1600	85.7	89.8	93.2	95.2	95.9	95.8	95.9		
2000	84.4	87.7	91.5	93.9	94.8	95.3	95.8		
2500	84.5	87.9	91.4	93.4	94.2	94.0	93.7		
3150	83.6	87.0	90.1	92.2	93.0	92.8	92.5		
4000	81.9	85.4	88.1	90.3	91.1	91.0	90.9		
5000	78.1	81.7	85.0	87.3	88.2	88.1	88.1		
6300	73.6	77.1	81.1	83.4	84.4	84.6	84.6		
8000	70.8	72.9	74.5	76.9	77.9	78.3	78.3		
10000	70.6	72.1	72.5	73.4	73.8	74.4	74.6		
12500									
L <sub>WA</sub>	96.6	99.7	102.8	105.0	105.9	105.9	105.9		





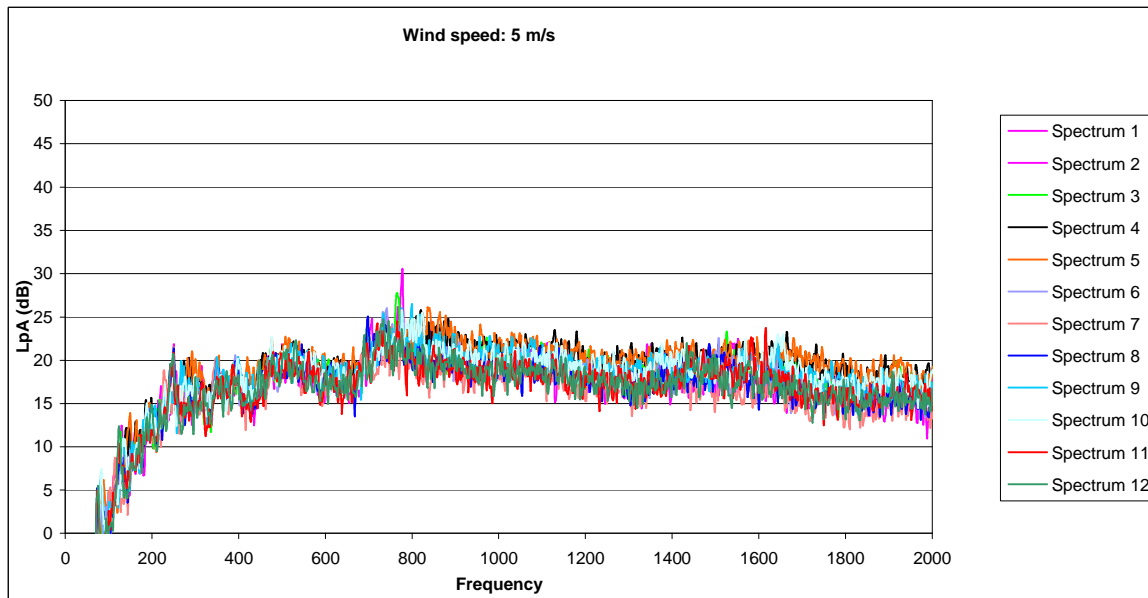
**Graph Sheet 6: Tonality analysis at 4 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 4 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	107.0	107.0	105.0	111.0	111.0	97.0	97.0	111.0	111.0	99.0	103.0	111.0	
Lp,tone/dB re 20 uPa	11.7	11.6	14.0	7.7	11.3	14.7	15.5	15.1	15.7	14.8	11.2	15.1	
Critical bandwidth/dB re 20 uPa	100.8	100.8	100.8	100.9	100.9	100.7	100.7	100.9	100.9	100.7	100.8	100.9	
Lower frequency/dB re 20 uPa	57	57	55	61	61	47	47	61	61	49	53	61	
Upper frequency/dB re 20 uPa	157	157	155	161	161	147	147	161	161	149	153	161	
Lp,noise,avg/dB re 20 uPa	16.6	16.5	16.3	18.3	17.9	14.8	14.2	16.4	17.1	14.8	13.4	16.4	
10*log(Critical bandwidth/Analysis bandwidth)	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	
Lp,critical band/dB re 20 uPa	31.9	31.8	31.6	33.6	33.2	30.1	29.5	31.7	32.4	30.1	28.7	31.7	
$\Delta L_{tn}$	-20.2	-20.2	-17.6	-25.9	-21.9	-15.4	-14.0	-16.6	-16.7	-15.3	-17.5	-16.6	-17.2
$\Delta L_a$	-18.2	-18.2	-15.6	-23.9	-19.9	-13.4	-12.0	-14.6	-14.7	-13.3	-15.5	-14.6	-15.2



