PARK - Main Result

Wake Model Eddy Viscosity Model (J.F. Ainslie) : 1988

Calculation performed in UTM (north)-WGS84 Zone: 32
At the site centre the difference between grid north and true north is: -1.8°

Power curve correction method
New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>
Air density calculation method
Height dependent, temperature from climate station
Station: KOLN W.GERMANY V3 2014
Base temperature: 9.8 °C at 45.0 m
Base pressure: 1013.3 hPa at 0.0 m
Air density for Site center in key hub height: 161.5 m + 50.0 m = 1.221 kg/m³ -> 99.6 % of Std
Relative humidity: 0.0 %

Wake Model Parameters

EV-setting	Ainslie with DAC offshore class 0 (0.0002-0.02) <default>
Turbulence measure-height	50.00 m
Ambient turbulence level	4.9 %
	Hub height dependent
Axial grid size [RDs]	100.0
Axial grid step [RDs]	0.25
Von Karman constant	0.4000
Length scale constant, K1	0.0150
DAC weight	1.000
DAC background roughness	0.00020
DAC added roughness	0.02000
DAC start of recovery distance [RDs]	60.0
DAC end of recovery distance [RDs]	80.0

Wake calculation settings

Angle [°]			Wind speed [m/s]		
start	end	step	start	end	step
0.5	360.0	1.0	0.5	30.5	1.0

Scale 1:400,000
New WTG
Meteorological Data

Key results for height 50.0 m above ground level

Terrain GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

	Easting	Northing	Name of wind distribution	Height [m]	Type	Wind energy [kWh/m²]	Mean wind speed [m/s]
A	2,546,000	5,627,000	Default Meteo data description (2)	100.0	WEIBULL	296	2.6

Calculated Annual Energy for Wind Farm

WTG combination	Result PARK [MWh/y]	Result-10.0% [MWh/y]	GROSS (no loss) Free WTGs [MWh/y]	Wake loss [%]	Specific results¤) Capacity factor [%]	Mean WTG result [MWh/y]	Full load hours [Hours/year]	Mean wind speed @hub height [m/s]
Wind farm	3,445.5	3,101.0	3,561.8	3.3	2.9	775.2	254	2.8

¤) Based on Result-10.0%

Calculated Annual Energy for each of 4 new WTGs with total 12.2 MW rated power

	Links	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Power curve Creator	Name	Annual Energy Result [MWh/y]	Result-10.0% [MWh/y]	Wake loss [%]	Free mean wind speed [m/s]
1	A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	886.3	798	0.5	2.81
2	A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	850.5	765	4.5	2.81
3	A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	853.1	768	4.2	2.81
4	A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	855.6	770	3.9	2.81

WTG siting

GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

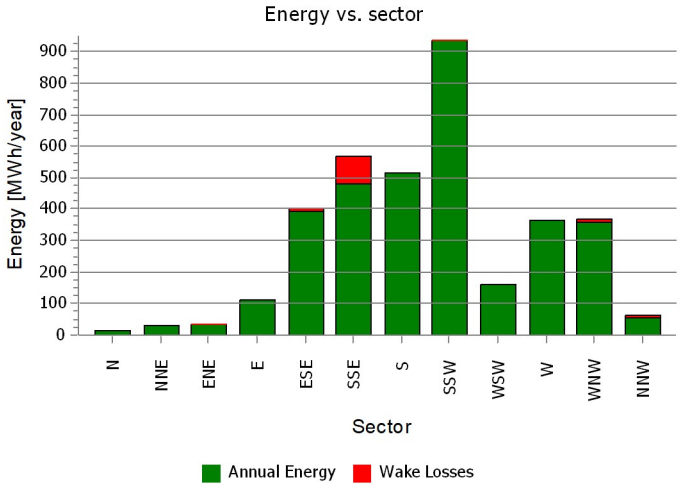
	Easting	Northing	Z [m]	Row data/Description
1 New	2,551,335	5,644,577	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)
2 New	2,550,853	5,645,184	157.7	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)
3 New	2,549,837	5,646,252	157.9	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (12)
4 New	2,550,284	5,645,743	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)

PARK - Production Analysis

WTG: All new WTGs, Air density 1.215 kg/m³

Directional Analysis

Sector		0 N	1 NNE	2 ENE	3 E	4 ESE	5 SSE	6 S	7 SSW	8 WSW	9 W	10 WNW	11 NNW	Total
Roughness based energy	[MWh]	14.5	28.0	35.9	112.6	400.4	566.4	513.6	935.2	159.8	363.0	368.7	63.5	3,561.8
-Decrease due to wake losses	[MWh]	0.0	0.0	0.0	0.0	9.6	86.8	0.0	0.0	0.0	0.0	8.9	11.0	116.3
Resulting energy	[MWh]	14.5	28.0	35.9	112.6	390.8	479.7	513.6	935.2	159.8	363.0	359.8	52.5	3,445.5
Specific energy	[kWh/m²]													108
Specific energy	[kWh/kW]													282
Decrease due to wake losses	[%]	0.0	0.0	0.0	0.0	2.4	15.3	0.0	0.0	0.0	0.0	2.4	17.3	3.26
Utilization	[%]	32.3	37.4	37.2	36.6	39.7	37.4	43.4	43.5	40.1	40.4	39.1	29.2	40.4
Operational	[Hours/year]	128	125	207	624	935	603	726	1,298	585	988	1,088	354	7,661
Full Load Equivalent	[Hours/year]	1	2	3	9	32	39	42	77	13	30	29	4	282



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PARK - Power Curve Analysis

WTG: 1 - ENERCON E-101 3050 101.0 !-!, Hub height: 99.0 m

Name: Level 0 - official - OM 0 - 3050kW - 03/2015
Source: Enercon

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
3/3/2015	EMD	11/25/2009	4/16/2015	25.0	Pitch	User defined	Variable	0.38

According to Enercon specification document D0372846-1_#_ger_#_Betriebsmodi_E-101___3050_kW

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	4,152	6,555	9,004	11,276	13,257	14,885
ENERCON E-101 3050 101.0 !-! Level 0 - official - OM 0 - 3050kW - 03/2015	[MWh]	4,479	6,981	9,495	11,793	13,760	15,345
Check value	[%]	-7	-6	-5	-4	-4	-3

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

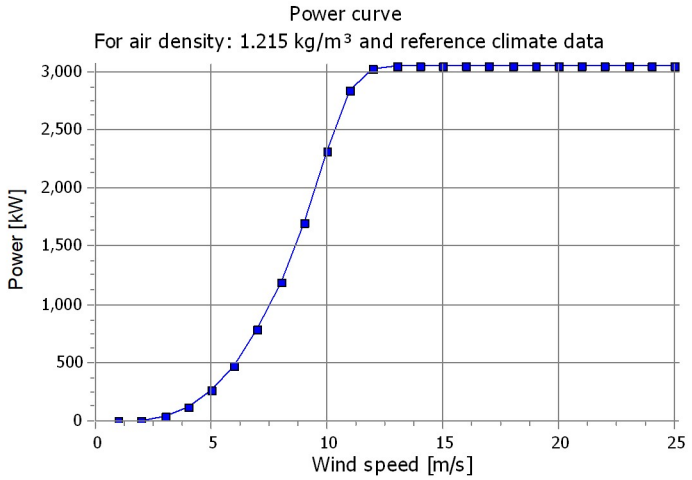
Original data, Air density: 1.225 kg/m³

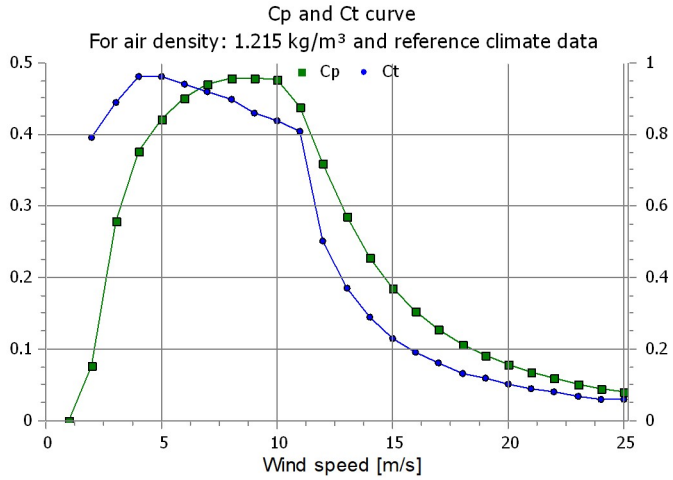
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
1.0	0.0	0.00	2.0	0.79
2.0	3.0	0.08	3.0	0.89
3.0	37.0	0.28	4.0	0.96
4.0	118.0	0.38	5.0	0.96
5.0	258.0	0.42	6.0	0.94
6.0	479.0	0.45	7.0	0.92
7.0	790.0	0.47	8.0	0.90
8.0	1,200.0	0.48	9.0	0.86
9.0	1,710.0	0.48	10.0	0.84
10.0	2,340.0	0.48	11.0	0.81
11.0	2,867.0	0.44	12.0	0.50
12.0	3,034.0	0.36	13.0	0.37
13.0	3,050.0	0.28	14.0	0.29
14.0	3,050.0	0.23	15.0	0.23
15.0	3,050.0	0.18	16.0	0.19
16.0	3,050.0	0.15	17.0	0.16
17.0	3,050.0	0.13	18.0	0.13
18.0	3,050.0	0.11	19.0	0.12
19.0	3,050.0	0.09	20.0	0.10
20.0	3,050.0	0.08	21.0	0.09
21.0	3,050.0	0.07	22.0	0.08
22.0	3,050.0	0.06	23.0	0.07
23.0	3,050.0	0.05	24.0	0.06
24.0	3,050.0	0.04	25.0	0.06
25.0	3,050.0	0.04		

Power, Efficiency and energy vs. wind speed

Data used in calculation, Air density: 1.215 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	1.6	1.6	0.2
2.0	3.0	0.08	1.50- 2.50	22.9	24.5	2.8
3.0	36.7	0.28	2.50- 3.50	82.5	107.0	12.1
4.0	117.1	0.38	3.50- 4.50	149.5	256.5	28.9
5.0	256.1	0.42	4.50- 5.50	177.7	434.3	49.0
6.0	475.4	0.45	5.50- 6.50	161.1	595.4	67.2
7.0	784.0	0.47	6.50- 7.50	121.1	716.5	80.8
8.0	1,190.9	0.48	7.50- 8.50	79.5	795.9	89.8
9.0	1,696.2	0.48	8.50- 9.50	47.0	842.9	95.1
10.0	2,317.9	0.48	9.50-10.50	25.0	867.9	97.9
11.0	2,842.6	0.44	10.50-11.50	11.6	879.6	99.2
12.0	3,024.3	0.36	11.50-12.50	4.5	884.1	99.7
13.0	3,049.0	0.29	12.50-13.50	1.6	885.7	99.9
14.0	3,050.0	0.23	13.50-14.50	0.5	886.1	100.0
15.0	3,050.0	0.19	14.50-15.50	0.1	886.3	100.0
16.0	3,050.0	0.15	15.50-16.50	0.0	886.3	100.0
17.0	3,050.0	0.13	16.50-17.50	0.0	886.3	100.0
18.0	3,050.0	0.11	17.50-18.50	0.0	886.3	100.0
19.0	3,050.0	0.09	18.50-19.50	0.0	886.3	100.0
20.0	3,050.0	0.08	19.50-20.50	0.0	886.3	100.0
21.0	3,050.0	0.07	20.50-21.50	0.0	886.3	100.0
22.0	3,050.0	0.06	21.50-22.50	0.0	886.3	100.0
23.0	3,050.0	0.05	22.50-23.50	0.0	886.3	100.0
24.0	3,050.0	0.05	23.50-24.50	0.0	886.3	100.0
25.0	3,050.0	0.04	24.50-25.50	0.0	886.3	100.0





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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 100.0

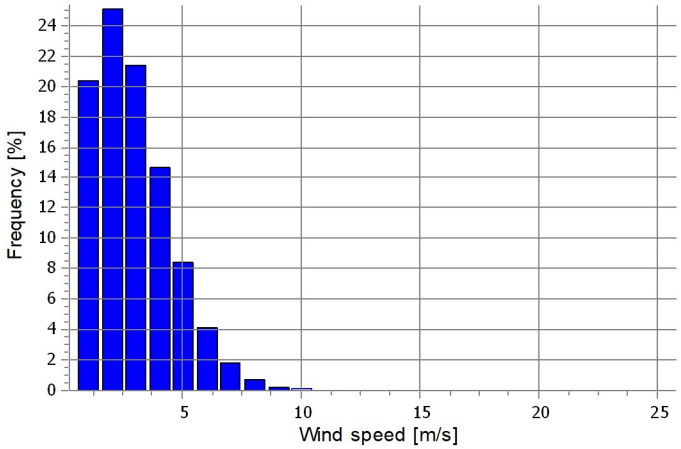
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

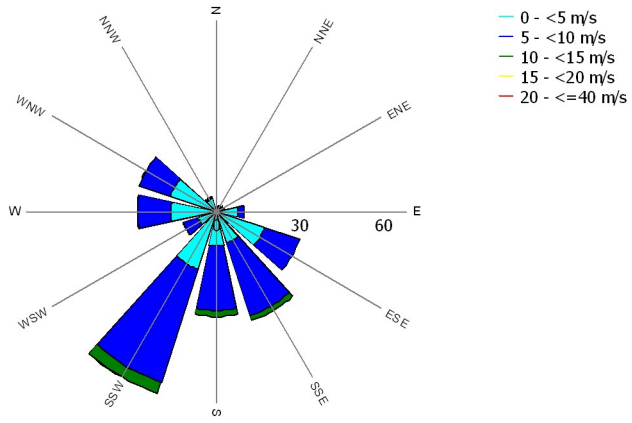
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	2.37	2.10	2.259	1.7	0.150
1 NNE	2.74	2.42	2.024	1.6	0.150
2 ENE	2.30	2.06	1.640	2.7	0.150
3 E	2.48	2.20	1.847	8.2	0.150
4 ESE	3.39	3.00	2.191	12.2	0.150
5 SSE	4.15	3.68	1.993	7.9	0.150
6 S	3.54	3.16	1.691	9.5	0.150
7 SSW	3.56	3.18	1.690	16.9	0.150
8 WSW	2.49	2.24	1.507	7.6	0.150
9 W	3.09	2.74	1.927	12.9	0.150
10 WNW	3.01	2.67	1.918	14.2	0.150
11 NNW	2.69	2.38	2.277	4.6	0.150
All	3.16	2.82	1.754	100.0	

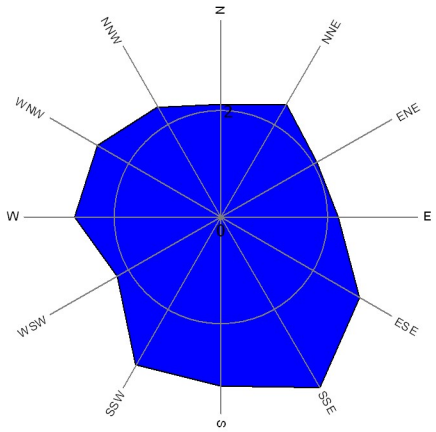
Weibull Distribution



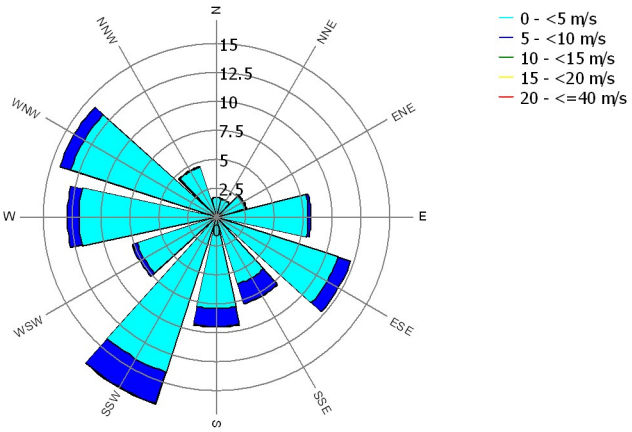
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 99.0

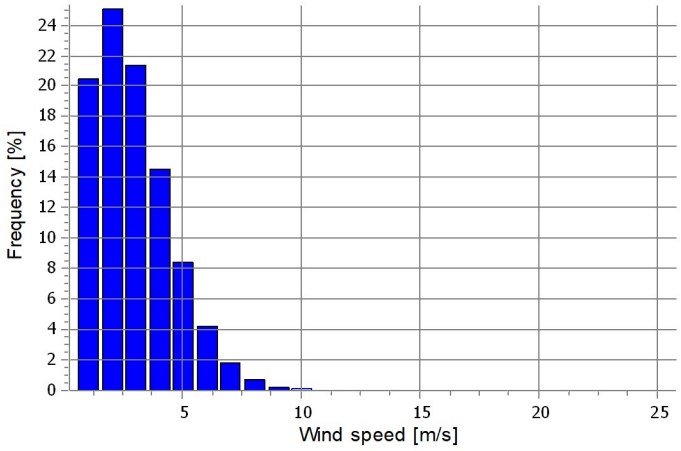
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

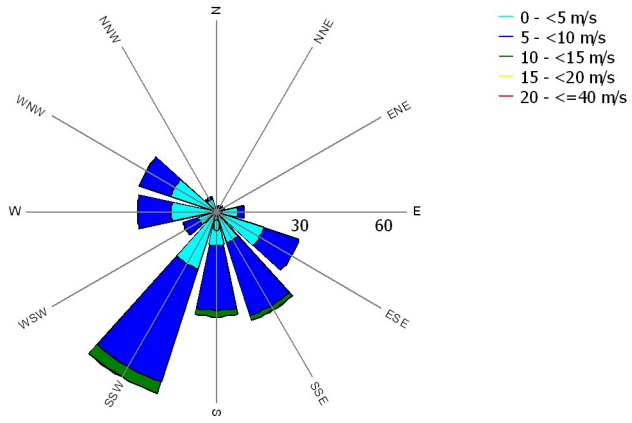
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	2.37	2.10	2.251	1.7	0.150
1 NNE	2.73	2.42	2.016	1.6	0.150
2 ENE	2.30	2.06	1.632	2.7	0.150
3 E	2.47	2.20	1.839	8.2	0.150
4 ESE	3.38	2.99	2.183	12.2	0.150
5 SSE	4.14	3.67	1.985	7.9	0.150
6 S	3.54	3.16	1.683	9.5	0.150
7 SSW	3.56	3.18	1.682	16.9	0.150
8 WSW	2.48	2.24	1.499	7.6	0.150
9 W	3.08	2.74	1.919	12.9	0.150
10 WNW	3.01	2.67	1.910	14.2	0.150
11 NNW	2.68	2.38	2.269	4.6	0.150
All	3.16	2.81	1.747	100.0	

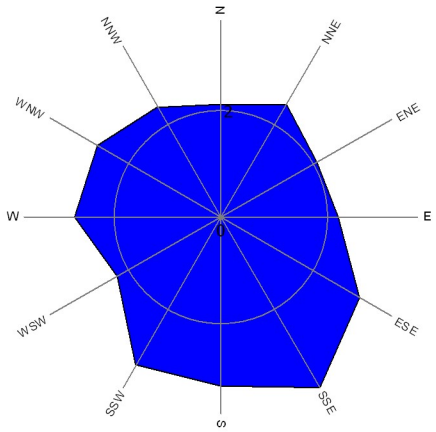
Weibull Distribution



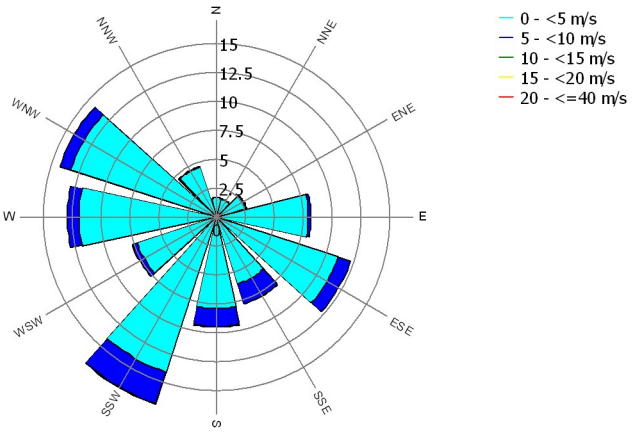
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 50.0