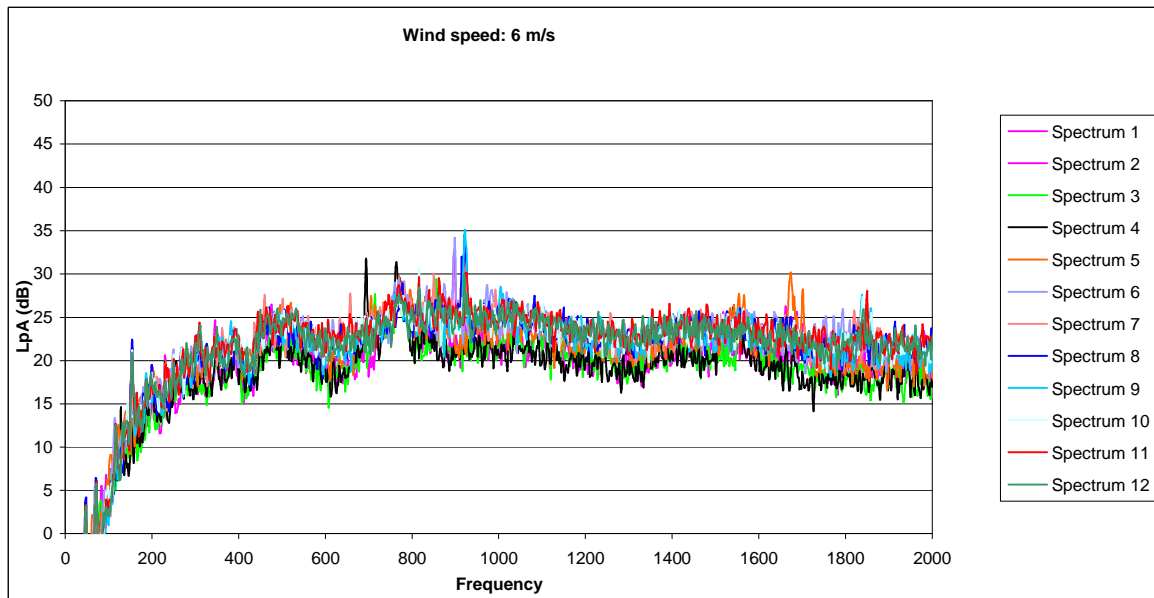
**Graph Sheet 7: Tonality analysis at 5 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 5 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	779.0	
Lp, tone/dB re 20 uPa	31.2												
Critical bandwidth/dB re 20 uPa	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	139.6	
Lower frequency/dB re 20 uPa	709	709	709	709	709	709	709	709	709	709	709	709	
Upper frequency/dB re 20 uPa	849	849	849	849	849	849	849	849	849	849	849	849	
Lp, noise, avg/dB re 20 uPa	22.0												
10*log(Critical bandwidth/Analysis bandwidth)	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	
Lp, critical band/dB re 20 uPa	16.7	38.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	
$\Delta L_{tn}$	-16.7	-7.5	-16.7	-16.7	-16.7	-16.7	-16.7	-16.7	-16.7	-16.7	-16.7	-16.7	-14.6
$\Delta L_a$	-14.1	-4.9	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-14.1	-12.0



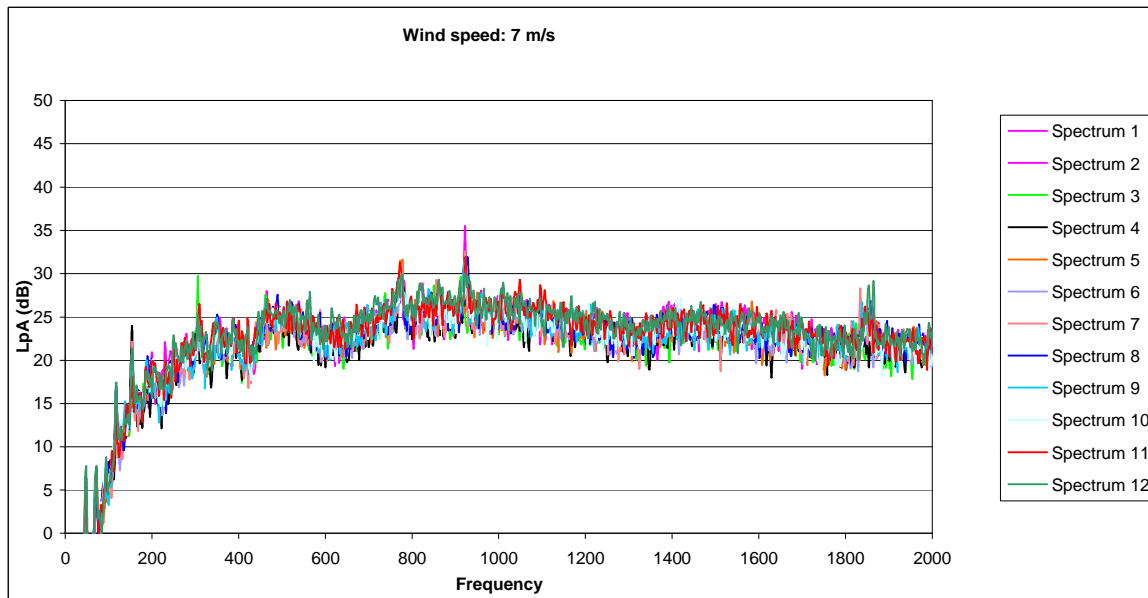
**Graph Sheet 8: Tonality analysis at 6 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 6 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	899.0	857.0		765.0		899.0	921.0	921.0	923.0				
Lp, tone/dB re 20 uPa	33.5	27.6		34.3		34.7	33.6	38.2	38.2				
Critical bandwidth/dB re 20 uPa	151.4	147.2	100.0	138.3	100.0	151.4	153.7	153.7	153.9	100.0	100.0	100.0	
Lower frequency/dB re 20 uPa	823	783	-50	696	-50	823	844	844	846	-50	-50	-50	
Upper frequency/dB re 20 uPa	975	931	50	834	50	975	998	998	1000	50	50	50	
Lp, noise, avg/dB re 20 uPa	24.9	22.5		24.2		26.1	25.6	25.5	24.9				
10*log(Critical bandwidth/Analysis bandwidth)	17.0	16.9	15.2	16.6	15.2	17.0	17.1	17.1	17.1	15.2	15.2	15.2	
Lp, critical band/dB re 20 uPa	41.9	39.4	15.2	40.8	15.2	43.1	42.7	42.6	42.0	15.2	15.2	15.2	
$\Delta L_{tn}$	-8.4	-11.8	-15.2	-6.5	-15.2	-8.4	-9.1	-4.4	-3.8	-15.2	-15.2	-15.2	-8.7
$\Delta L_{La}$	-5.7	-9.1	-13.2	-3.9	-13.2	-5.7	-6.4	-1.7	-1.1	-13.2	-13.2	-13.2	-6.0