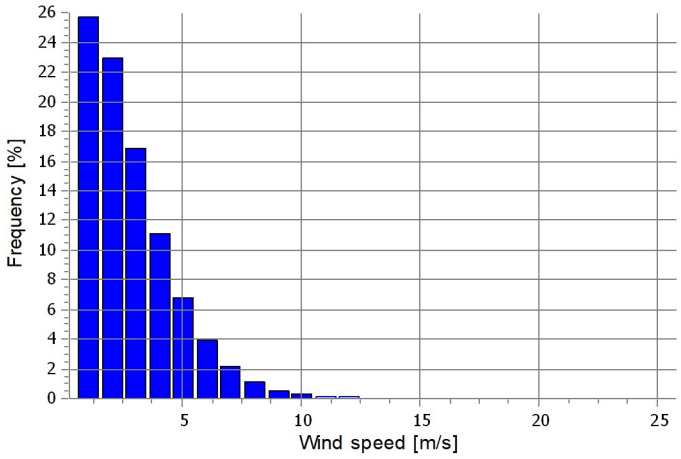
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

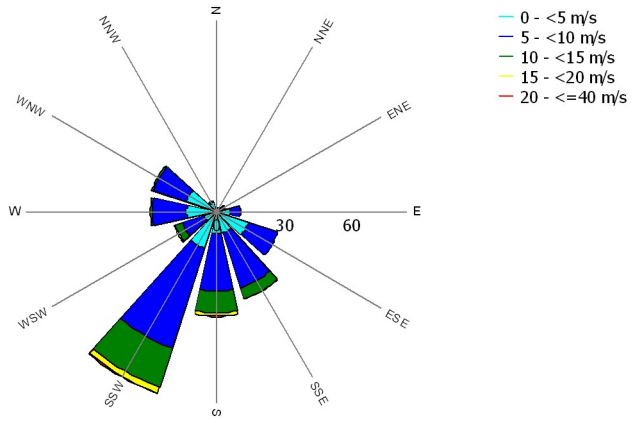
Weibull Data

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	2.14	1.90	1.859	1.7	0.150
1 NNE	2.47	2.21	1.624	1.6	0.150
2 ENE	2.08	1.94	1.240	2.7	0.150
3 E	2.23	2.02	1.447	8.2	0.150
4 ESE	3.05	2.71	1.791	12.2	0.150
5 SSE	3.74	3.36	1.593	7.9	0.150
6 S	3.19	2.95	1.291	9.5	0.150
7 SSW	3.21	2.97	1.290	16.9	0.150
8 WSW	2.24	2.16	1.107	7.6	0.150
9 W	2.78	2.51	1.527	12.9	0.150
10 WNW	2.71	2.45	1.518	14.2	0.150
11 NNW	2.42	2.15	1.877	4.6	0.150
All	2.84	2.60	1.382	100.0	

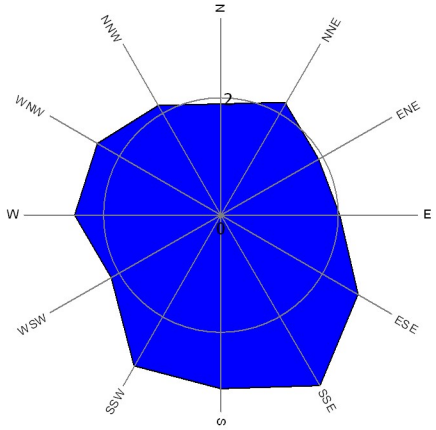
Weibull Distribution



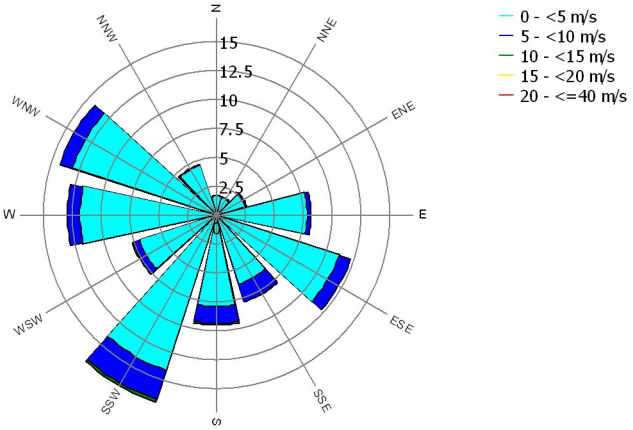
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



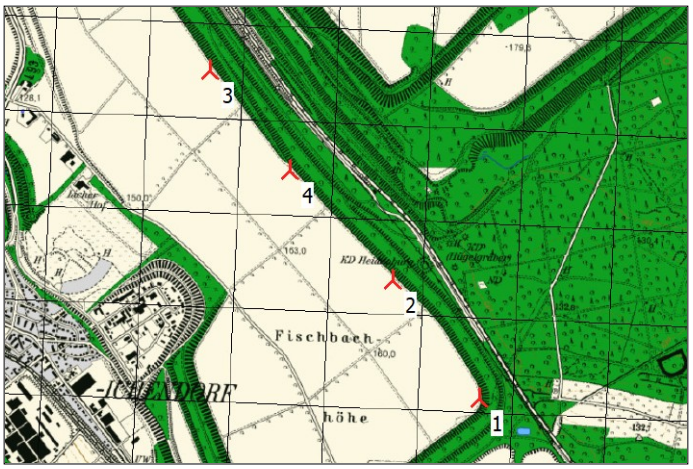
Frequency (%)



PARK - WTG distances

WTG distances

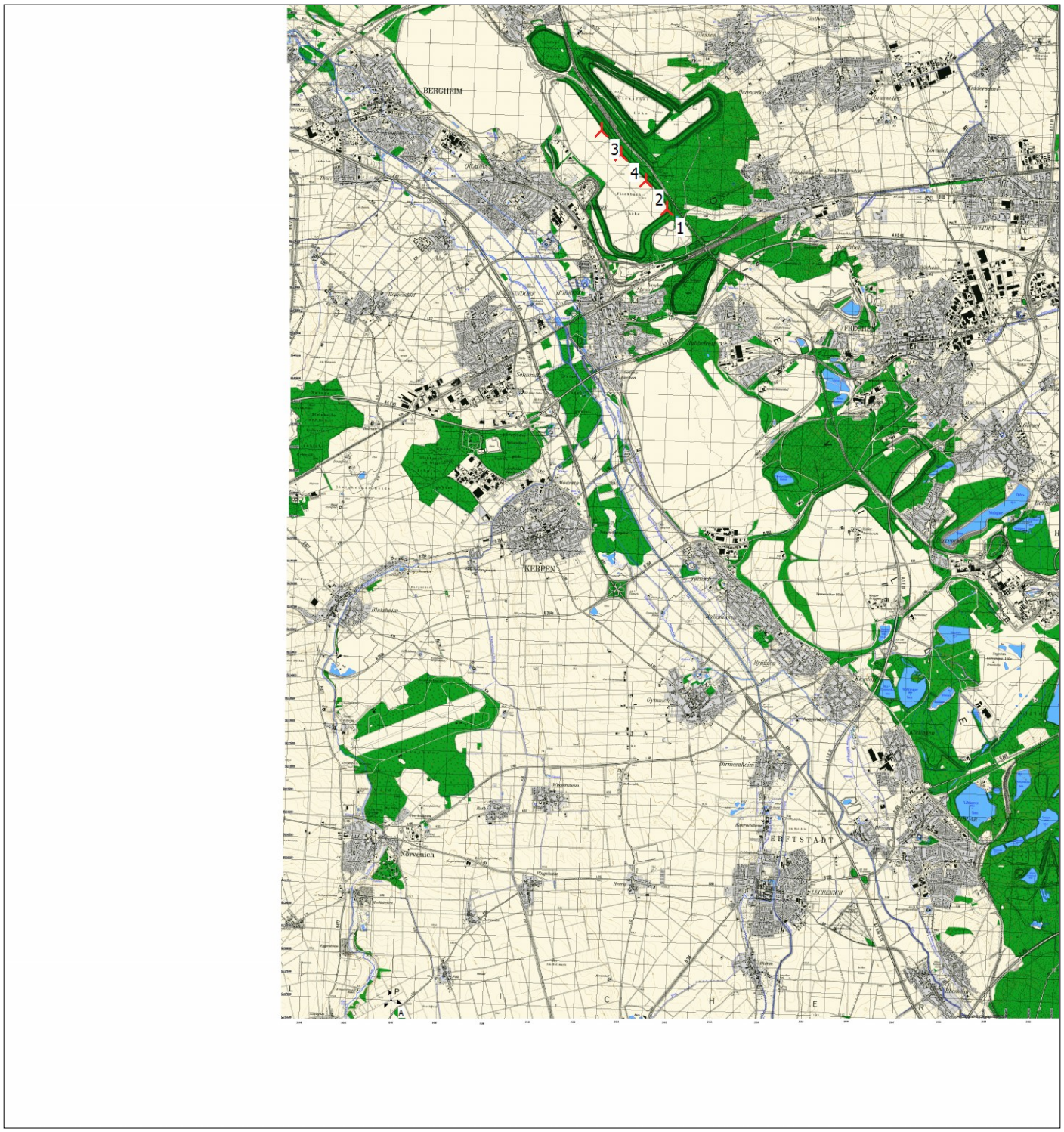
	Z	Nearest WTG	Z	Horizontal distance	Distance in rotor diameters
	[m]		[m]	[m]	
1	157.5	2	157.7	775	7.7
2	157.7	1	157.5	775	7.7
3	157.9	4	157.5	678	6.7
4	157.5	3	157.9	678	6.7
Min	157.5		157.5	678	6.7
Max	157.9		157.9	775	7.7



Scale 1:40,000

New WTG

PARK - Map



0 2.5 5 7.5 10km

Map: SelfReferrencedMap , Print scale 1:125,000, Map center GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2 East: 2,548,667 North: 5,636,626

New WTG Meteorological Data

PARK - Main Result

Wake Model EWTS II (G.C.Larsen) : 2008

Calculation performed in UTM (north)-WGS84 Zone: 32
At the site centre the difference between grid north and true north is: -1.8°

Power curve correction method
New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>
Air density calculation method
Height dependent, temperature from climate station
Station: KOLN W.GERMANY V3 2014
Base temperature: 9.8 °C at 45.0 m
Base pressure: 1013.3 hPa at 0.0 m
Air density for Site center in key hub height: 161.5 m + 50.0 m = 1.221 kg/m³ -> 99.6 % of Std
Relative humidity: 0.0 %

Wake Model Parameters

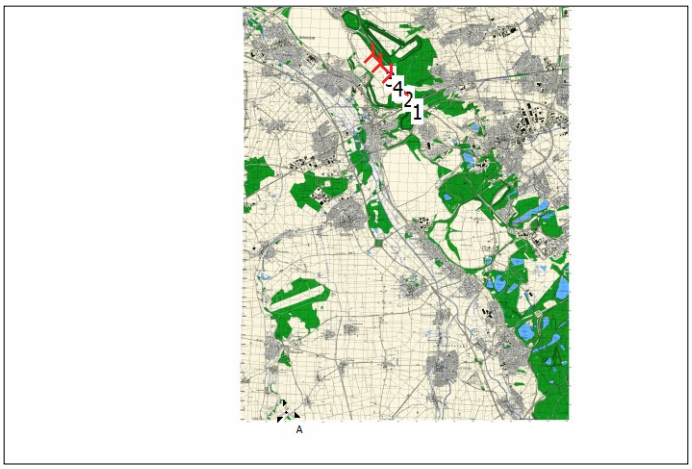
Turbulence measure-height	50.00 m
Ambient turbulence level	0.0 %
	Hub height independent

Combination model

Linear weight	RSS weight
1.00	0.00

Wake calculation settings

Angle [°]			Wind speed [m/s]		
start	end	step	start	end	step
0.5	360.0	1.0	0.5	30.5	1.0



Scale 1:400,000
New WTG
Meteorological Data

Key results for height 50.0 m above ground level

Terrain GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

	Easting	Northing	Name of wind distribution	Height [m]	Type	Wind energy [kWh/m²]	Mean wind speed [m/s]
A	2,546,000	5,627,000	Default Meteo data description (2)	100.0	WEIBULL	296	2.6

Calculated Annual Energy for Wind Farm

WTG combination	Result PARK [MWh/y]	Result-10.0% [MWh/y]	GROSS (no loss) Free WTGs [MWh/y]	Wake loss [%]	Specific results¤) Capacity factor [%]	Mean WTG result [MWh/y]	Full load hours [Hours/year]	Mean wind speed @hub height [m/s]
Wind farm	3,405.3	3,064.8	3,561.8	4.4	2.9	766.2	251	2.8

¤) Based on Result-10.0%

Calculated Annual Energy for each of 4 new WTGs with total 12.2 MW rated power

Links	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Power curve Creator	Name	Annual Energy Result [MWh/y]	Result-10.0% [MWh/y]	Wake loss [%]	Free mean wind speed [m/s]
1 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	876.3	789	1.6	2.81
2 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	849.2	764	4.6	2.81
3 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	837.2	753	6.0	2.81
4 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	842.7	758	5.4	2.81

WTG siting

GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

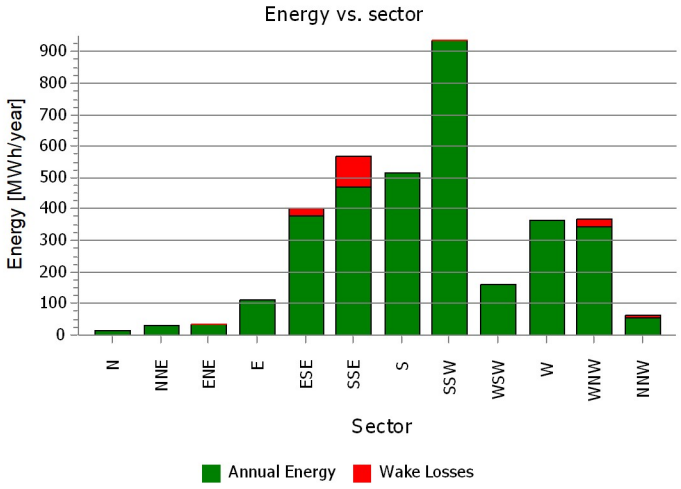
	Easting	Northing	Z [m]	Row data/Description
1 New	2,551,335	5,644,577	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)
2 New	2,550,853	5,645,184	157.7	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)
3 New	2,549,837	5,646,252	157.9	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (12)
4 New	2,550,284	5,645,743	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)

PARK - Production Analysis

WTG: All new WTGs, Air density 1.215 kg/m³

Directional Analysis

Sector		0 N	1 NNE	2 ENE	3 E	4 ESE	5 SSE	6 S	7 SSW	8 WSW	9 W	10 WNW	11 NNW	Total
Roughness based energy	[MWh]	14.5	28.0	35.9	112.6	400.4	566.4	513.6	935.2	159.8	363.0	368.7	63.5	3,561.8
-Decrease due to wake losses	[MWh]	0.0	0.0	0.0	0.0	22.4	97.0	0.0	0.0	0.0	0.0	24.4	12.5	156.4
Resulting energy	[MWh]	14.5	28.0	35.9	112.6	378.0	469.4	513.6	935.2	159.8	363.0	344.3	51.0	3,405.3
Specific energy	[kWh/m²]													106
Specific energy	[kWh/kW]													279
Decrease due to wake losses	[%]	0.0	0.0	0.0	0.0	5.6	17.1	0.0	0.0	0.0	0.0	6.6	19.7	4.39
Utilization	[%]	32.3	37.4	37.2	36.6	38.4	36.6	43.4	43.5	40.1	40.4	37.4	28.4	40.0
Operational	[Hours/year]	128	125	207	624	935	603	726	1,298	585	988	1,088	354	7,661
Full Load Equivalent	[Hours/year]	1	2	3	9	31	38	42	77	13	30	28	4	279



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PARK - Power Curve Analysis

WTG: 1 - ENERCON E-101 3050 101.0 !-!, Hub height: 99.0 m

Name: Level 0 - official - OM 0 - 3050kW - 03/2015
Source: Enercon

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
3/3/2015	EMD	11/25/2009	4/16/2015	25.0	Pitch	User defined	Variable	0.38

According to Enercon specification document D0372846-1_#_ger_#_Betriebsmodi_E-101___3050_kW

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	4,152	6,555	9,004	11,276	13,257	14,885
ENERCON E-101 3050 101.0 !-! Level 0 - official - OM 0 - 3050kW - 03/2015	[MWh]	4,479	6,981	9,495	11,793	13,760	15,345
Check value	[%]	-7	-6	-5	-4	-4	-3

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

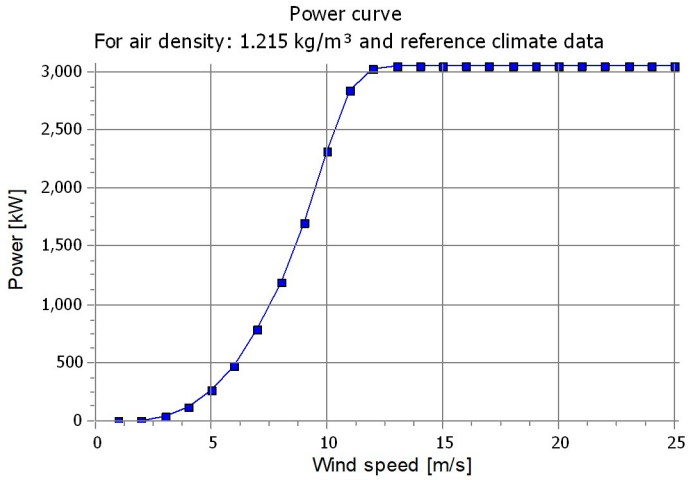
Original data, Air density: 1.225 kg/m³

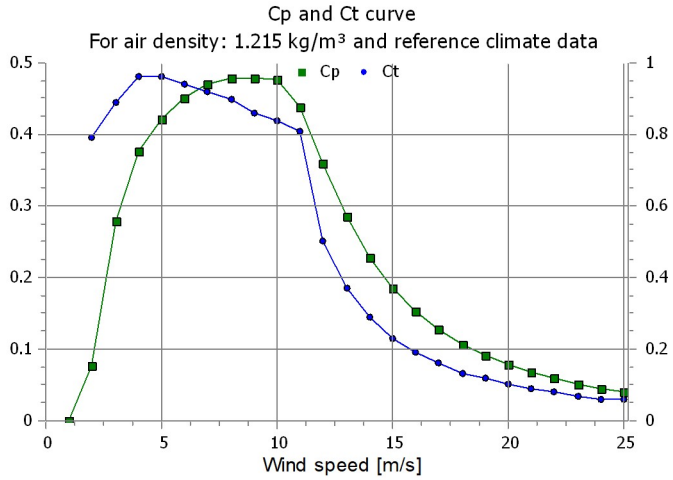
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
1.0	0.0	0.00	2.0	0.79
2.0	3.0	0.08	3.0	0.89
3.0	37.0	0.28	4.0	0.96
4.0	118.0	0.38	5.0	0.96
5.0	258.0	0.42	6.0	0.94
6.0	479.0	0.45	7.0	0.92
7.0	790.0	0.47	8.0	0.90
8.0	1,200.0	0.48	9.0	0.86
9.0	1,710.0	0.48	10.0	0.84
10.0	2,340.0	0.48	11.0	0.81
11.0	2,867.0	0.44	12.0	0.50
12.0	3,034.0	0.36	13.0	0.37
13.0	3,050.0	0.28	14.0	0.29
14.0	3,050.0	0.23	15.0	0.23
15.0	3,050.0	0.18	16.0	0.19
16.0	3,050.0	0.15	17.0	0.16
17.0	3,050.0	0.13	18.0	0.13
18.0	3,050.0	0.11	19.0	0.12
19.0	3,050.0	0.09	20.0	0.10
20.0	3,050.0	0.08	21.0	0.09
21.0	3,050.0	0.07	22.0	0.08
22.0	3,050.0	0.06	23.0	0.07
23.0	3,050.0	0.05	24.0	0.06
24.0	3,050.0	0.04	25.0	0.06
25.0	3,050.0	0.04		