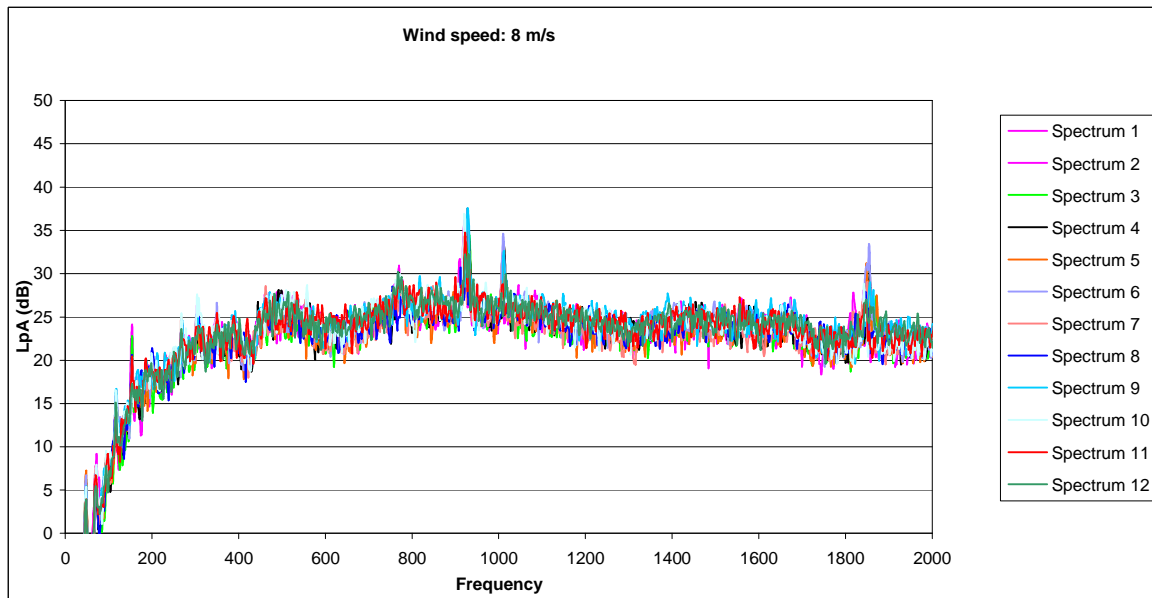
**Graph Sheet 9: Tonality analysis at 7 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 7 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	923.0			921.0			923.0	929.0					
Lp, tone/dB re 20 uPa	35.7			30.1			30.7	30.1					
Critical bandwidth/dB re 20 uPa	153.9	100.0	100.0	153.7	100.0	100.0	153.9	154.6	100.0	100.0	100.0	100.0	
Lower frequency/dB re 20 uPa	846	-50	-50	844	-50	-50	846	852	-50	-50	-50	-50	
Upper frequency/dB re 20 uPa	1000	50	50	998	50	50	1000	1006	50	50	50	50	
Lp, noise, avg/dB re 20 uPa	26.2			24.8			25.4	25.8					
10*log(Critical bandwidth/Analysis bandwidth)	17.1	15.2	15.2	17.1	15.2	15.2	17.1	17.1	15.2	15.2	15.2	15.2	
Lp, critical band/dB re 20 uPa	43.3	15.2	15.2	41.9	15.2	15.2	42.5	42.9	15.2	15.2	15.2	15.2	
$\Delta L_{tn}$	-7.6	-15.2	-15.2	-11.8	-15.2	-15.2	-11.8	-12.8	-15.2	-15.2	-15.2	-15.2	-13.0
$\Delta L_{La}$	-4.9	-13.2	-13.2	-9.1	-13.2	-13.2	-9.1	-10.0	-13.2	-13.2	-13.2	-13.2	-10.6



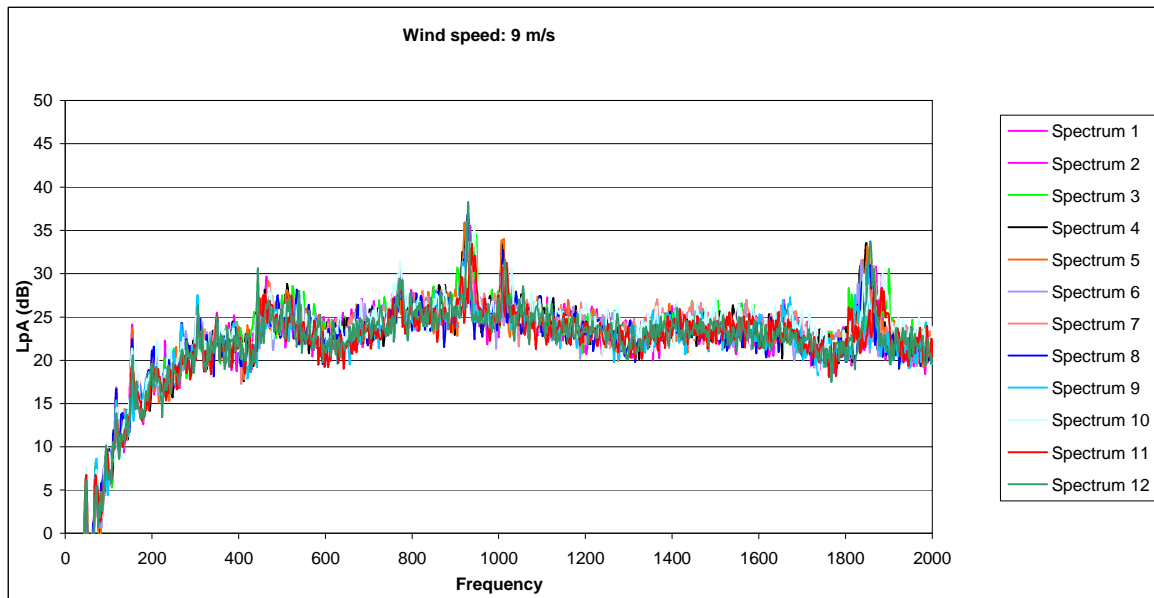
**Graph Sheet 10: Tonality analysis at 8 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 8 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	925.0	921.0	923.0	929.0	933.0	929.0			929.0	921.0	923.0		
Lp, tone/dB re 20 uPa	32.0	37.8	38.5	39.8	30.8	40.2			40.6	39.0	35.7		
Critical bandwidth/dB re 20 uPa	154.1	153.7	153.9	154.6	155.0	154.6	100.0	100.0	154.6	153.7	153.9	100.0	
Lower frequency/dB re 20 uPa	848	844	846	852	856	852	-50	-50	852	844	846	-50	
Upper frequency/dB re 20 uPa	1002	998	1000	1006	1010	1006	50	50	1006	998	1000	50	
Lp, noise, avg/dB re 20 uPa	26.0	26.4	26.3	26.4	26.4	26.6			27.0	26.8	26.9		
10*log(Critical bandwidth/Analysis bandwidth)	17.1	17.1	17.1	17.1	17.1	17.1	15.2	15.2	17.1	17.1	17.1	15.2	
Lp, critical band/dB re 20 uPa	43.1	43.5	43.4	43.5	43.5	43.7	15.2	15.2	44.1	43.9	44.0	15.2	
$\Delta L_{tn}$	-11.1	-5.7	-4.9	-3.7	-12.7	-3.5	-15.2	-15.2	-3.5	-4.9	-8.3	-15.2	-6.6
$\Delta L_a$	-8.4	-3.0	-2.2	-0.9	-9.9	-0.7	-13.2	-13.2	-0.7	-2.2	-5.6	-13.2	-3.9