Power, Efficiency and energy vs. wind speed

Data used in calculation, Air density: 1.215 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	1.6	1.6	0.2
2.0	3.0	0.08	1.50- 2.50	22.7	24.3	2.8
3.0	36.7	0.28	2.50- 3.50	81.5	105.8	12.1
4.0	117.1	0.38	3.50- 4.50	147.8	253.6	28.9
5.0	256.1	0.42	4.50- 5.50	175.7	429.3	49.0
6.0	475.4	0.45	5.50- 6.50	159.3	588.6	67.2
7.0	784.0	0.47	6.50- 7.50	119.7	708.4	80.8
8.0	1,190.9	0.48	7.50- 8.50	78.5	786.9	89.8
9.0	1,696.2	0.48	8.50- 9.50	46.4	833.3	95.1
10.0	2,317.9	0.48	9.50-10.50	24.8	858.1	97.9
11.0	2,842.6	0.44	10.50-11.50	11.5	869.6	99.2
12.0	3,024.3	0.36	11.50-12.50	4.5	874.1	99.7
13.0	3,049.0	0.29	12.50-13.50	1.5	875.6	99.9
14.0	3,050.0	0.23	13.50-14.50	0.5	876.1	100.0
15.0	3,050.0	0.19	14.50-15.50	0.1	876.2	100.0
16.0	3,050.0	0.15	15.50-16.50	0.0	876.3	100.0
17.0	3,050.0	0.13	16.50-17.50	0.0	876.3	100.0
18.0	3,050.0	0.11	17.50-18.50	0.0	876.3	100.0
19.0	3,050.0	0.09	18.50-19.50	0.0	876.3	100.0
20.0	3,050.0	0.08	19.50-20.50	0.0	876.3	100.0
21.0	3,050.0	0.07	20.50-21.50	0.0	876.3	100.0
22.0	3,050.0	0.06	21.50-22.50	0.0	876.3	100.0
23.0	3,050.0	0.05	22.50-23.50	0.0	876.3	100.0
24.0	3,050.0	0.05	23.50-24.50	0.0	876.3	100.0
25.0	3,050.0	0.04	24.50-25.50	0.0	876.3	100.0





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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 100.0

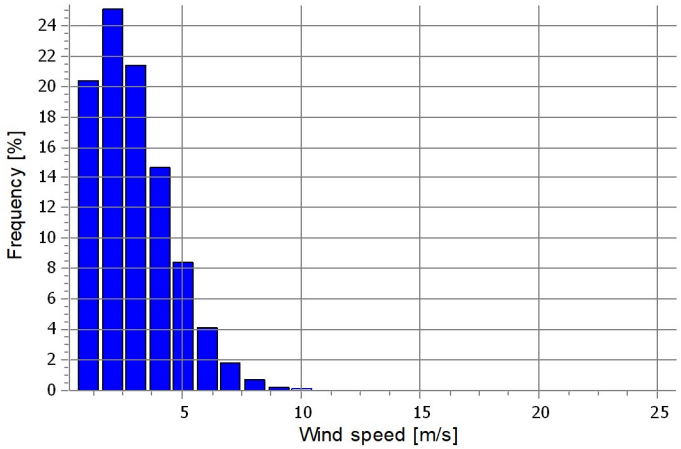
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

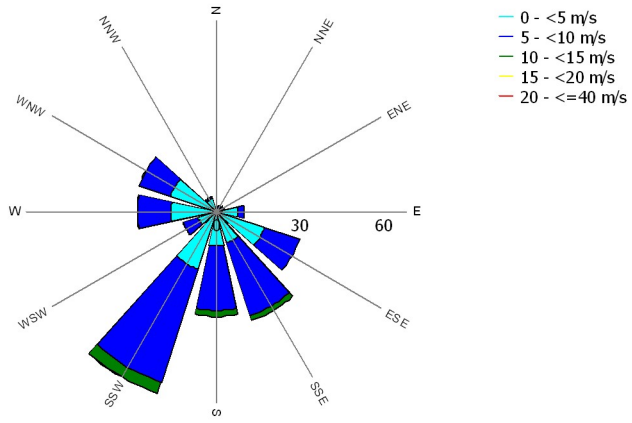
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	2.37	2.10	2.259	1.7	0.150
1 NNE	2.74	2.42	2.024	1.6	0.150
2 ENE	2.30	2.06	1.640	2.7	0.150
3 E	2.48	2.20	1.847	8.2	0.150
4 ESE	3.39	3.00	2.191	12.2	0.150
5 SSE	4.15	3.68	1.993	7.9	0.150
6 S	3.54	3.16	1.691	9.5	0.150
7 SSW	3.56	3.18	1.690	16.9	0.150
8 WSW	2.49	2.24	1.507	7.6	0.150
9 W	3.09	2.74	1.927	12.9	0.150
10 WNW	3.01	2.67	1.918	14.2	0.150
11 NNW	2.69	2.38	2.277	4.6	0.150
All	3.16	2.82	1.754	100.0	

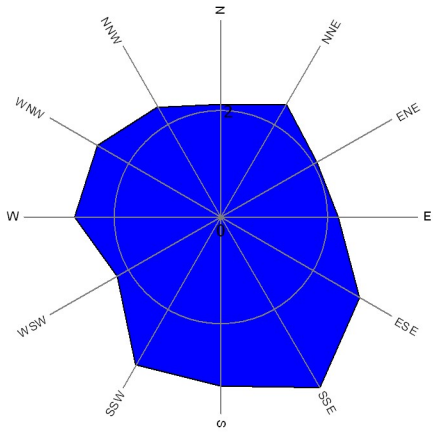
Weibull Distribution



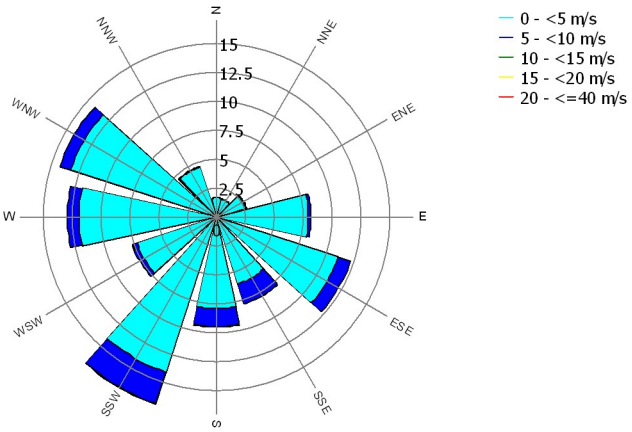
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 99.0

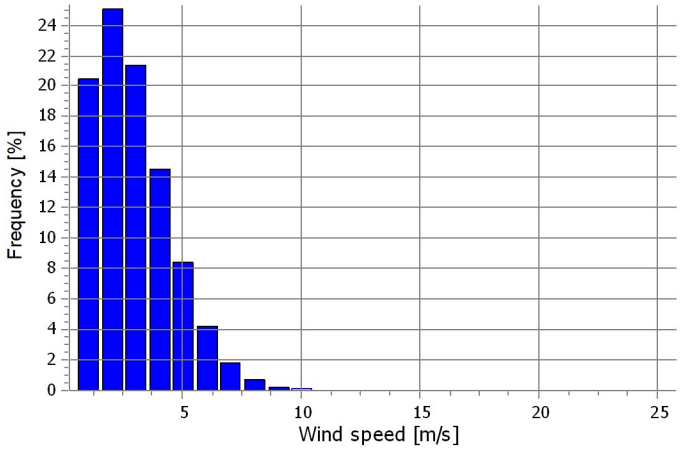
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

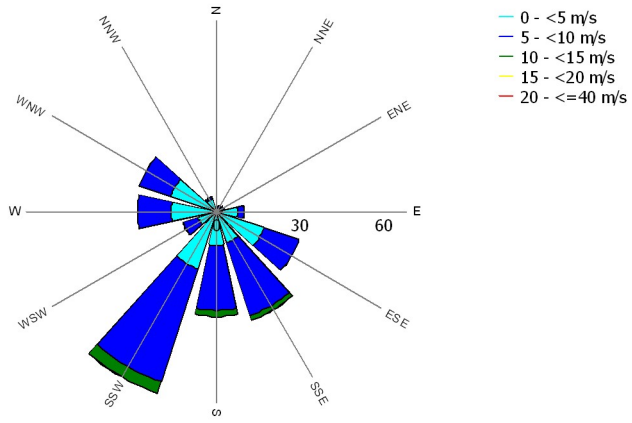
Weibull Data

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	2.37	2.10	2.251	1.7	0.150
1 NNE	2.73	2.42	2.016	1.6	0.150
2 ENE	2.30	2.06	1.632	2.7	0.150
3 E	2.47	2.20	1.839	8.2	0.150
4 ESE	3.38	2.99	2.183	12.2	0.150
5 SSE	4.14	3.67	1.985	7.9	0.150
6 S	3.54	3.16	1.683	9.5	0.150
7 SSW	3.56	3.18	1.682	16.9	0.150
8 WSW	2.48	2.24	1.499	7.6	0.150
9 W	3.08	2.74	1.919	12.9	0.150
10 WNW	3.01	2.67	1.910	14.2	0.150
11 NNW	2.68	2.38	2.269	4.6	0.150
All	3.16	2.81	1.747	100.0	

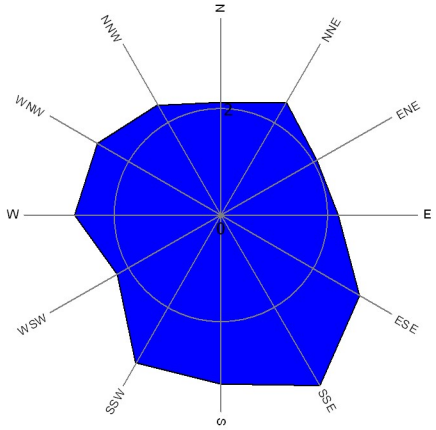
Weibull Distribution



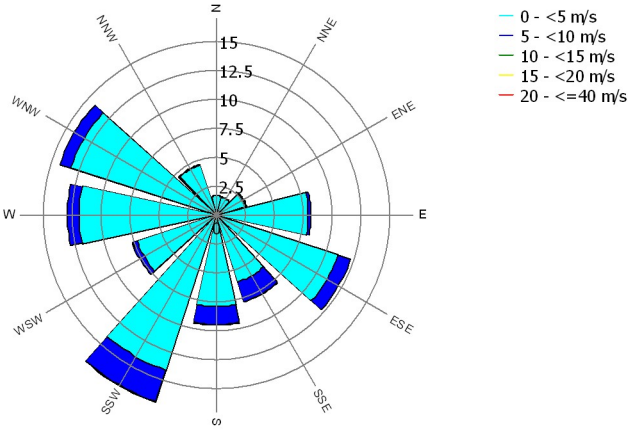
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 50.0

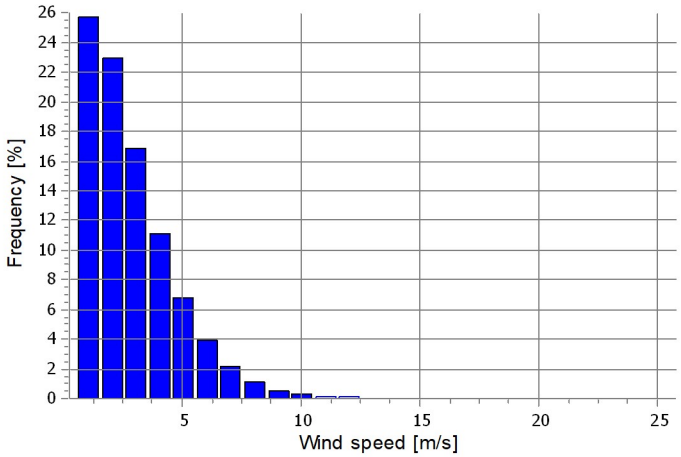
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

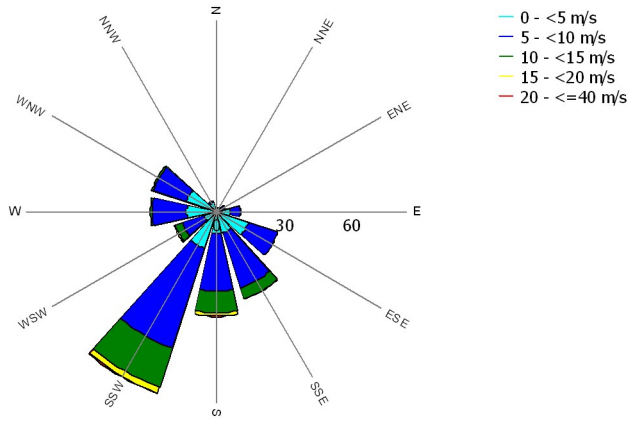
Weibull Data

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	2.14	1.90	1.859	1.7	0.150
1 NNE	2.47	2.21	1.624	1.6	0.150
2 ENE	2.08	1.94	1.240	2.7	0.150
3 E	2.23	2.02	1.447	8.2	0.150
4 ESE	3.05	2.71	1.791	12.2	0.150
5 SSE	3.74	3.36	1.593	7.9	0.150
6 S	3.19	2.95	1.291	9.5	0.150
7 SSW	3.21	2.97	1.290	16.9	0.150
8 WSW	2.24	2.16	1.107	7.6	0.150
9 W	2.78	2.51	1.527	12.9	0.150
10 WNW	2.71	2.45	1.518	14.2	0.150
11 NNW	2.42	2.15	1.877	4.6	0.150
All	2.84	2.60	1.382	100.0	

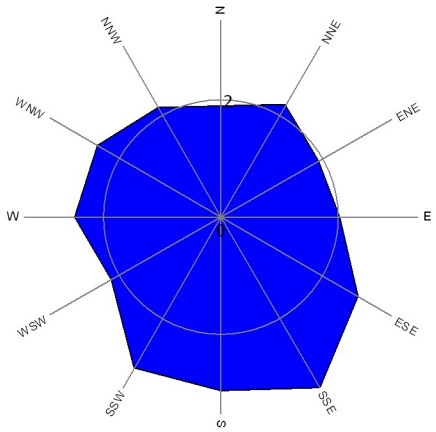
Weibull Distribution



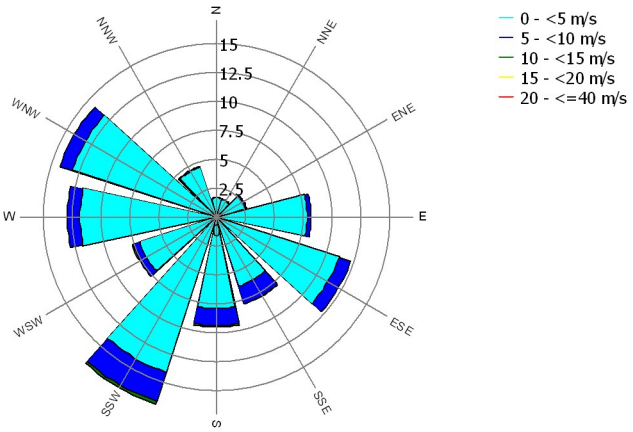
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



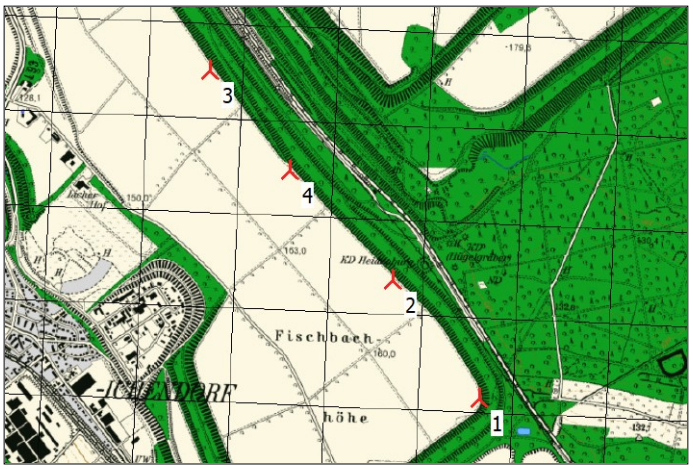
Frequency (%)



PARK - WTG distances

WTG distances

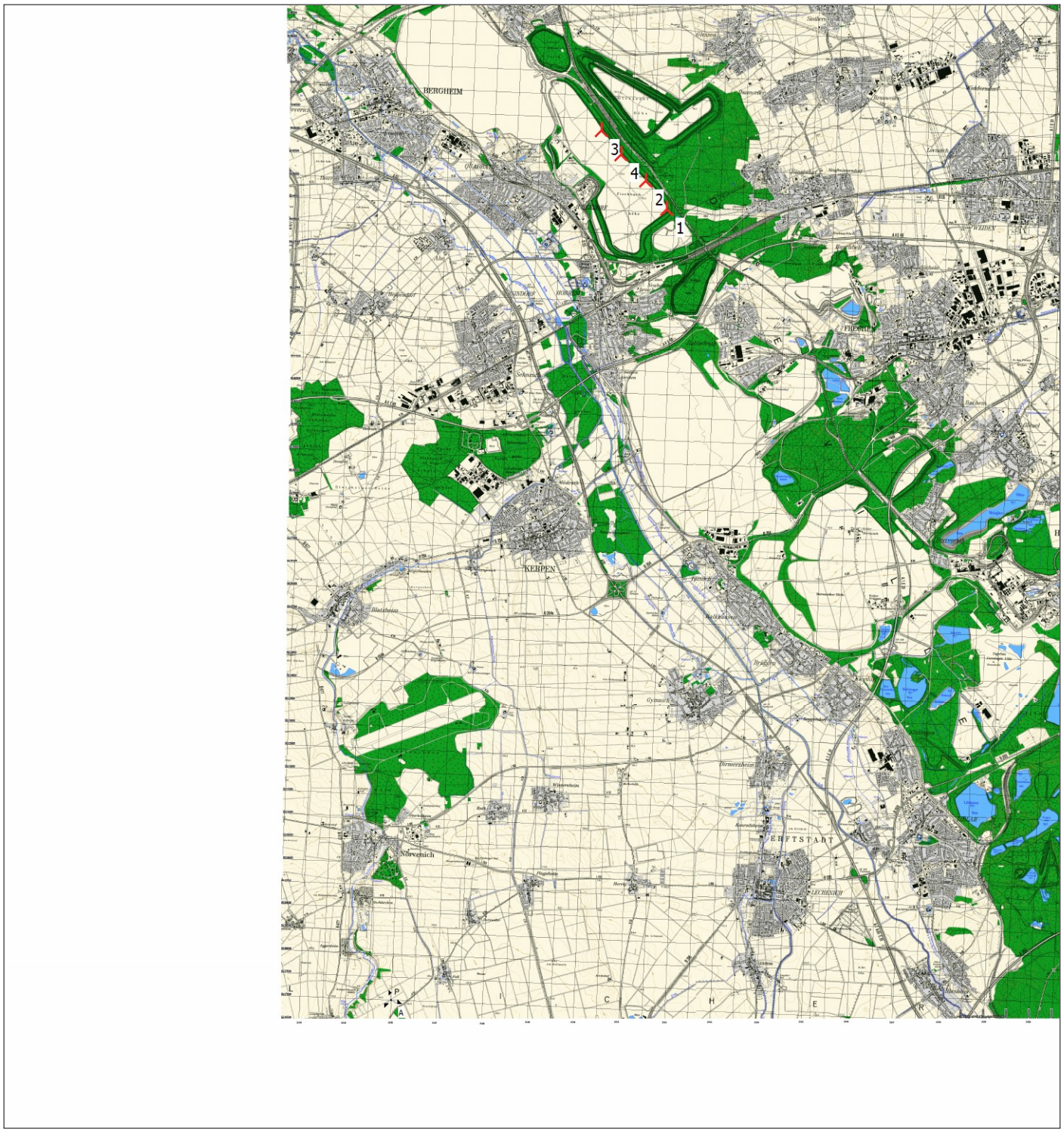
	Z	Nearest WTG	Z	Horizontal distance	Distance in rotor diameters
	[m]		[m]	[m]	
1	157.5	2	157.7	775	7.7
2	157.7	1	157.5	775	7.7
3	157.9	4	157.5	678	6.7
4	157.5	3	157.9	678	6.7
Min	157.5		157.5	678	6.7
Max	157.9		157.9	775	7.7