**Graph Sheet 11: Tonality analysis at 9 m/s**

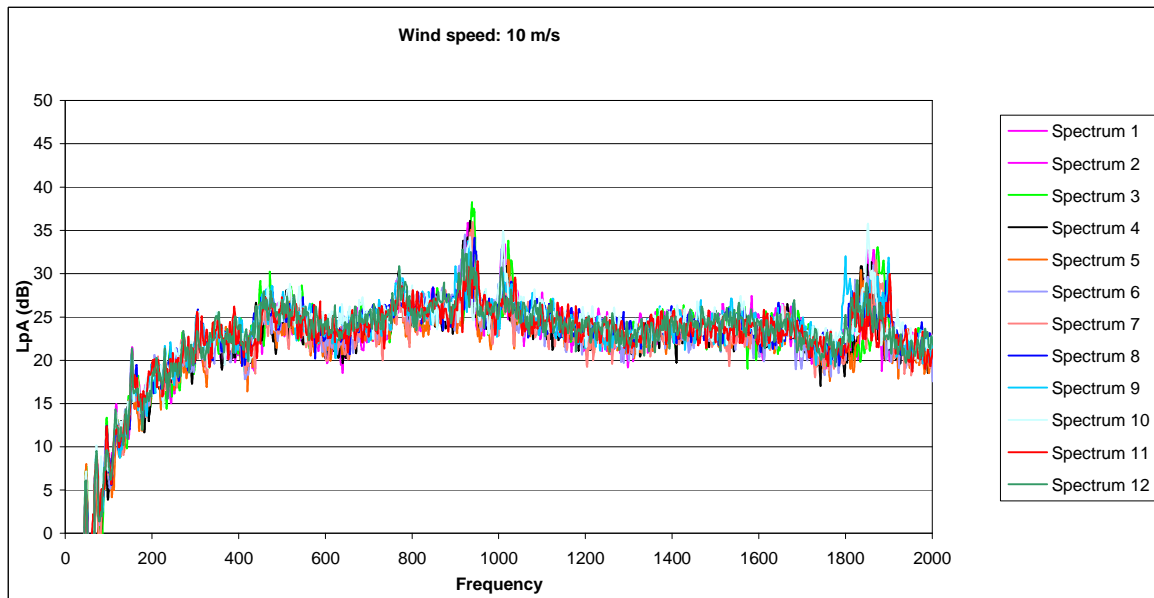
Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 9 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	935.0	935.0	949.0	923.0	923.0		927.0	929.0	927.0	945.0	939.0	931.0	
Lp, tone/dB re 20 uPa	36.3	36.9	32.7	38.0	39.3		38.7	39.5	37.5	37.7	34.4	40.1	
Critical bandwidth/dB re 20 uPa	155.2	155.2	156.7	153.9	153.9	100.0	154.3	154.6	154.3	156.2	155.6	154.8	
Lower frequency/dB re 20 uPa	857	857	871	846	846	-50	850	852	850	867	861	854	
Upper frequency/dB re 20 uPa	1013	1013	1027	1000	1000	50	1004	1006	1004	1023	1017	1008	
Lp, noise, avg/dB re 20 uPa	26.9	26.4	27.7	26.7	26.3		26.5	26.0	26.4	27.6	26.5	25.9	
10*log(Critical bandwidth/Analysis bandwidth)	17.1	17.1	17.2	17.1	17.1	15.2	17.1	17.1	17.1	17.2	17.1	17.1	
Lp, critical band/dB re 20 uPa	44.0	43.5	44.9	43.8	43.4	15.2	43.6	43.1	43.5	44.8	43.6	43.0	
$\Delta L_{tn}$	-7.7	-6.6	-12.2	-5.8	-4.1	-15.2	-4.9	-3.6	-6.0	-7.1	-9.2	-2.9	-6.1
$\Delta L_a$	-4.9	-3.8	-9.4	-3.1	-1.4	-13.2	-2.1	-0.8	-3.2	-4.3	-6.4	-0.1	-3.3