Scale 1:40,000

New WTG

PARK - Map



0 2.5 5 7.5 10km

Map: SelfReferrencedMap , Print scale 1:125,000, Map center GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2 East: 2,548,667 North: 5,636,626

New WTG Meteorological Data

PARK - Main Result

Wake Model N.O. Jensen (RISØ/EMD) Park 2 2018

Calculation performed in UTM (north)-WGS84 Zone: 32
At the site centre the difference between grid north and true north is: -1.8°

Power curve correction method
New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>
Air density calculation method
Height dependent, temperature from climate station
Station: KOLN W.GERMANY V3 2014
Base temperature: 9.8 °C at 45.0 m
Base pressure: 1013.3 hPa at 0.0 m
Air density for Site center in key hub height: 161.5 m + 50.0 m = 1.221 kg/m³ -> 99.6 % of Std
Relative humidity: 0.0 %

Wake Model Parameters
Terrain type Wake decay constant
Very stable 0.030 Hub height dependent

Wake calculation settings

Angle [°]			Wind speed [m/s]		
start	end	step	start	end	step
0.5	360.0	1.0	0.5	30.5	1.0

Scale 1:400,000
New WTG Meteorological Data

Key results for height 50.0 m above ground level

Terrain GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

	Easting	Northing	Name of wind distribution	Height [m]	Type	Wind energy [kWh/m²]	Mean wind speed [m/s]
A	2,546,000	5,627,000	Default Meteo data description (2)	100.0	WEIBULL	296	2.6

Calculated Annual Energy for Wind Farm

WTG combination	Result PARK [MWh/y]	Result-10.0% [MWh/y]	GROSS (no loss) Free WTGs [MWh/y]	Wake loss [%]	Specific results¤) Capacity factor [%]	Mean WTG result [MWh/y]	Full load hours [Hours/year]	Mean wind speed @hub height [m/s]
Wind farm	3,404.0	3,063.6	3,561.8	4.4	2.9	765.9	251	2.8

¤) Based on Result-10.0%

Calculated Annual Energy for each of 4 new WTGs with total 12.2 MW rated power

Links	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Power curve Creator	Name	Annual Energy Result [MWh/y]	Result-10.0% [MWh/y]	Wake loss [%]	Free mean wind speed [m/s]
1 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	884.7	796	0.7	2.81
2 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	838.8	755	5.8	2.81
3 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	840.3	756	5.6	2.81
4 A	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	840.2	756	5.6	2.81

WTG siting

GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

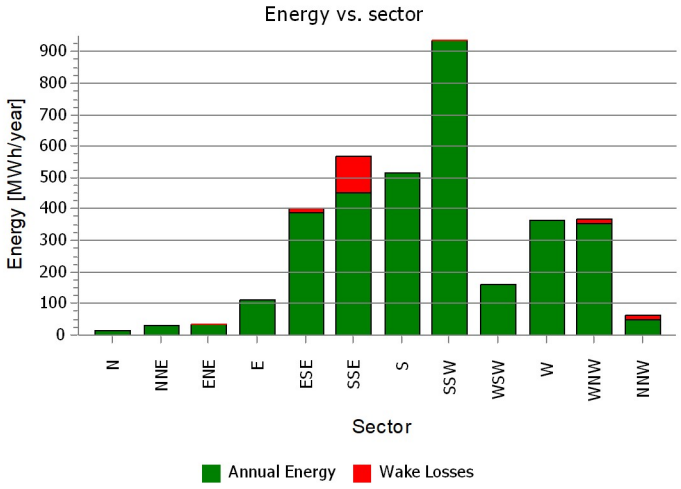
	Easting	Northing	Z [m]	Row data/Description
1 New	2,551,335	5,644,577	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)
2 New	2,550,853	5,645,184	157.7	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)
3 New	2,549,837	5,646,252	157.9	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (12)
4 New	2,550,284	5,645,743	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)

PARK - Production Analysis

WTG: All new WTGs, Air density 1.215 kg/m³

Directional Analysis

Sector		0 N	1 NNE	2 ENE	3 E	4 ESE	5 SSE	6 S	7 SSW	8 WSW	9 W	10 WNW	11 NNW	Total
Roughness based energy	[MWh]	14.5	28.0	35.9	112.6	400.4	566.4	513.6	935.2	159.8	363.0	368.7	63.5	3,561.8
-Decrease due to wake losses	[MWh]	0.0	0.0	0.0	0.0	13.6	117.1	0.0	0.0	0.0	0.0	12.6	14.5	157.8
Resulting energy	[MWh]	14.5	28.0	35.9	112.6	386.8	449.3	513.6	935.2	159.8	363.0	356.1	49.1	3,404.0
Specific energy	[kWh/m²]													106
Specific energy	[kWh/kW]													279
Decrease due to wake losses	[%]	0.0	0.0	0.0	0.0	3.4	20.7	0.0	0.0	0.0	0.0	3.4	22.8	4.43
Utilization	[%]	32.3	37.4	37.2	36.6	39.3	35.1	43.4	43.5	40.1	40.4	38.7	27.3	40.0
Operational	[Hours/year]	128	125	207	624	935	603	726	1,298	585	988	1,088	354	7,661
Full Load Equivalent	[Hours/year]	1	2	3	9	32	37	42	77	13	30	29	4	279



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PARK - Power Curve Analysis

WTG: 1 - ENERCON E-101 3050 101.0 !-!, Hub height: 99.0 m

Name: Level 0 - official - OM 0 - 3050kW - 03/2015
Source: Enercon

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type	Generator type	Specific power kW/m²
3/3/2015	EMD	11/25/2009	4/16/2015	25.0	Pitch	User defined	Variable	0.38

According to Enercon specification document D0372846-1_#_ger_#_Betriebsmodi_E-101___3050_kW

HP curve comparison - Note: For standard air density

Vmean	[m/s]	5	6	7	8	9	10
HP value Pitch, variable speed (2013)	[MWh]	4,152	6,555	9,004	11,276	13,257	14,885
ENERCON E-101 3050 101.0 !-! Level 0 - official - OM 0 - 3050kW - 03/2015	[MWh]	4,479	6,981	9,495	11,793	13,760	15,345
Check value	[%]	-7	-6	-5	-4	-4	-3

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

Power curve

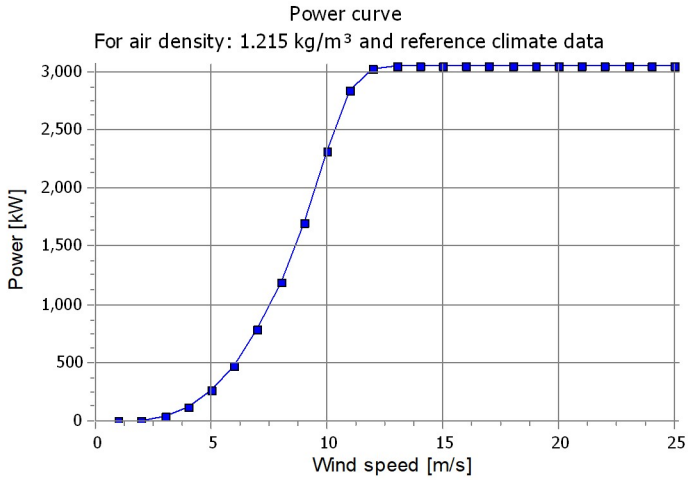
Original data, Air density: 1.225 kg/m³

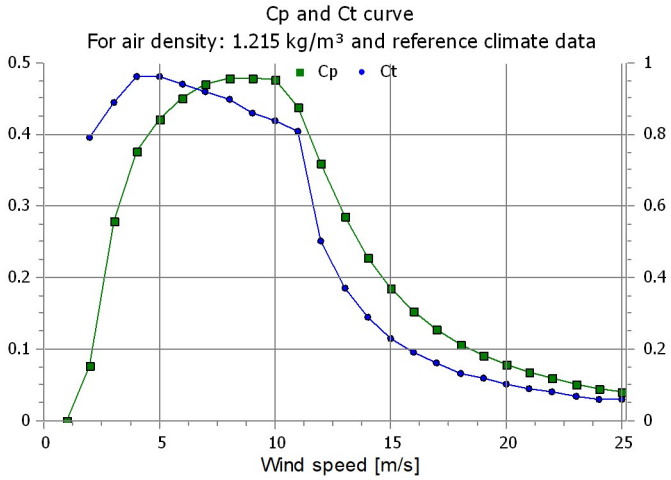
Wind speed [m/s]	Power [kW]	Cp	Wind speed [m/s]	Ct curve
1.0	0.0	0.00	2.0	0.79
2.0	3.0	0.08	3.0	0.89
3.0	37.0	0.28	4.0	0.96
4.0	118.0	0.38	5.0	0.96
5.0	258.0	0.42	6.0	0.94
6.0	479.0	0.45	7.0	0.92
7.0	790.0	0.47	8.0	0.90
8.0	1,200.0	0.48	9.0	0.86
9.0	1,710.0	0.48	10.0	0.84
10.0	2,340.0	0.48	11.0	0.81
11.0	2,867.0	0.44	12.0	0.50
12.0	3,034.0	0.36	13.0	0.37
13.0	3,050.0	0.28	14.0	0.29
14.0	3,050.0	0.23	15.0	0.23
15.0	3,050.0	0.18	16.0	0.19
16.0	3,050.0	0.15	17.0	0.16
17.0	3,050.0	0.13	18.0	0.13
18.0	3,050.0	0.11	19.0	0.12
19.0	3,050.0	0.09	20.0	0.10
20.0	3,050.0	0.08	21.0	0.09
21.0	3,050.0	0.07	22.0	0.08
22.0	3,050.0	0.06	23.0	0.07
23.0	3,050.0	0.05	24.0	0.06
24.0	3,050.0	0.04	25.0	0.06
25.0	3,050.0	0.04		

Power, Efficiency and energy vs. wind speed

Data used in calculation, Air density: 1.215 kg/m³ New windPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Cp	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	1.6	1.6	0.2
2.0	3.0	0.08	1.50- 2.50	22.9	24.5	2.8
3.0	36.7	0.28	2.50- 3.50	82.3	106.8	12.1
4.0	117.1	0.38	3.50- 4.50	149.2	256.0	28.9
5.0	256.1	0.42	4.50- 5.50	177.4	433.5	49.0
6.0	475.4	0.45	5.50- 6.50	160.8	594.3	67.2
7.0	784.0	0.47	6.50- 7.50	120.9	715.1	80.8
8.0	1,190.9	0.48	7.50- 8.50	79.3	794.4	89.8
9.0	1,696.2	0.48	8.50- 9.50	46.9	841.3	95.1
10.0	2,317.9	0.48	9.50-10.50	25.0	866.3	97.9
11.0	2,842.6	0.44	10.50-11.50	11.6	877.9	99.2
12.0	3,024.3	0.36	11.50-12.50	4.5	882.4	99.7
13.0	3,049.0	0.29	12.50-13.50	1.5	884.0	99.9
14.0	3,050.0	0.23	13.50-14.50	0.5	884.5	100.0
15.0	3,050.0	0.19	14.50-15.50	0.1	884.6	100.0
16.0	3,050.0	0.15	15.50-16.50	0.0	884.6	100.0
17.0	3,050.0	0.13	16.50-17.50	0.0	884.7	100.0
18.0	3,050.0	0.11	17.50-18.50	0.0	884.7	100.0
19.0	3,050.0	0.09	18.50-19.50	0.0	884.7	100.0
20.0	3,050.0	0.08	19.50-20.50	0.0	884.7	100.0
21.0	3,050.0	0.07	20.50-21.50	0.0	884.7	100.0
22.0	3,050.0	0.06	21.50-22.50	0.0	884.7	100.0
23.0	3,050.0	0.05	22.50-23.50	0.0	884.7	100.0
24.0	3,050.0	0.05	23.50-24.50	0.0	884.7	100.0
25.0	3,050.0	0.04	24.50-25.50	0.0	884.7	100.0





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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 100.0

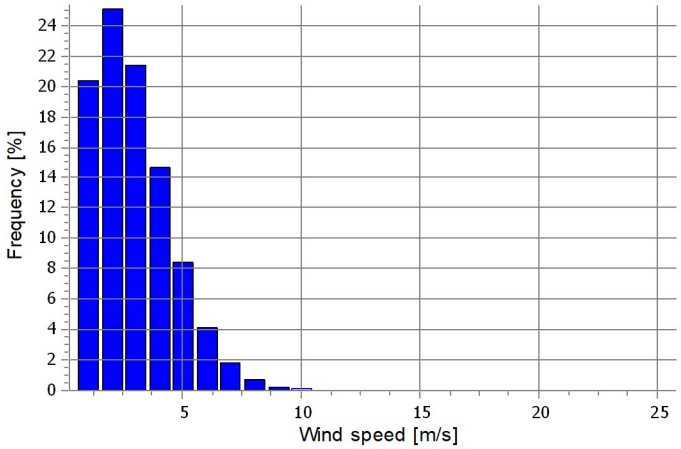
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

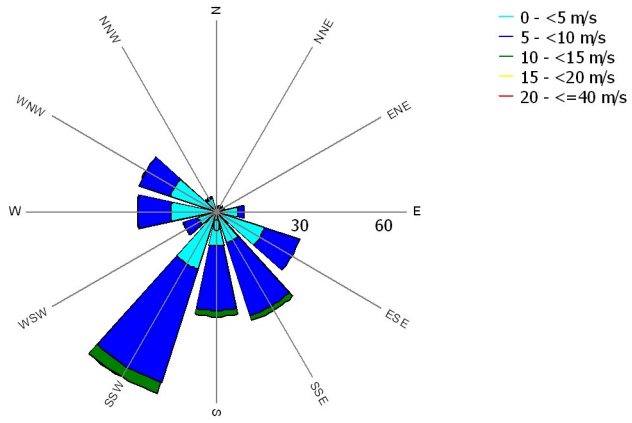
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	2.37	2.10	2.259	1.7	0.150
1 NNE	2.74	2.42	2.024	1.6	0.150
2 ENE	2.30	2.06	1.640	2.7	0.150
3 E	2.48	2.20	1.847	8.2	0.150
4 ESE	3.39	3.00	2.191	12.2	0.150
5 SSE	4.15	3.68	1.993	7.9	0.150
6 S	3.54	3.16	1.691	9.5	0.150
7 SSW	3.56	3.18	1.690	16.9	0.150
8 WSW	2.49	2.24	1.507	7.6	0.150
9 W	3.09	2.74	1.927	12.9	0.150
10 WNW	3.01	2.67	1.918	14.2	0.150
11 NNW	2.69	2.38	2.277	4.6	0.150
All	3.16	2.82	1.754	100.0	

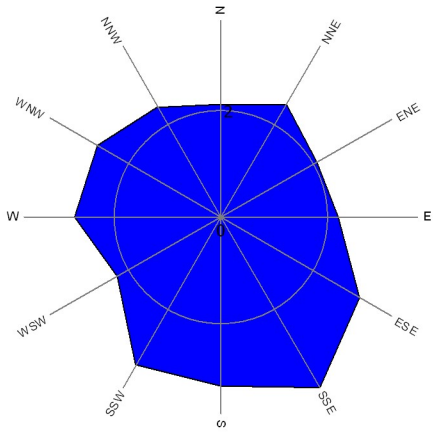
Weibull Distribution



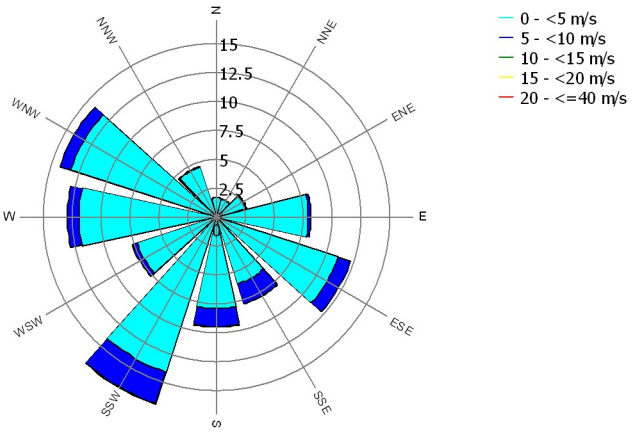
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 99.0

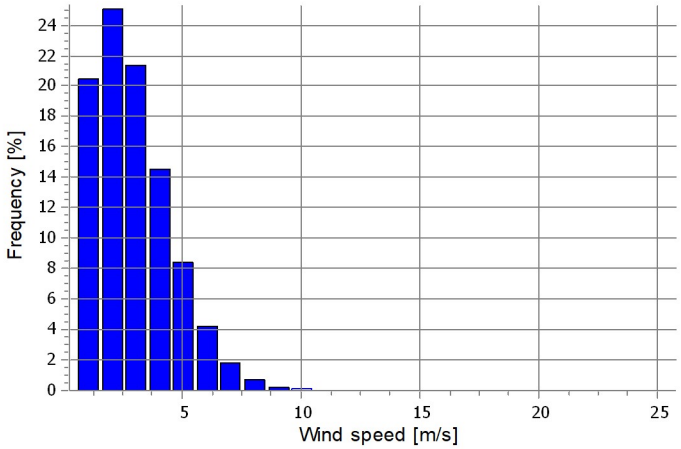
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

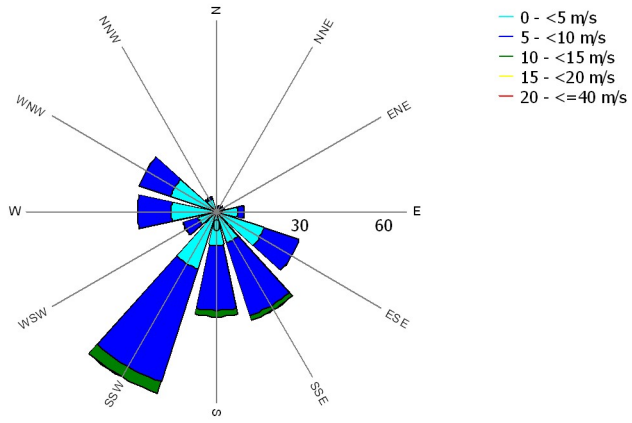
Weibull Data

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	2.37	2.10	2.251	1.7	0.150
1 NNE	2.73	2.42	2.016	1.6	0.150
2 ENE	2.30	2.06	1.632	2.7	0.150
3 E	2.47	2.20	1.839	8.2	0.150
4 ESE	3.38	2.99	2.183	12.2	0.150
5 SSE	4.14	3.67	1.985	7.9	0.150
6 S	3.54	3.16	1.683	9.5	0.150
7 SSW	3.56	3.18	1.682	16.9	0.150
8 WSW	2.48	2.24	1.499	7.6	0.150
9 W	3.08	2.74	1.919	12.9	0.150
10 WNW	3.01	2.67	1.910	14.2	0.150
11 NNW	2.68	2.38	2.269	4.6	0.150
All	3.16	2.81	1.747	100.0	

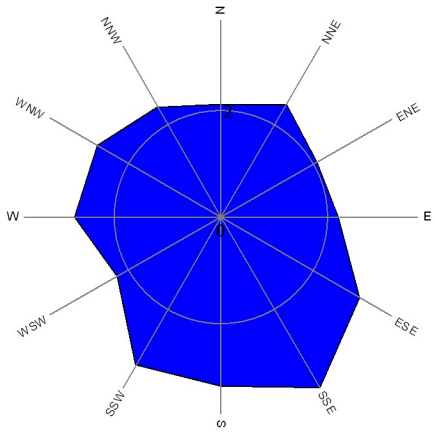
Weibull Distribution



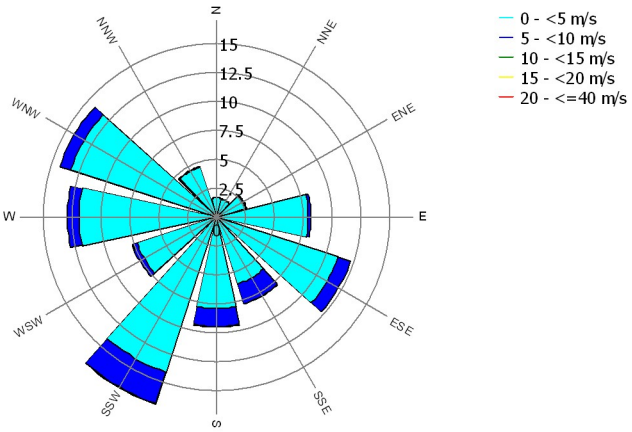
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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PARK - Wind Data Analysis

Wind data: A - Default Meteo data description (2); Hub height: 50.0

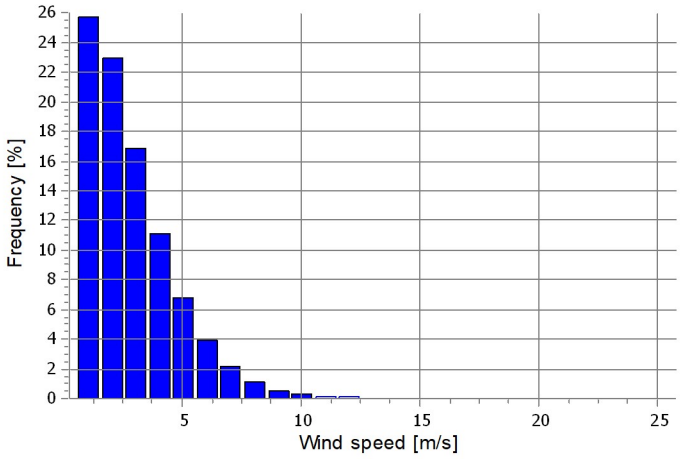
Site coordinates
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2
East: 2,546,000 North: 5,627,000

Meteo data
Default Meteo data description (2)

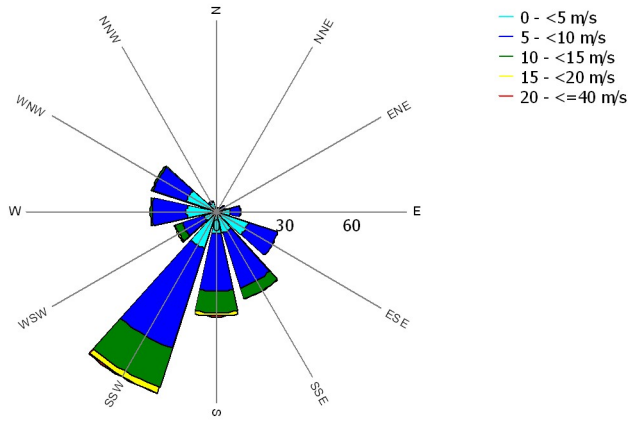
Weibull Data

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	2.14	1.90	1.859	1.7	0.150
1 NNE	2.47	2.21	1.624	1.6	0.150
2 ENE	2.08	1.94	1.240	2.7	0.150
3 E	2.23	2.02	1.447	8.2	0.150
4 ESE	3.05	2.71	1.791	12.2	0.150
5 SSE	3.74	3.36	1.593	7.9	0.150
6 S	3.19	2.95	1.291	9.5	0.150
7 SSW	3.21	2.97	1.290	16.9	0.150
8 WSW	2.24	2.16	1.107	7.6	0.150
9 W	2.78	2.51	1.527	12.9	0.150
10 WNW	2.71	2.45	1.518	14.2	0.150
11 NNW	2.42	2.15	1.877	4.6	0.150
All	2.84	2.60	1.382	100.0	

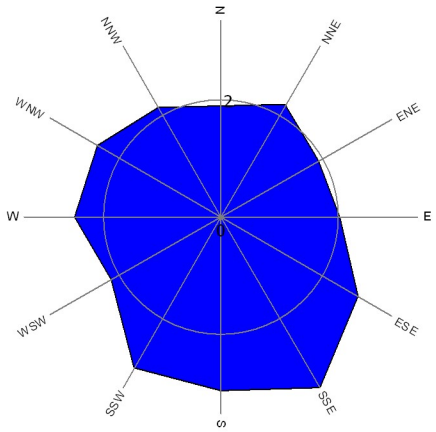
Weibull Distribution



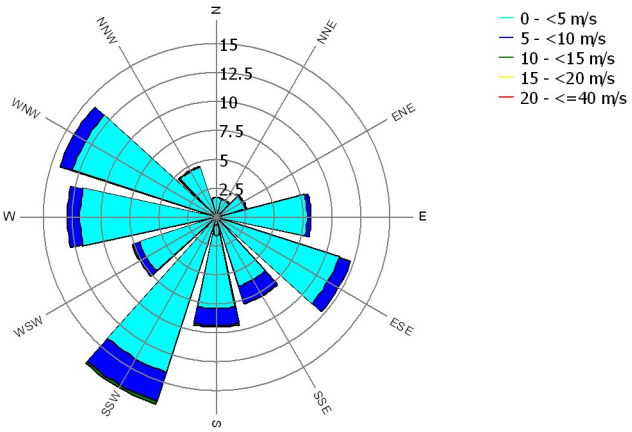
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



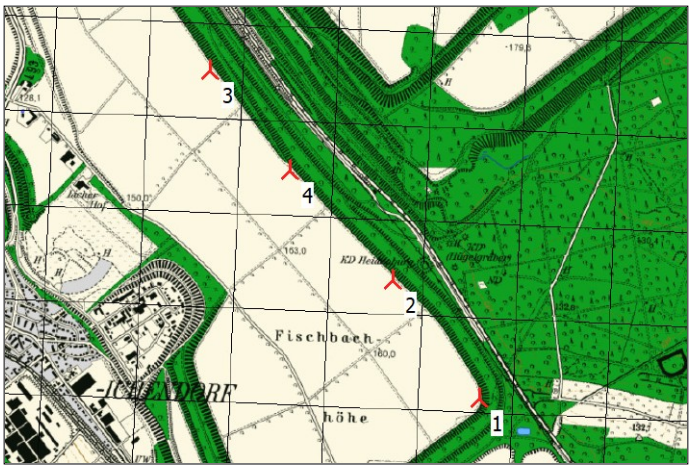
Frequency (%)



PARK - WTG distances

WTG distances

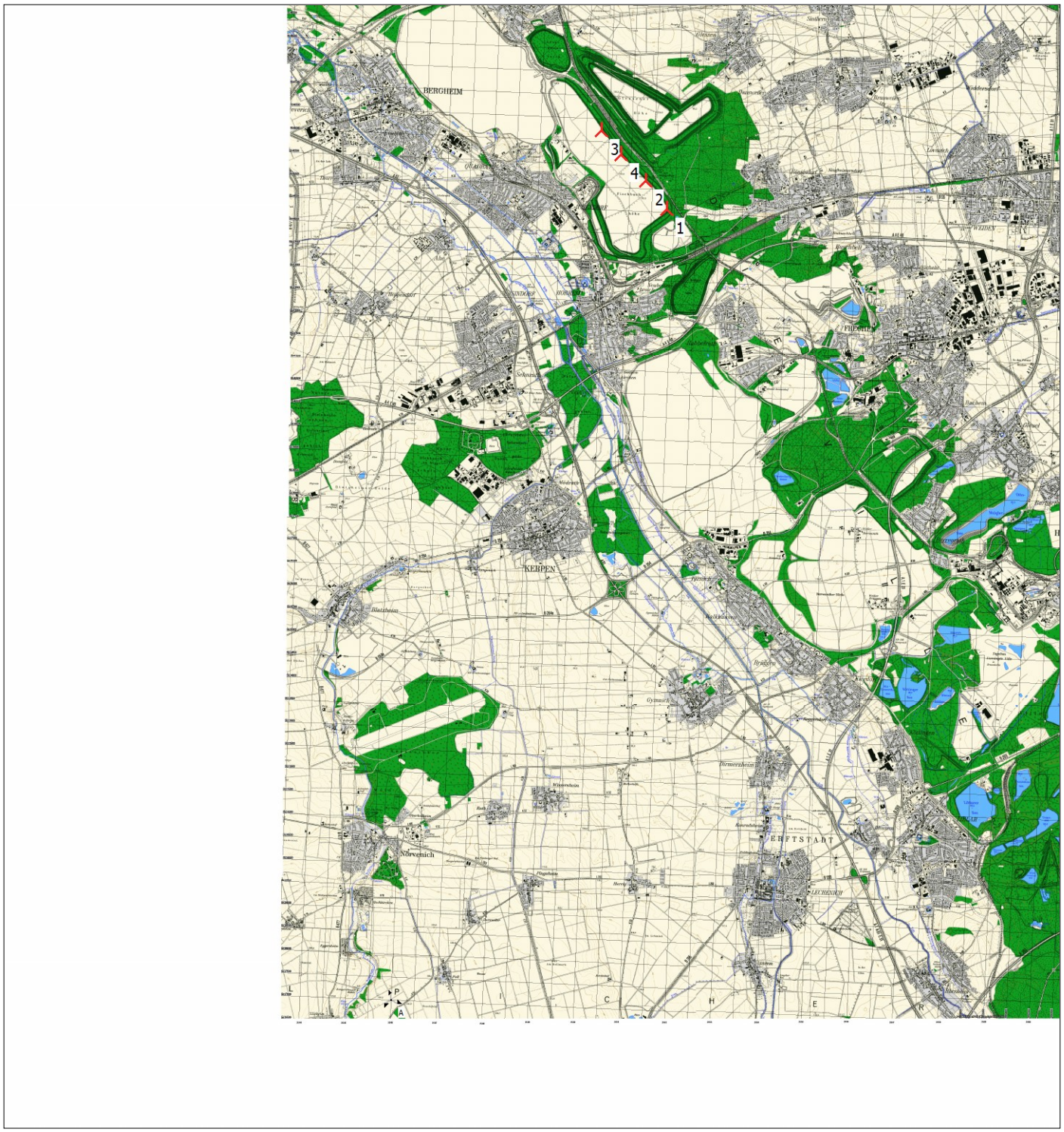
	Z	Nearest WTG	Z	Horizontal distance	Distance in rotor diameters
	[m]		[m]	[m]	
1	157.5	2	157.7	775	7.7
2	157.7	1	157.5	775	7.7
3	157.9	4	157.5	678	6.7
4	157.5	3	157.9	678	6.7
Min	157.5		157.5	678	6.7
Max	157.9		157.9	775	7.7



Scale 1:40,000

New WTG

PARK - Map



0 2.5 5 7.5 10km

Map: SelfReferrencedMap , Print scale 1:125,000, Map center GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2 East: 2,548,667 North: 5,636,626

New WTG Meteorological Data

DECIBEL - Main Result

ISO 9613-2 German (Interimsverfahren)

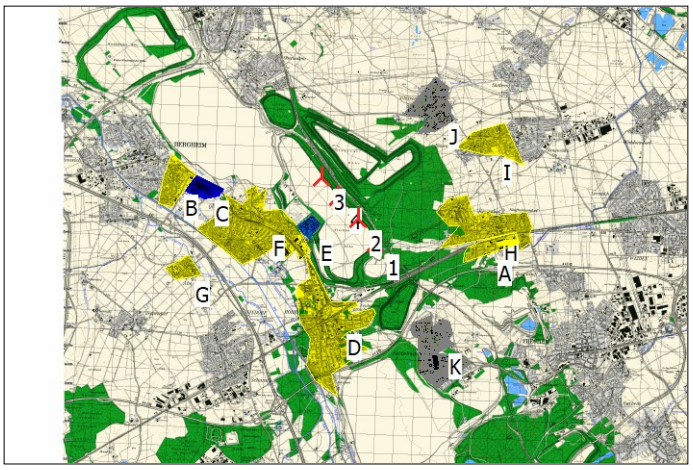
The calculation is based on the international norm "ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors"

Meteorological correction factor, C0: 0.0 dB

Die Immissionsrichtwerte entsprechend TA Lärm sind (Nacht / Tag):

Industriegebiet: 70 / 70 dB(A)
Kerngebiet, Dorf- und Mischgebiet: 45 / 60 dB(A)
Reines Wohngebiet: 35 / 50 dB(A)
Gewerbegebiet: 50 / 65 dB(A)
Allgemeines Wohngebiet, Kleinsiedlungsgebiet: 40 / 55 dB(A)
Kurgebiet, Krankenhaus, Pflegeanstalt: 35 / 45 dB(A)

All coordinates are in
GK (3 deg)-DHDN/PD/Bessel (DE 1995 < ±5m) Zone: 2



Scale 1:200,000

New WTG Noise sensitive area

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Uncertainty	
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	[dB(A)]	
1	2,551,335	5,644,577	157.5	ENERCON E-101 3050 101...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	13.0	105.5	0.0	h
2	2,550,853	5,645,184	157.7	ENERCON E-101 3050 101...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	13.0	105.5	0.0	h
3	2,549,837	5,646,252	157.9	ENERCON E-101 3050 101...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	13.0	105.5	0.0	h
4	2,550,284	5,645,743	157.5	ENERCON E-101 3050 101...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	EMD	Level 0 - official - OM 0 - 3050kW - 03/2015	13.0	105.5	0.0	h

h) Generic octave distribution used

Calculation Results

Sound level

Noise sensitive area No.	Name	Easting	Northing	Z	Immission height	Demands Noise	Sound level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
A	Noise sensitive area: German TA Lärm - General residential areas (4)	2,553,706	5,644,388	110.2	5.0	40.0-2.6=37.4	27.6	1,514	Yes
B	Noise sensitive area: German TA Lärm - General residential areas (8)	2,546,502	5,646,163	72.0	5.0	40.0-2.6=37.4	24.0	2,450	Yes
C	Noise sensitive area: German TA Lärm - User defined (9)	2,547,244	5,645,816	74.0	5.0	70.0-2.6=67.4	26.9		Yes
D	Noise sensitive area: German TA Lärm - General residential areas (10)	2,549,583	5,644,154	90.1	5.0	40.0-2.6=37.4	34.0	508	Yes
E	Noise sensitive area: German TA Lärm - Enterprise zone (11)	2,549,875	5,644,994	108.6	5.0	50.0-2.6=47.4	39.8	556	Yes
F	Noise sensitive area: German TA Lärm - General residential areas (12)	2,549,270	5,644,933	75.2	5.0	40.0-2.6=37.4	35.8	210	Yes
G	Noise sensitive area: German TA Lärm - General residential areas (13)	2,546,774	5,643,535	71.2	5.0	40.0-2.6=37.4	23.0	3,049	Yes
H	Noise sensitive area: German TA Lärm - General residential areas (14)	2,552,928	5,645,435	89.4	5.0	40.0-2.6=37.4	31.3	873	Yes
I	Noise sensitive area: German TA Lärm - General residential areas (15)	2,553,376	5,647,161	81.4	5.0	40.0-2.6=37.4	26.2	2,136	Yes
J	Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (16)	2,552,354	5,647,483	94.3	5.0	45.0-2.6=42.4	28.5	2,110	Yes
K	Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (17)	2,552,405	5,642,476	118.0	5.0	45.0-2.6=42.4	27.3	1,877	Yes

Distances (m)

	WTG			
NSA	1	2	3	4
A	2378	2961	4294	3680
B	5086	4460	3336	3805
C	4274	3664	2629	3041
D	1659	1635	2113	1736
E	1518	996	1058	831
F	1733	1509	1368	1297
G	4678	4399	4082	4146
H	1714	2090	3197	2662
I	3292	3205	3653	3401
J	3079	2746	2690	2704
K	2358	3121	4566	3895

DECIBEL - Detailed results

Noise calculation model: ISO 9613-2 German (Interimsverfahren) 10.0 m/s

Assumptions

Calculated L(DW) = LWA,ref + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet
(when calculated with ground attenuation, then Dc = Domega)

LWA,ref:	Sound pressure level at WTG
K:	Pure tone
Dc:	Directivity correction
Adiv:	the attenuation due to geometrical divergence
Aatm:	the attenuation due to atmospheric absorption
Agr:	the attenuation due to ground effect
Abar:	the attenuation due to a barrier
Amisc:	the attenuation due to miscellaneous other effects
Cmet:	Meteorological correction

Calculation Results

Noise sensitive area: A Noise sensitive area: German TA Lärm - General residential areas (4)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	2,378	2,381	24.60	24.60	105.5	0.00	78.54	5.36	-3.00	0.00	0.00	80.90
2	2,961	2,964	21.86	21.86	105.5	0.00	80.44	6.19	-3.00	0.00	0.00	83.63
3	4,294	4,296	16.98	16.98	105.5	0.00	83.66	7.85	-3.00	0.00	0.00	88.51
4	3,680	3,682	19.05	19.05	105.5	0.00	82.32	7.12	-3.00	0.00	0.00	86.45
Sum				27.57								

Noise sensitive area: B Noise sensitive area: German TA Lärm - General residential areas (8)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	5,086	5,089	14.65	14.65	105.5	0.00	85.13	8.71	-3.00	0.00	0.00	90.84
2	4,460	4,463	16.46	16.46	105.5	0.00	83.99	8.04	-3.00	0.00	0.00	89.03
3	3,336	3,340	20.32	20.32	105.5	0.00	81.48	6.69	-3.00	0.00	0.00	85.17
4	3,805	3,809	18.60	18.60	105.5	0.00	82.62	7.28	-3.00	0.00	0.00	86.90
Sum				24.04								