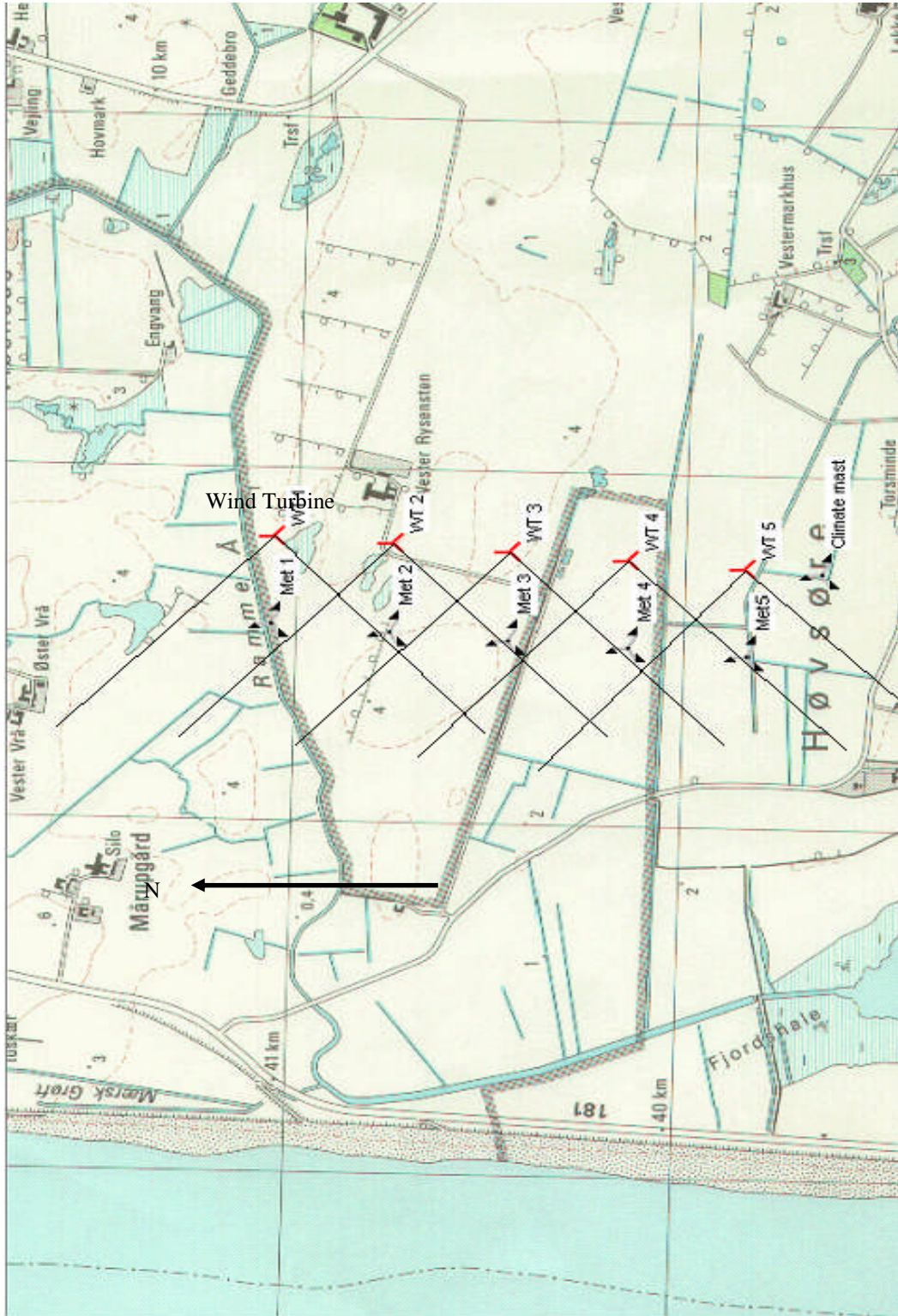


**Graph Sheet 12: Tonality analysis at 10 m/s**

Linespacing (analysis bandwidth)	Vestas V90 3MW												Avg
	Wind speed: 10 m/s												
Spectrum no	1	2	3	4	5	6	7	8	9	10	11	12	
Frequency/Hz	931.0	929.0	939.0	919.0	937.0	923.0	935.0	945.0	931.0	935.0			
Lp, tone/dB re 20 uPa	38.4	39.7	42.7	42.2	38.8	40.6	39.6	32.4	31.9	39.9			
Critical bandwidth/dB re 20 uPa	154.8	154.6	155.6	153.5	155.4	153.9	155.2	156.2	154.8	155.2	100.0	100.0	
Lower frequency/dB re 20 uPa	854	852	861	842	859	846	857	867	854	857	-50	-50	
Upper frequency/dB re 20 uPa	1008	1006	1017	996	1015	1000	1013	1023	1008	1013	50	50	
Lp, noise, avg/dB re 20 uPa	26.9	26.3	26.3	25.6	26.1	26.6	26.5	27.0	27.4	26.7			
10*log(Critical bandwidth/Analysis bandwidth)	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.2	17.1	17.1	15.2	15.2	
Lp, critical band/dB re 20 uPa	44.0	43.4	43.4	42.7	43.2	43.7	43.6	44.1	44.6	43.8	15.2	15.2	
$\Delta L_{tn}$	-5.6	-3.7	-0.7	-0.5	-4.4	-3.1	-4.0	-11.7	-12.7	-3.9	-15.2	-15.2	-4.5
$\Delta L_a$	-2.8	-0.9	2.1	2.2	-1.7	-0.3	-1.3	-9.0	-9.9	-1.2	-13.2	-13.2	-1.7



Annex 1: Site location



**Annex 2: Photos from the site. Reference position**





**Annex 3: Photos from the site. Right and front positions**



**Annex 4: Wind turbine specifications**

<b>– Wind turbine details:</b>	
• manufacturer;	VESTAS Wind Systems A/S
• model number	V90 3MW VCS 50 Hz
• serial number	30909
<b>– Operating details:</b>	
• vertical or horizontal axis wind turbine	Horizontal
• upwind or downwind rotor	Upwind
• hub height	107 m
• horizontal distance from rotor centre to tower axis	3.05 m
• diameter of rotor	90 m
• tower type (lattice or tube)	Conical tubular
• passive stall, active stall, or pitch controlled turbine	Pitch control
• constant or variable speed	Variable speed
• rated power output	3 MW
• control software version	VMP6000 – 3.09.01
<b>– Rotor details:</b>	
• rotor control devices	Hydraulic
• presence of vortex generators, stall strips, serrated trailing edges	Vortex generators
• blade type	Vestas 44 m
• number of blades	3
<b>– Gearbox details:</b>	
• Manufacturer	Hansen
• model number	EF901E - E55-K1
• fixed-parallel-shaft or planetary gearbox	Planetary
• Gear ratio	1:104.56
<b>– Generator details:</b>	
• Manufacturer	Leroy Somer
• Model number	G54-10/4P MK61S 50 Hz
• Rated RPM / Rated Slip	1680 rpm / 12 %