Noise sensitive area: C Noise sensitive area: German TA Lärm - User defined (9)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	4,274	4,278	17.04	17.04	105.5	0.00	83.62	7.83	-3.00	0.00	0.00	88.45
2	3,664	3,668	19.10	19.10	105.5	0.00	82.29	7.11	-3.00	0.00	0.00	86.40
3	2,629	2,635	23.35	23.35	105.5	0.00	79.41	5.73	-3.00	0.00	0.00	82.15
4	3,041	3,045	21.52	21.52	105.5	0.00	80.67	6.30	-3.00	0.00	0.00	83.98
Sum				26.90								

Noise sensitive area: D Noise sensitive area: German TA Lärm - General residential areas (10)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	1,802	1,809	27.89	27.89	105.5	0.00	76.15	4.45	-3.00	0.00	0.00	77.60
2	1,635	1,643	29.01	29.01	105.5	0.00	75.31	4.17	-3.00	0.00	0.00	76.48
3	2,113	2,119	26.02	26.02	105.5	0.00	77.52	4.96	-3.00	0.00	0.00	79.48
4	1,736	1,743	28.32	28.32	105.5	0.00	75.83	4.34	-3.00	0.00	0.00	77.17
Sum				33.97								

DECIBEL - Detailed results

Noise calculation model: ISO 9613-2 German (Interimsverfahren) 10.0 m/s

Noise sensitive area: E Noise sensitive area: German TA Lärm - Enterprise zone (11)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	1,518	1,522	29.89	29.89	105.5	0.00	74.65	3.96	-3.00	0.00	0.00	75.61
2	996	1,002	34.52	34.52	105.5	0.00	71.02	2.95	-3.00	0.00	0.00	70.97
3	1,258	1,263	31.99	31.99	105.5	0.00	73.02	3.47	-3.00	0.00	0.00	73.50
4	853	859	36.16	36.16	105.5	0.00	69.68	2.64	-3.00	0.00	0.00	69.33
Sum				39.79								

Noise sensitive area: F Noise sensitive area: German TA Lärm - General residential areas (12)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	2,095	2,100	26.12	26.12	105.5	0.00	77.45	4.93	-3.00	0.00	0.00	79.37
2	1,602	1,610	29.25	29.25	105.5	0.00	75.13	4.11	-3.00	0.00	0.00	76.25
3	1,435	1,443	30.50	30.50	105.5	0.00	74.19	3.81	-3.00	0.00	0.00	75.00
4	1,297	1,306	31.62	31.62	105.5	0.00	73.32	3.56	-3.00	0.00	0.00	73.87
Sum				35.82								

Noise sensitive area: G Noise sensitive area: German TA Lärm - General residential areas (13)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	4,678	4,682	15.81	15.81	105.5	0.00	84.41	8.28	-3.00	0.00	0.00	89.69
2	4,399	4,403	16.65	16.65	105.5	0.00	83.88	7.97	-3.00	0.00	0.00	88.85
3	4,094	4,098	17.62	17.62	105.5	0.00	83.25	7.62	-3.00	0.00	0.00	87.87
4	4,146	4,150	17.45	17.45	105.5	0.00	83.36	7.68	-3.00	0.00	0.00	88.04
Sum				22.96								

Noise sensitive area: H Noise sensitive area: German TA Lärm - General residential areas (14)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	1,809	1,815	27.85	27.85	105.5	0.00	76.18	4.46	-3.00	0.00	0.00	77.64
2	2,090	2,094	26.15	26.15	105.5	0.00	77.42	4.92	-3.00	0.00	0.00	79.34
3	3,197	3,200	20.88	20.88	105.5	0.00	81.10	6.51	-3.00	0.00	0.00	84.61
4	2,662	2,665	23.20	23.20	105.5	0.00	79.51	5.78	-3.00	0.00	0.00	82.29
Sum				31.32								

Noise sensitive area: I Noise sensitive area: German TA Lärm - General residential areas (15)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	3,292	3,296	20.50	20.50	105.5	0.00	81.36	6.64	-3.00	0.00	0.00	85.00
2	3,205	3,209	20.84	20.84	105.5	0.00	81.13	6.52	-3.00	0.00	0.00	84.65
3	3,653	3,657	19.14	19.14	105.5	0.00	82.26	7.09	-3.00	0.00	0.00	86.36
4	3,401	3,405	20.07	20.07	105.5	0.00	81.64	6.78	-3.00	0.00	0.00	85.42
Sum				26.20								

Noise sensitive area: J Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (16)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	3,079	3,083	21.36	21.36	105.5	0.00	80.78	6.35	-3.00	0.00	0.00	84.13
2	2,746	2,749	22.81	22.81	105.5	0.00	79.78	5.90	-3.00	0.00	0.00	82.68
3	2,802	2,805	22.56	22.56	105.5	0.00	79.96	5.97	-3.00	0.00	0.00	82.93
4	2,704	2,708	23.00	23.00	105.5	0.00	79.65	5.84	-3.00	0.00	0.00	82.49
Sum				28.50								

DECIBEL - Detailed results

Noise calculation model: ISO 9613-2 German (Interimsverfahren) 10.0 m/s

Noise sensitive area: K Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (17)

Highest noise value

WTG No.	Distance [m]	Sound distance [m]	From WTGs [dB(A)]	WTG + Uncertainty margin [dB]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]
1	2,358	2,362	24.70	24.70	105.5	0.00	78.46	5.33	-3.00	0.00	0.00	80.79
2	3,121	3,124	21.19	21.19	105.5	0.00	80.89	6.41	-3.00	0.00	0.00	84.30
3	4,566	4,568	16.14	16.14	105.5	0.00	84.19	8.16	-3.00	0.00	0.00	89.35
4	3,895	3,897	18.29	18.29	105.5	0.00	82.81	7.39	-3.00	0.00	0.00	87.20
Sum				27.29								

DECIBEL - Assumptions for noise calculation

Noise calculation model:
ISO 9613-2 German (Interimsverfahren)
Wind speed (at hubheight):
Highest noise value
Ground attenuation:
Fixed values, Agr: -3.0, Dc: 0.0
Meteorological coefficient, C0:
Selected option: Fixed value: 0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5.0 m; Allow override of model height with height from NSA object
Uncertainty margin:
Uncertainty added to source noise level of the WTGs in the calculation
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
-2.6 dB(A)
Octave data required
Frequency dependent air absorption

63	125	250	500	1,000	2,000	4,000	8,000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0.10	0.40	1.00	1.90	3.70	9.70	32.80	117.00

All coordinates are in
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2

WTG: ENERCON E-101 3050 101.0 !-!
Noise: Level 0 - official - OM 0 - 3050kW - 03/2015

Source	Source/Date	Creator	Edited
Enercon	3/3/2015	EMD	4/17/2015 10:59 AM

official values from specification document D0372846-1_#_ger_#_Betriebsmodi_E-101___3050_kW

Status	Wind speed (hh) [m/s]	LwA,ref [dB(A)]	Pure tones		Octave data 63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	13.0	105.5	No	Generic data	85.2	93.6	97.8	100.0	99.5	97.5	93.5	82.6

Noise sensitive area: A Noise sensitive area: German TA Lärm - General residential areas (4)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: B Noise sensitive area: German TA Lärm - General residential areas (8)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: C Noise sensitive area: German TA Lärm - User defined (9)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 70.0 dB(A)
No distance demand

DECIBEL - Assumptions for noise calculation

Noise sensitive area: D Noise sensitive area: German TA Lärm - General residential areas (10)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: E Noise sensitive area: German TA Lärm - Enterprise zone (11)
Predefined calculation standard: Enterprise zone
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 50.0 dB(A)
No distance demand

Noise sensitive area: F Noise sensitive area: German TA Lärm - General residential areas (12)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: G Noise sensitive area: German TA Lärm - General residential areas (13)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

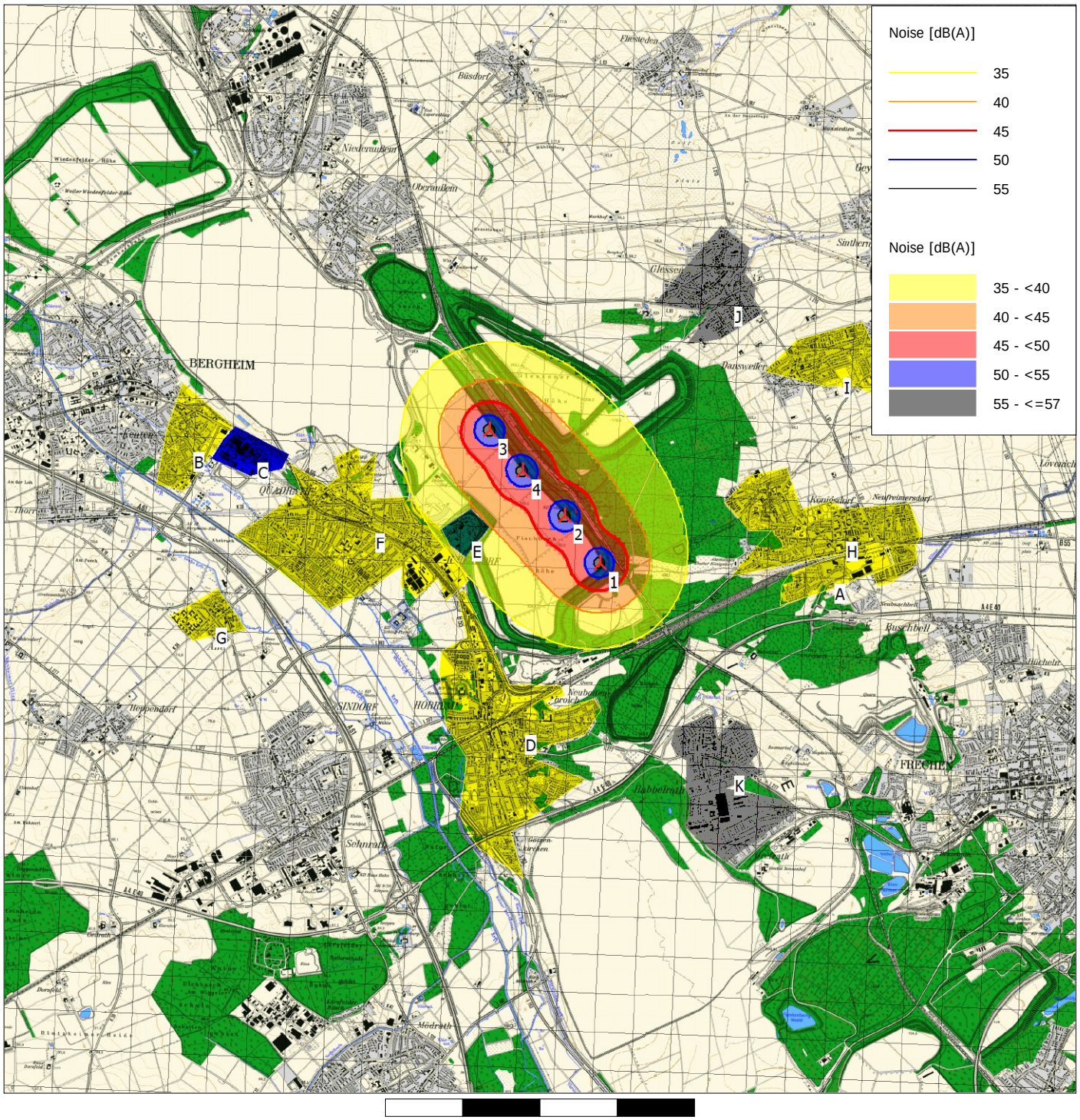
Noise sensitive area: H Noise sensitive area: German TA Lärm - General residential areas (14)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: I Noise sensitive area: German TA Lärm - General residential areas (15)
Predefined calculation standard: General residential areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 40.0 dB(A)
No distance demand

Noise sensitive area: J Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (16)
Predefined calculation standard: Rural villages, Mixed areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 45.0 dB(A)
No distance demand

Noise sensitive area: K Noise sensitive area: German TA Lärm - Rural villages, Mixed areas (17)
Predefined calculation standard: Rural villages, Mixed areas
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model
No temporal binning
Noise demand: 45.0 dB(A)
No distance demand

DECIBEL - Map Highest noise value



Map: SelfReferrencedMap , Print scale 1:75,000, Map center GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2 East: 2,550,518 North: 5,644,745

New WTG Noise sensitive area

Noise calculation model: ISO 9613-2 German (Interimsverfahren). Wind speed: Highest noise value
Height above sea level from active line object

SHADOW - Main Result

Assumptions for shadow calculations

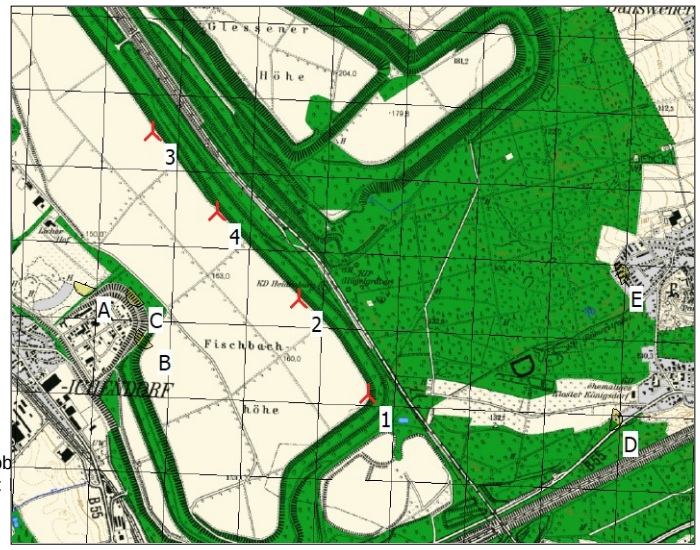
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

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

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Projekt_0.wpo (1)
Area object(s) used in calculation:
Background Area object (Roughness, Heights a.g.l. for e.g. Forest (ORA tool) or ZVI ob
Area object (Roughness, Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions):
Receptor grid resolution: 1.0 m

All coordinates are in
GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2



Scale 1:50,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	2,551,335	5,644,577	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 1...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	2,216	14.5
2	2,550,853	5,645,184	157.7	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 1...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	2,216	14.5
3	2,549,837	5,646,252	157.9	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 1...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	2,216	14.5
4	2,550,284	5,645,743	157.5	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 1...	Yes	ENERCON	E-101-3,050	3,050	101.0	99.0	2,216	14.5

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Degrees from south cw	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]	[°]		[m]
A	2,549,430	5,645,223	129.3	1.0	1.0	1.0	-160.0	90.0	Fixed direction	2.0
B	2,549,847	5,644,889	145.3	1.0	1.0	1.0	-130.5	90.0	Fixed direction	2.0
C	2,549,782	5,645,169	138.0	1.0	1.0	1.0	-130.5	90.0	Fixed direction	2.0
D	2,552,956	5,644,478	129.8	1.0	1.0	1.0	-260.6	90.0	Fixed direction	2.0
E	2,552,961	5,645,441	111.8	1.0	1.0	1.0	69.4	90.0	Fixed direction	2.0

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	18:44	67	0:24
B	14:14	56	0:23
C	11:13	48	0:22
D	0:00	0	0:00
E	0:00	0	0:00

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

No.	Name	Worst case [h/year]
1	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)	6:27
2	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)	21:31
3	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (12)	0:00
4	ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)	14:13

SHADOW - Main Result

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

SHADOW - Calendar

Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (26)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March		April		May		June		July		August	September		October	November	December
1	08:37	08:12	07:20		07:12	07:54 (2)	06:09		05:26	06:03 (4)	05:23	06:04 (4)	05:58	06:46		07:33	07:24	08:13
	16:37	17:24	18:13		20:05	5 07:59 (2)	20:54		21:38	11 06:14 (4)	21:51	22 06:26 (4)	21:21	20:21		19:14	17:10	16:31
2	08:37	08:10	07:18		07:09		06:07		05:25	06:03 (4)	05:24	06:04 (4)	06:00	06:47		07:34	07:26	08:15
	16:38	17:25	18:15		20:07		20:55		21:39	13 06:16 (4)	21:51	21 06:25 (4)	21:19	20:19		19:12	17:08	16:31
3	08:37	08:09	07:16		07:07		06:05		05:24	06:02 (4)	05:25	06:05 (4)	06:01	06:49		07:36	07:28	08:16
	16:40	17:27	18:17		20:08		20:57		21:40	15 06:17 (4)	21:51	20 06:25 (4)	21:18	20:17		19:09	17:06	16:30
4	08:36	08:07	07:14		07:05		06:04		05:24	06:02 (4)	05:25	06:06 (4)	06:03	06:50		07:37	07:29	08:17
	16:41	17:29	18:18		20:10		20:59		21:41	16 06:18 (4)	21:50	20 06:26 (4)	21:16	20:15		19:07	17:05	16:30
5	08:36	08:05	07:12		07:03		06:02		05:23	06:01 (4)	05:26	06:06 (4)	06:04	06:52		07:39	07:31	08:19
	16:42	17:31	18:20		20:12		21:00		21:42	17 06:18 (4)	21:50	20 06:26 (4)	21:14	20:12		19:05	17:03	16:29
6	08:36	08:04	07:10		07:01		06:00		05:22	06:01 (4)	05:27	06:06 (4)	06:06	06:53		07:41	07:33	08:20
	16:43	17:32	18:22		20:13		21:02		21:43	18 06:19 (4)	21:49	19 06:25 (4)	21:13	20:10		19:03	17:01	16:29
7	08:36	08:02	07:07		06:58		05:58		05:22	06:00 (4)	05:28	06:07 (4)	06:07	06:55		07:42	07:35	08:21
	16:44	17:34	18:24		20:15		21:03		21:44	19 06:19 (4)	21:49	18 06:25 (4)	21:11	20:08		19:00	17:00	16:28
8	08:35	08:01	07:05		06:56		05:57		05:21	06:00 (4)	05:29	06:08 (4)	06:09	06:57		07:44	07:36	08:22
	16:45	17:36	18:25		20:16		21:05		21:44	20 06:20 (4)	21:48	17 06:25 (4)	21:09	20:06		18:58	16:58	16:28
9	08:35	07:59	07:03		06:54		05:55		05:21	06:00 (4)	05:30	06:09 (4)	06:10	06:58		07:45	07:38	08:23
	16:47	17:38	18:27		20:18		21:06		21:45	20 06:20 (4)	21:48	15 06:24 (4)	21:08	20:03		18:56	16:56	16:28
10	08:34	07:57	07:01		06:52		05:53		05:20	06:00 (4)	05:30	06:10 (4)	06:12	07:00		07:47	07:40	08:25
	16:48	17:40	18:29		20:20		21:08		21:46	21 06:21 (4)	21:47	14 06:24 (4)	21:06	20:01		18:54	16:55	16:28
11	08:34	07:55	06:59		06:50		05:52		05:20	06:00 (4)	05:31	06:11 (4)	06:13	07:01	07:47 (2)	07:49	07:41	08:26
	16:50	17:41	18:30		20:21		21:10		21:47	22 06:22 (4)	21:46	12 06:23 (4)	21:04	19:59	4 07:51 (2)	18:52	16:53	16:27
12	08:33	07:54	06:56		06:48		05:50		05:20	06:00 (4)	05:32	06:12 (4)	06:15	07:03	07:44 (2)	07:50	07:43	08:27
	16:51	17:43	18:32		20:23		21:11		21:47	22 06:22 (4)	21:45	10 06:22 (4)	21:02	19:57	10 07:54 (2)	18:50	16:52	16:27
13	08:32	07:52	06:54		06:45		05:49		05:19	06:00 (4)	05:34	06:14 (4)	06:16	07:04	07:42 (2)	07:52	07:45	08:28
	16:52	17:45	18:34		20:25		21:13		21:48	22 06:22 (4)	21:45	7 06:21 (4)	21:00	19:54	13 07:55 (2)	18:47	16:50	16:27
14	08:32	07:50	06:52		06:43		05:47		05:19	06:00 (4)	05:35		06:18	07:06	07:41 (2)	07:54	07:47	08:29
	16:54	17:47	18:35		20:26		21:14		21:49	22 06:22 (4)	21:44		20:58	19:52	15 07:56 (2)	18:45	16:49	16:27
15	08:31	07:48	06:50		06:41		05:46		05:19	06:00 (4)	05:36		06:19	07:07	07:39 (2)	07:55	07:48	08:29
	16:55	17:49	18:37		20:28		21:16		21:49	23 06:23 (4)	21:43		20:56	19:50	16 07:55 (2)	18:43	16:48	16:27
16	08:30	07:46	06:48		06:39		05:44		05:19	06:00 (4)	05:37		06:21	07:09	07:39 (2)	07:57	07:50	08:30
	16:57	17:50	18:39		20:30		21:17		21:50	23 06:23 (4)	21:42		20:54	19:48	17 07:56 (2)	18:41	16:46	16:28
17	08:29	07:44	06:45		06:37		05:43		05:19	06:00 (4)	05:38		06:22	07:11	07:38 (2)	07:59	07:52	08:31
	16:58	17:52	18:40		20:31		21:18		21:50	23 06:23 (4)	21:41		20:52	19:45	17 07:55 (2)	18:39	16:45	16:28
18	08:29	07:42	06:43		06:35		05:41		05:19	06:00 (4)	05:39		06:24	07:12	07:39 (2)	08:00	07:53	08:32
	17:00	17:54	18:42		20:33		21:20		21:51	23 06:23 (4)	21:40		20:50	19:43	15 07:54 (2)	18:37	16:44	16:28
19	08:28	07:40	06:41		06:33		05:40		05:19	06:00 (4)	05:40		06:25	07:14	07:39 (2)	08:02	07:55	08:32
	17:02	17:56	18:44		20:34		21:21		21:51	24 06:24 (4)	21:39		20:48	19:41	13 07:52 (2)	18:35	16:42	16:28
20	08:27	07:38	06:39		06:31		05:39		05:19	06:01 (4)	05:42		06:27	07:15	07:40 (2)	08:04	07:57	08:33
	17:03	17:57	18:45		20:36		21:23		21:51	23 06:24 (4)	21:37		20:46	19:39	11 07:51 (2)	18:33	16:41	16:29
21	08:26	07:37	06:36		06:29		05:37		05:19	06:02 (4)	05:43		06:29	07:17	07:42 (2)	08:05	07:58	08:34
	17:05	17:59	18:47		20:38		21:24		21:51	23 06:25 (4)	21:36		20:44	19:36	6 07:48 (2)	18:31	16:40	16:29
22	08:24	07:35	06:34	06:57 (2)	06:27		05:36		05:19	06:02 (4)	05:44		06:30	07:18		08:07	08:00	08:34
	17:06	18:01	18:49	4 07:01 (2)	20:39		21:25		21:52	23 06:25 (4)	21:35		20:42	19:34		18:29	16:39	16:30
23	08:23	07:33	06:32	06:54 (2)	06:25		05:35		05:20	06:01 (4)	05:46		06:32	07:20		08:09	08:01	08:35
	17:08	18:03	18:50	10 07:04 (2)	20:41		21:27		21:52	24 06:25 (4)	21:34		20:40	19:32		18:27	16:38	16:30
24	08:22	07:31	06:30	06:53 (2)	06:23		05:34		05:20	06:01 (4)	05:47		06:33	07:22		08:10	08:03	08:35
	17:10	18:05	18:52	13 07:06 (2)	20:43		21:28		21:52	23 06:24 (4)	21:33		20:38	19:30		18:25	16:37	16:31
25	08:21	07:28	06:27	06:51 (2)	06:21		05:32		05:20	06:02 (4)	05:48		06:35	07:23		08:12	08:04	08:36
	17:11	18:06	18:54	15 07:06 (2)	20:44		21:29		21:52	23 06:25 (4)	21:31		20:36	19:27		17:23	16:36	16:31
26	08:20	07:26	06:25	06:50 (2)	06:19		05:31		05:21	06:02 (4)	05:50		06:36	07:25		07:14	08:06	08:36
	17:13	18:08	18:55	16 07:06 (2)	20:46		21:31		21:52	23 06:25 (4)	21:30		20:34	19:25		17:21	16:35	16:32
27	08:19	07:24	06:23	06:50 (2)	06:17		05:30		05:21	06:03 (4)	05:51		06:38	07:26		07:16	08:08	08:36
	17:15	18:10	18:57	16 07:06 (2)	20:47		21:32		21:52	23 06:26 (4)	21:29		20:32	19:23		17:19	16:34	16:33
28	08:17	07:22	06:21	06:50 (2)	06:15		05:29		05:21	06:03 (4)	05:52		06:39	07:28		07:17	08:09	08:36
	17:17	18:12	18:58	16 07:06 (2)	20:49		21:33		21:52	22 06:25 (4)	21:27		20:30	19:20		17:17	16:33	16:33
29	08:16		07:18	07:50 (2)	06:13		05:28		05:22	06:04 (4)	05:54		06:41	07:29		07:19	08:10	08:37
	17:18		20:00	15 08:05 (2)	20:51		21:34		21:52	22 06:26 (4)	21:26		20:28	19:18		17:15	16:33	16:34
30	08:14		07:16	07:50 (2)	06:11		05:27	06:07 (4)	05:23	06:03 (4)	05:55		06:43	07:31		07:21	08:12	08:37
	17:20		20:02	13 08:03 (2)	20:52		21:35	4 06:11 (4)	21:52	22 06:25 (4)	21:24		20:25	19:16		17:13	16:32	16:35
31	08:13		07:14	07:51 (2)			05:27	06:04 (4)			05:57		06:44			07:22		08:37
	17:22		20:03	11 08:02 (2)			21:37	9 06:13 (4)			21:23		20:23			17:12		16:36
Potential sun hours	263	280	367		414		481		493		497		451	380		333	270	249
Total, worst case				129		5		13		625		215			137			

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

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

SHADOW - Calendar

Shadow receptor: B - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (27)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March		April		May		June	July	August		September		October		November	December
1	08:37	08:12	07:20		07:12		06:09	06:44 (2)	05:26	05:23	05:58		06:46		07:33	08:06 (1)	07:24	08:13
	16:37	17:24	18:13		20:05		20:54 23	07:07 (2)	21:38	21:51	21:21		20:21		19:14 11	08:17 (1)	17:10	16:31
2	08:37	08:10	07:18		07:09		06:07	06:44 (2)	05:25	05:24	06:00		06:47		07:34	08:05 (1)	07:26	08:15
	16:38	17:25	18:15		20:07		20:55 22	07:06 (2)	21:39	21:51	21:19		20:19		19:11 13	08:18 (1)	17:08	16:31
3	08:37	08:09	07:16		07:07		06:05	06:44 (2)	05:24	05:25	06:01		06:49		07:36	08:03 (1)	07:28	08:16
	16:39	17:27	18:17		20:08		20:57 21	07:05 (2)	21:40	21:51	21:18		20:17		19:09 15	08:18 (1)	17:06	16:30
4	08:36	08:07	07:14		07:05		06:04	06:46 (2)	05:24	05:25	06:03	07:02 (2)	06:50		07:37	08:03 (1)	07:29	08:17
	16:41	17:29	18:18		20:10		20:59 19	07:05 (2)	21:41	21:50	21:16 5	07:07 (2)	20:15		19:07 15	08:18 (1)	17:05	16:30
5	08:36	08:05	07:12	07:34 (1)	07:03		06:02	06:46 (2)	05:23	05:26	06:04	07:00 (2)	06:52		07:39	08:04 (1)	07:31	08:19
	16:42	17:31	18:20	4 07:38 (1)	20:12		21:00 18	07:04 (2)	21:42	21:50	21:14 10	07:10 (2)	20:12		19:05 14	08:18 (1)	17:03	16:29
6	08:36	08:04	07:09	07:32 (1)	07:01		06:00	06:47 (2)	05:22	05:27	06:06	06:57 (2)	06:53		07:41	08:05 (1)	07:33	08:20
	16:43	17:32	18:22	8 07:40 (1)	20:13		21:02 15	07:02 (2)	21:43	21:49	21:13 15	07:12 (2)	20:10		19:03 12	08:17 (1)	17:01	16:29
7	08:36	08:02	07:07	07:30 (1)	06:58		05:58	06:48 (2)	05:22	05:28	06:07	06:56 (2)	06:55		07:42	08:07 (1)	07:35	08:21
	16:44	17:34	18:24	11 07:41 (1)	20:15		21:03 14	07:02 (2)	21:44	21:49	21:11 16	07:12 (2)	20:08		19:00 9	08:16 (1)	17:00	16:28
8	08:35	08:00	07:05	07:28 (1)	06:56		05:57	06:50 (2)	05:21	05:29	06:09	06:55 (2)	06:57		07:44	08:09 (1)	07:36	08:22
	16:45	17:36	18:25	13 07:41 (1)	20:16		21:05 9	06:59 (2)	21:44	21:48	21:09 19	07:14 (2)	20:06		18:58 6	08:15 (1)	16:58	16:28
9	08:35	07:59	07:03	07:25 (1)	06:54		05:55		05:21	05:29	06:10	06:54 (2)	06:58		07:45	08:10 (1)	07:38	08:23
	16:47	17:38	18:27	15 07:40 (1)	20:18		21:06		21:45	21:48	21:07 20	07:14 (2)	20:03		18:56 2	08:12 (1)	16:56	16:28
10	08:34	07:57	07:01	07:25 (1)	06:52		05:53		05:20	05:30	06:12	06:54 (2)	07:00		07:47		07:40	08:24
	16:48	17:40	18:29	15 07:40 (1)	20:20		21:08		21:46	21:47	21:06 21	07:15 (2)	20:01		18:54		16:55	16:28
11	08:34	07:55	06:59	07:26 (1)	06:50		05:52		05:20	05:31	06:13	06:53 (2)	07:01		07:49		07:41	08:26
	16:49	17:41	18:30	13 07:39 (1)	20:21		21:10		21:47	21:46	21:04 22	07:15 (2)	19:59		18:52		16:53	16:27
12	08:33	07:54	06:56	07:26 (1)	06:48		05:50		05:20	05:32	06:15	06:53 (2)	07:03		07:50		07:43	08:27
	16:51	17:43	18:32	12 07:38 (1)	20:23		21:11		21:47	21:45	21:02 23	07:16 (2)	19:57		18:50		16:52	16:27
13	08:32	07:52	06:54	07:28 (1)	06:45		05:49		05:19	05:34	06:16	06:52 (2)	07:04		07:52		07:45	08:28
	16:52	17:45	18:34	9 07:37 (1)	20:25		21:13		21:48	21:44	21:00 23	07:15 (2)	19:54		18:47		16:50	16:27
14	08:32	07:50	06:52		06:43		05:47		05:19	05:35	06:18	06:53 (2)	07:06		07:54		07:47	08:28
	16:54	17:47	18:35		20:26		21:14		21:49	21:44	20:58 22	07:15 (2)	19:52		18:45		16:49	16:27
15	08:31	07:48	06:50		06:41		05:46		05:19	05:36	06:19	06:52 (2)	07:07		07:55		07:48	08:29
	16:55	17:49	18:37		20:28		21:16		21:49	21:43	20:56 23	07:15 (2)	19:50		18:43		16:48	16:27
16	08:30	07:46	06:48		06:39		05:44		05:19	05:37	06:21	06:52 (2)	07:09		07:57		07:50	08:30
	16:57	17:50	18:39		20:30		21:17		21:50	21:42	20:54 22	07:14 (2)	19:48		18:41		16:46	16:28
17	08:29	07:44	06:45		06:37		05:43		05:19	05:38	06:22	06:53 (2)	07:11		07:59		07:52	08:31
	16:58	17:52	18:40		20:31		21:18		21:50	21:41	20:52 21	07:14 (2)	19:45		18:39		16:45	16:28
18	08:28	07:42	06:43		06:35		05:41		05:19	05:39	06:24	06:53 (2)	07:12		08:00		07:53	08:32
	17:00	17:54	18:42		20:33		21:20		21:50	21:40	20:50 19	07:12 (2)	19:43		18:37		16:44	16:28
19	08:28	07:40	06:41		06:33		05:40		05:19	05:40	06:25	06:54 (2)	07:14		08:02		07:55	08:32
	17:01	17:56	18:44		20:34		21:21		21:51	21:39	20:48 17	07:11 (2)	19:41		18:35		16:42	16:28
20	08:27	07:38	06:39		06:31		05:39		05:19	05:42	06:27	06:54 (2)	07:15		08:04		07:56	08:33
	17:03	17:57	18:45		20:36		21:23		21:51	21:37	20:46 15	07:09 (2)	19:39		18:33		16:41	16:29
21	08:26	07:36	06:36		06:29	06:54 (2)	05:37		05:19	05:43	06:29	06:57 (2)	07:17		08:05		07:58	08:34
	17:05	17:59	18:47		20:38 6	07:00 (2)	21:24		21:51	21:36	20:44 11	07:08 (2)	19:36		18:31		16:40	16:29
22	08:24	07:35	06:34		06:27	06:52 (2)	05:36		05:19	05:44	06:30	07:00 (2)	07:18		08:07		08:00	08:34
	17:06	18:01	18:49		20:39 12	07:04 (2)	21:25		21:52	21:35	20:42 3	07:03 (2)	19:34		18:29		16:39	16:30
23	08:23	07:32	06:32		06:25	06:49 (2)	05:35		05:20	05:46	06:32		07:20		08:09		08:01	08:35
	17:08	18:03	18:50		20:41 16	07:05 (2)	21:27		21:52	21:34	20:40		19:32		18:27		16:38	16:30
24	08:22	07:30	06:30		06:23	06:48 (2)	05:34		05:20	05:47	06:33		07:21		08:10		08:03	08:35
	17:10	18:05	18:52		20:43 18	07:06 (2)	21:28		21:52	21:33	20:38		19:30		18:25		16:37	16:31
25	08:21	07:28	06:27		06:21	06:47 (2)	05:32		05:20	05:48	06:35		07:23		07:12		08:04	08:36
	17:11	18:06	18:54		20:44 20	07:07 (2)	21:29		21:52	21:31	20:36		19:27		17:23		16:36	16:31
26	08:20	07:26	06:25		06:19	06:46 (2)	05:31		05:21	05:50	06:36		07:25		07:14		08:06	08:36
	17:13	18:08	18:55		20:46 21	07:07 (2)	21:31		21:52	21:30	20:34		19:25		17:21		16:35	16:32
27	08:18	07:24	06:23		06:17	06:45 (2)	05:30		05:21	05:51	06:38		07:26		07:16		08:07	08:36
	17:15	18:10	18:57		20:47 22	07:07 (2)	21:32		21:52	21:28	20:32		19:23		17:19		16:34	16:33
28	08:17	07:22	06:21		06:15	06:44 (2)	05:29		05:21	05:52	06:39		07:28		07:17		08:09	08:36
	17:17	18:11	18:58		20:49 23	07:07 (2)	21:33		21:52	21:27	20:30		19:20		17:17		16:33	16:33
29	08:16		07:18		06:13	06:44 (2)	05:28		05:22	05:54	06:41		07:29		07:19		08:10	08:37
	17:18		20:00		20:51 23	07:07 (2)	21:34		21:52	21:26	20:28		19:18		17:15		16:33	16:34
30	08:14		07:16		06:11	06:45 (2)	05:27		05:23	05:55	06:43		07:31	08:08 (1)	07:21		08:12	08:37
	17:20		20:02		20:52 22	07:07 (2)	21:35		21:51	21:24	20:25		19:16 6	08:14 (1)	17:13		16:32	16:35
31	08:13		07:14				05:27			05:57	06:44				07:22			08:37
	17:22		20:03				21:37			21:23	20:23				17:12			16:36
Potential sun hours	263	280	367		414		481		493	497	451		380		333		270	249
Total, worst case				100		183		141				327		6		97		