**Annex 5: Power Curve**

<b>V90-3MW Power Curve</b>		<b>Mode 0</b>
<b>Document</b>		<b>GS-950011</b>
<b>Air Density [kg/m<sup>3</sup>]</b>		<b>1.225</b>
<b>Wind speed in hub height</b>		<b>Power curve</b>
<b>[m/s]</b>		<b>[kW]</b>
4		77
5		190
6		353
7		581
8		886
9		1273
10		1710
11		2145
12		2544
13		2837
14		2965
15		2995
16		3000
17		3000
18		3000
19		3000
20		3000
21		3000
22		3000
23		3000
24		3000
25		3000



**Annex 6: Instruments**

No.	Equipment	Make	Type	Calibration	
				Latest	Next
17L027	Cup anemometer	Schiltknecht	655-660-LNE/21	16-08-2007	08-2009
17L027	Windvane	Schiltknecht	655-660-LNE/21	16-08-2007	08-2009
02L022	Calibrator	Brüel & Kjær	4231	05-05-2008	11-2008
14L002	Data acquisition card	National Instruments	9233	28-08-2008	08-2010
06L053	½" Microphone	G.R.A..S.	40AE	14-10-2008	10-2009
09L031	Preamplifier	G.R.A..S.	26CA	28-06-2008	06-2010
06L059	½" Microphone	G.R.A..S.	40AE	18-03-2009	03-2010
09L036	Preamplifier	G.R.A..S.	26CA	28-06-2008	06-2010
06L057	½" Microphone	G.R.A..S.	40AE	08-09-2008	09-2009
09L035	Preamplifier	G.R.A..S.	26CA	26-06-2008	06-2010
10L011	Measurement software	DELTA	Wind Turbine 2.0	28-08-2008	08-2010



## Tongeren F. van (Freek)

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**Van:** Middel, Martijn <Martijn.Middel@dnvgl.com>  
**Verzonden:** dinsdag 30 juni 2015 11:29  
**Aan:** Kassenberg P.C.A. (P.C.A.Kassenberg@gastransport.nl); Chevalking, H.R. (Reinier)  
**Onderwerp:** WT's Spijk: ff componenten

**Opvolgingsvlag:** Opvolgen  
**Vlagstatus:** Met vlag

Paul, Reinier,

Hieronder de tabel met uitstroomb frequenties voor de verdringercompressoren in de gebouwen: kleine gebouw 1, grotere gebouw 4 (niet te verwarren met het kantoorgebouw in zuidoosten). Helemaal in het westen van het invloedsgebied wordt nog een stukje bovengrondse leidingen beïnvloed. Daarvoor gelden de frequenties zoals gegeven in de onderste tabel (centrifugaalcompressoren van Gasunie zijn gelijkgesteld met leidingen).

*Tabel 10-21 Uitstroomb scenario's en -frequenties voor een verdringer*

Scenario
Breuk van de toevoerleiding
Lek van de toevoerleiding (10% van de diameter van de toevoerleiding maximaal 50 mm)

*Tabel 10-11 Uitstroomb scenario's en -frequenties voor hogedruk gas*

Scenario	Frequentie
Breuk van de leiding	5,6x
Lek in de leiding (10% van de leidingdiameter, max. 50 mm)	2,0x
Flenslek (10% van de leidingdiameter, maximaal 50 mm)*	9,3x

\* Lek van de leiding en lek van de flens mogen met één (gezamenlijk) ingevoerd in de risicoberekening. Dit wordt dan ingevoerd als een flenslek. De flenzen wordt in dat geval gelijkmatig verdeeld over de leiding.

Met vriendelijke groet/ Best regards,

**Martijn Middel M.Sc.**  
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