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

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

SHADOW - Calendar

Shadow receptor: C - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (28)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February		March		April		May	June	July	August	September		October		November	December
1	08:37	08:12		07:20		07:12	07:42 (2)	06:09	05:26	05:23	05:58	06:46		07:33		07:24	08:13
	16:37	17:24		18:13		20:05	21 08:03 (2)	20:54	21:38	21:51	21:21	20:21		19:14		17:10	16:31
2	08:37	08:10		07:18		07:09	07:41 (2)	06:07	05:25	05:24	06:00	06:47		07:34		07:26	08:15
	16:38	17:25		18:15		20:07	22 08:03 (2)	20:55	21:39	21:51	21:19	20:19		19:12		17:08	16:31
3	08:37	08:09		07:16		07:07	07:40 (2)	06:05	05:24	05:25	06:01	06:49	07:44 (2)	07:36		07:28	08:16
	16:39	17:27		18:17		20:08	22 08:02 (2)	20:57	21:40	21:51	21:18	20:17	7 07:51 (2)	19:09		17:06	16:30
4	08:36	08:07		07:14		07:05	07:40 (2)	06:04	05:24	05:25	06:03	06:50	07:41 (2)	07:37		07:29	08:17
	16:41	17:29		18:18		20:10	22 08:02 (2)	20:59	21:41	21:50	21:16	20:15	13 07:54 (2)	19:07		17:05	16:30
5	08:36	08:05		07:12		07:03	07:41 (2)	06:02	05:23	05:26	06:04	06:52	07:39 (2)	07:39		07:31	08:19
	16:42	17:31		18:20		20:12	20 08:01 (2)	21:00	21:42	21:50	21:14	20:12	16 07:55 (2)	19:05		17:03	16:29
6	08:36	08:04		07:09		07:01	07:42 (2)	06:00	05:22	05:27	06:06	06:53	07:38 (2)	07:41		07:33	08:20
	16:43	17:32		18:22		20:13	18 08:00 (2)	21:02	21:43	21:49	21:13	20:10	18 07:56 (2)	19:03		17:01	16:29
7	08:36	08:02		07:07		06:58	07:43 (2)	05:58	05:22	05:28	06:07	06:55	07:36 (2)	07:42		07:35	08:21
	16:44	17:34		18:24		20:15	16 07:59 (2)	21:03	21:44	21:49	21:11	20:08	20 07:56 (2)	19:00		17:00	16:28
8	08:35	08:00		07:05		06:56	07:43 (2)	05:57	05:21	05:29	06:09	06:57	07:36 (2)	07:44		07:36	08:22
	16:45	17:36		18:25		20:16	13 07:56 (2)	21:05	21:44	21:48	21:09	20:06	21 07:57 (2)	18:58		16:58	16:28
9	08:35	07:59		07:03		06:54	07:46 (2)	05:55	05:21	05:29	06:10	06:58	07:34 (2)	07:45		07:38	08:23
	16:47	17:38		18:27		20:18	7 07:53 (2)	21:06	21:45	21:48	21:07	20:03	22 07:56 (2)	18:56		16:56	16:28
10	08:34	07:57		07:01		06:52		05:53	05:20	05:30	06:12	07:00		07:35 (2)	07:47		07:40	08:25
	16:48	17:40		18:29		20:20		21:08	21:46	21:47	21:06	20:01	21 07:56 (2)	18:54		16:55	16:28
11	08:34	07:55		06:59		06:50		05:52	05:20	05:31	06:13	07:01		07:34 (2)	07:49		07:41	08:26
	16:49	17:41		18:30		20:21		21:10	21:47	21:46	21:04	19:59	21 07:55 (2)	18:52		16:53	16:27
12	08:33	07:54		06:56		06:48		05:50	05:20	05:32	06:15	07:03		07:34 (2)	07:50		07:43	08:27
	16:51	17:43		18:32		20:23		21:11	21:47	21:45	21:02	19:57	21 07:55 (2)	18:50		16:52	16:27
13	08:32	07:52		06:54		06:45		05:49	05:19	05:34	06:16	07:04		07:34 (2)	07:52		07:45	08:28
	16:52	17:45		18:34		20:25		21:13	21:48	21:44	21:00	19:54	20 07:54 (2)	18:47		16:50	16:27
14	08:32	07:50		06:52		06:43		05:47	05:19	05:35	06:18	07:06		07:35 (2)	07:54		07:47	08:28
	16:54	17:47		18:35		20:26		21:14	21:49	21:44	20:58	19:52	18 07:53 (2)	18:45			16:49	16:27
15	08:31	07:48		06:50		06:41		05:45	05:19	05:36	06:19	07:07		07:35 (2)	07:55	08:33 (1)	07:48	08:29
	16:55	17:49		18:37		20:28		21:16	21:49	21:43	20:56	19:50	16 07:51 (2)	18:43	6	08:39 (1)	16:48	16:27
16	08:30	07:46		06:48		06:39		05:44	05:19	05:37	06:21	07:09		07:38 (2)	07:57	08:30 (1)	07:50	08:30
	16:57	17:50		18:39		20:30		21:17	21:50	21:42	20:54	19:48	11 07:49 (2)	18:41	11	08:41 (1)	16:46	16:28
17	08:29	07:44		06:45		06:37		05:43	05:19	05:38	06:22	07:11		07:42 (2)	07:59	08:29 (1)	07:52	08:31
	16:58	17:52		18:40		20:31		21:18	21:50	21:41	20:52	19:45	1 07:43 (2)	18:39	13	08:42 (1)	16:45	16:28
18	08:28	07:42	08:06 (1)	06:43		06:35		05:41	05:19	05:39	06:24	07:12		08:00		08:29 (1)	07:53	08:32
	17:00	17:54	2 08:08 (1)	18:42		20:33		21:20	21:50	21:40	20:50	19:43		18:37	13	08:42 (1)	16:44	16:28
19	08:28	07:40	08:04 (1)	06:41		06:33		05:40	05:19	05:40	06:25	07:14		08:02		08:29 (1)	07:55	08:32
	17:01	17:56	6 08:10 (1)	18:44		20:34		21:21	21:51	21:39	20:48	19:41		18:35	14	08:43 (1)	16:42	16:28
20	08:27	07:38	08:02 (1)	06:39		06:31		05:39	05:19	05:42	06:27	07:15		08:04		08:29 (1)	07:57	08:33
	17:03	17:57	9 08:11 (1)	18:45		20:36		21:23	21:51	21:37	20:46	19:39		18:33	13	08:42 (1)	16:41	16:29
21	08:26	07:37	08:00 (1)	06:36		06:29		05:37	05:19	05:43	06:29	07:17		08:05		08:31 (1)	07:58	08:34
	17:05	17:59	11 08:11 (1)	18:47		20:38		21:24	21:51	21:36	20:44	19:36		18:31	10	08:41 (1)	16:40	16:29
22	08:24	07:35	07:58 (1)	06:34		06:27		05:36	05:19	05:44	06:30	07:18		08:07		08:33 (1)	08:00	08:34
	17:06	18:01	13 08:11 (1)	18:49		20:39		21:25	21:52	21:35	20:42	19:34		18:29	8	08:41 (1)	16:39	16:30
23	08:23	07:33	07:57 (1)	06:32		06:25		05:35	05:20	05:46	06:32	07:20		08:09		08:35 (1)	08:01	08:35
	17:08	18:03	14 08:11 (1)	18:50		20:41		21:27	21:52	21:34	20:40	19:32		18:27	5	08:40 (1)	16:38	16:30
24	08:22	07:30	07:58 (1)	06:30		06:23		05:34	05:20	05:47	06:33	07:21		08:10			08:03	08:35
	17:10	18:05	13 08:11 (1)	18:52		20:43		21:28	21:52	21:33	20:38	19:30		18:25			16:37	16:31
25	08:21	07:28	07:58 (1)	06:27		06:21		05:32	05:20	05:48	06:35	07:23		07:12			08:04	08:36
	17:11	18:06	12 08:10 (1)	18:54		20:44		21:29	21:52	21:31	20:36	19:27		17:23			16:36	16:31
26	08:20	07:26	07:59 (1)	06:25		06:19		05:31	05:21	05:50	06:36	07:25		07:14			08:06	08:36
	17:13	18:08	9 08:08 (1)	18:55		20:46		21:31	21:52	21:30	20:34	19:25		17:21			16:35	16:32
27	08:18	07:24	08:02 (1)	06:23	06:49 (2)	06:17		05:30	05:21	05:51	06:38	07:26		07:16			08:07	08:36
	17:15	18:10	2 08:04 (1)	18:57	10 06:59 (2)	20:47		21:32	21:52	21:28	20:32	19:23		17:19			16:34	16:33
28	08:17	07:22		06:21	06:46 (2)	06:15		05:29	05:21	05:52	06:39	07:28		07:17			08:09	08:36
	17:17	18:11		18:58	15 07:01 (2)	20:49		21:33	21:52	21:27	20:30	19:20		17:17			16:33	16:33
29	08:16			07:18	07:44 (2)	06:13		05:28	05:22	05:54	06:41	07:29		07:19			08:10	08:37
	17:18			20:00	17 08:01 (2)	20:51		21:34	21:52	21:26	20:28	19:18		17:15			16:33	16:34
30	08:14			07:16	07:43 (2)	06:11		05:27	05:23	05:55	06:43	07:31		07:21			08:12	08:37
	17:20			20:02	19 08:02 (2)	20:52		21:35	21:51	21:24	20:25	19:16		17:13			16:32	16:35
31	08:13			07:14	07:42 (2)			05:27		05:57	06:44			07:22				08:37
	17:22			20:03	21 08:03 (2)			21:37		21:23	20:23			17:12				16:36
Potential sun hours	263	280		367		414		481	493	497	451	380		333		270	249	
Total, worst case			91		82		161						246		93			

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

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

SHADOW - Calendar

Shadow receptor: D - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (29)

Assumptions for shadow calculations

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:11	07:20	07:12	06:09	05:26	05:23	05:58	06:46	07:32	07:24	08:13
	16:37	17:23	18:13	20:05	20:54	21:37	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09	06:07	05:25	05:24	05:59	06:47	07:34	07:26	08:14
	16:38	17:25	18:15	20:06	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:31
3	08:36	08:08	07:16	07:07	06:05	05:24	05:24	06:01	06:49	07:36	07:27	08:16
	16:39	17:27	18:17	20:08	20:57	21:40	21:50	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05	06:03	05:23	05:25	06:02	06:50	07:37	07:29	08:17
	16:40	17:29	18:18	20:10	20:58	21:41	21:50	21:16	20:14	19:07	17:04	16:29
5	08:36	08:05	07:11	07:03	06:02	05:23	05:26	06:04	06:52	07:39	07:31	08:18
	16:42	17:31	18:20	20:11	21:00	21:42	21:50	21:14	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09	07:00	06:00	05:22	05:27	06:05	06:53	07:40	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:42	21:49	21:13	20:10	19:02	17:01	16:29
7	08:35	08:02	07:07	06:58	05:58	05:22	05:28	06:07	06:55	07:42	07:34	08:21
	16:44	17:34	18:23	20:15	21:03	21:43	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:00	07:05	06:56	05:56	05:21	05:28	06:08	06:56	07:44	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:05	18:58	16:58	16:28
9	08:35	07:59	07:03	06:54	05:55	05:21	05:29	06:10	06:58	07:45	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:47	21:07	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01	06:52	05:53	05:20	05:30	06:11	06:59	07:47	07:40	08:24
	16:48	17:39	18:28	20:20	21:08	21:46	21:47	21:05	20:01	18:54	16:55	16:27
11	08:33	07:55	06:58	06:50	05:52	05:20	05:31	06:13	07:01	07:49	07:41	08:25
	16:49	17:41	18:30	20:21	21:09	21:46	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:53	06:56	06:47	05:50	05:20	05:32	06:14	07:03	07:50	07:43	08:26
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:49	16:52	16:27
13	08:32	07:52	06:54	06:45	05:48	05:19	05:33	06:16	07:04	07:52	07:45	08:27
	16:52	17:45	18:33	20:24	21:12	21:48	21:44	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19	05:34	06:18	07:06	07:53	07:46	08:28
	16:54	17:47	18:35	20:26	21:14	21:48	21:43	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19	05:36	06:19	07:07	07:55	07:48	08:29
	16:55	17:48	18:37	20:28	21:15	21:49	21:42	20:56	19:50	18:43	16:47	16:27
16	08:30	07:46	06:47	06:39	05:44	05:19	05:37	06:21	07:09	07:57	07:50	08:30
	16:57	17:50	18:39	20:29	21:17	21:49	21:42	20:54	19:47	18:41	16:46	16:27
17	08:29	07:44	06:45	06:37	05:42	05:19	05:38	06:22	07:10	07:58	07:51	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:28	07:42	06:43	06:35	05:41	05:19	05:39	06:24	07:12	08:00	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:50	21:39	20:50	19:43	18:37	16:44	16:28
19	08:27	07:40	06:41	06:33	05:40	05:19	05:40	06:25	07:13	08:02	07:55	08:32
	17:01	17:56	18:43	20:34	21:21	21:51	21:38	20:48	19:41	18:35	16:42	16:28
20	08:26	07:38	06:38	06:30	05:38	05:19	05:42	06:27	07:15	08:03	07:56	08:33
	17:03	17:57	18:45	20:36	21:22	21:51	21:37	20:46	19:38	18:33	16:41	16:29
21	08:25	07:36	06:36	06:28	05:37	05:19	05:43	06:28	07:17	08:05	07:58	08:33
	17:05	17:59	18:47	20:37	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:34	06:34	06:26	05:36	05:19	05:44	06:30	07:18	08:07	08:00	08:34
	17:06	18:01	18:48	20:39	21:25	21:51	21:35	20:42	19:34	18:29	16:39	16:29
23	08:23	07:32	06:32	06:24	05:35	05:19	05:45	06:31	07:20	08:09	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30	06:29	06:22	05:33	05:20	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:42	21:28	21:52	21:32	20:38	19:29	18:25	16:37	16:31
25	08:21	07:28	06:27	06:20	05:32	05:20	05:48	06:35	07:23	07:12	08:04	08:35
	17:11	18:06	18:53	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26	06:25	06:18	05:31	05:20	05:49	06:36	07:24	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:30	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:18	07:24	06:23	06:16	05:30	05:21	05:51	06:38	07:26	07:15	08:07	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:28	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:20	06:15	05:29	05:21	05:52	06:39	07:28	07:17	08:09	08:36
	17:16	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18	06:13	05:28	05:22	05:54	06:41	07:29	07:19	08:10	08:36
	17:18		20:00	20:50	21:34	21:51	21:25	20:27	19:18	17:15	16:33	16:34
30	08:14		07:16	06:11	05:27	05:22	05:55	06:42	07:31	07:21	08:12	08:36
	17:20		20:02	20:52	21:35	21:51	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14		05:26		05:57	06:44		07:22		08:37
	17:22		20:03		21:36		21:22	20:23		17:11		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Total, worst case												

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

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

SHADOW - Calendar

Shadow receptor: E - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (30)

Assumptions for shadow calculations

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

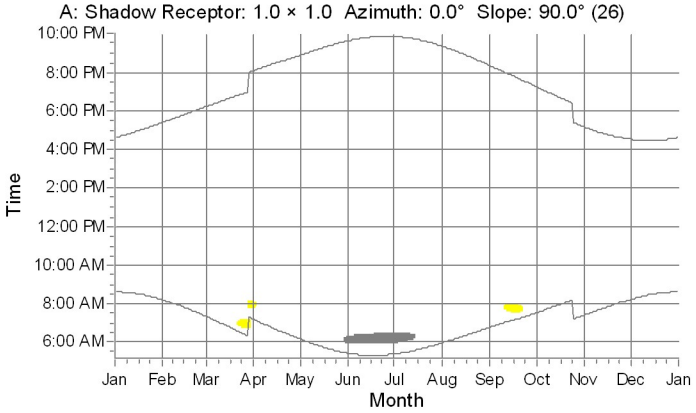
	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:11	07:20	07:12	06:09	05:26	05:23	05:58	06:45	07:32	07:24	08:13
	16:37	17:23	18:13	20:05	20:54	21:37	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09	06:07	05:25	05:24	05:59	06:47	07:34	07:26	08:14
	16:38	17:25	18:15	20:06	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:30
3	08:36	08:08	07:16	07:07	06:05	05:24	05:24	06:01	06:49	07:36	07:27	08:16
	16:39	17:27	18:16	20:08	20:57	21:40	21:50	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05	06:03	05:23	05:25	06:02	06:50	07:37	07:29	08:17
	16:40	17:29	18:18	20:10	20:58	21:41	21:50	21:16	20:14	19:07	17:04	16:29
5	08:36	08:05	07:11	07:03	06:02	05:23	05:26	06:04	06:52	07:39	07:31	08:18
	16:42	17:30	18:20	20:11	21:00	21:42	21:50	21:14	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09	07:00	06:00	05:22	05:27	06:05	06:53	07:40	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:42	21:49	21:13	20:10	19:02	17:01	16:29
7	08:35	08:02	07:07	06:58	05:58	05:22	05:27	06:07	06:55	07:42	07:34	08:21
	16:44	17:34	18:23	20:15	21:03	21:43	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:00	07:05	06:56	05:56	05:21	05:28	06:08	06:56	07:44	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:05	18:58	16:58	16:28
9	08:35	07:59	07:03	06:54	05:55	05:21	05:29	06:10	06:58	07:45	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:47	21:07	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01	06:52	05:53	05:20	05:30	06:11	06:59	07:47	07:40	08:24
	16:48	17:39	18:28	20:20	21:08	21:46	21:47	21:06	20:01	18:54	16:55	16:27
11	08:34	07:55	06:58	06:50	05:51	05:20	05:31	06:13	07:01	07:49	07:41	08:25
	16:49	17:41	18:30	20:21	21:09	21:47	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:53	06:56	06:47	05:50	05:19	05:32	06:14	07:03	07:50	07:43	08:26
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:49	16:52	16:27
13	08:32	07:52	06:54	06:45	05:48	05:19	05:33	06:16	07:04	07:52	07:45	08:27
	16:52	17:45	18:33	20:24	21:12	21:48	21:44	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19	05:34	06:18	07:06	07:53	07:46	08:28
	16:54	17:47	18:35	20:26	21:14	21:48	21:43	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19	05:36	06:19	07:07	07:55	07:48	08:29
	16:55	17:48	18:37	20:28	21:15	21:49	21:43	20:56	19:50	18:43	16:47	16:27
16	08:30	07:46	06:47	06:39	05:44	05:19	05:37	06:21	07:09	07:57	07:50	08:30
	16:57	17:50	18:39	20:29	21:17	21:49	21:42	20:54	19:47	18:41	16:46	16:27
17	08:29	07:44	06:45	06:37	05:42	05:19	05:38	06:22	07:10	07:58	07:51	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:28	07:42	06:43	06:35	05:41	05:19	05:39	06:24	07:12	08:00	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:50	21:40	20:50	19:43	18:37	16:43	16:28
19	08:27	07:40	06:41	06:33	05:40	05:19	05:40	06:25	07:13	08:02	07:55	08:32
	17:01	17:56	18:43	20:34	21:21	21:51	21:38	20:48	19:41	18:35	16:42	16:28
20	08:26	07:38	06:38	06:30	05:38	05:19	05:41	06:27	07:15	08:03	07:56	08:33
	17:03	17:57	18:45	20:36	21:23	21:51	21:37	20:46	19:38	18:33	16:41	16:28
21	08:25	07:36	06:36	06:28	05:37	05:19	05:43	06:28	07:17	08:05	07:58	08:34
	17:05	17:59	18:47	20:37	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:34	06:34	06:26	05:36	05:19	05:44	06:30	07:18	08:07	08:00	08:34
	17:06	18:01	18:48	20:39	21:25	21:51	21:35	20:42	19:34	18:29	16:39	16:29
23	08:23	07:32	06:32	06:24	05:35	05:19	05:45	06:31	07:20	08:09	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30	06:29	06:22	05:33	05:20	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:42	21:28	21:52	21:32	20:38	19:29	18:25	16:37	16:30
25	08:21	07:28	06:27	06:20	05:32	05:20	05:48	06:35	07:23	07:12	08:04	08:35
	17:11	18:06	18:53	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26	06:25	06:18	05:31	05:20	05:49	06:36	07:24	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:30	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:18	07:24	06:23	06:16	05:30	05:21	05:51	06:38	07:26	07:15	08:07	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:28	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:20	06:15	05:29	05:21	05:52	06:39	07:28	07:17	08:09	08:36
	17:16	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18	06:13	05:28	05:22	05:54	06:41	07:29	07:19	08:10	08:36
	17:18		20:00	20:50	21:34	21:52	21:25	20:27	19:18	17:15	16:32	16:34
30	08:14		07:16	06:11	05:27	05:22	05:55	06:42	07:31	07:21	08:12	08:37
	17:20		20:02	20:52	21:35	21:51	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14		05:26		05:56	06:44		07:22		08:37
	17:22		20:03		21:36		21:22	20:23		17:11		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Total, worst case												

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

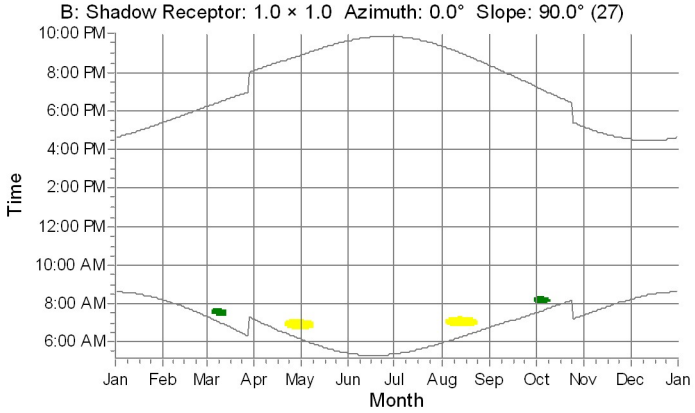
Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

SHADOW - Calendar, graphical

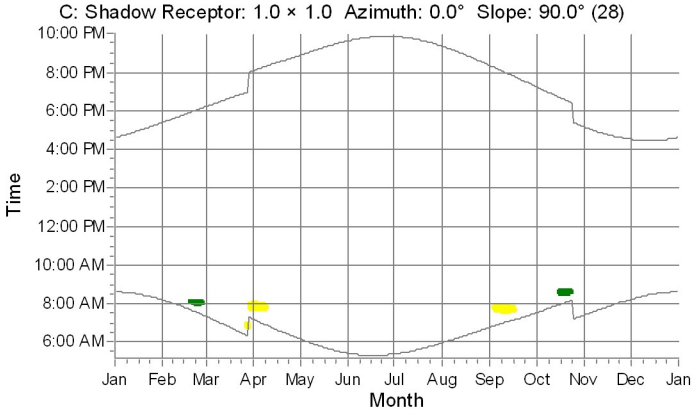
A: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (26)



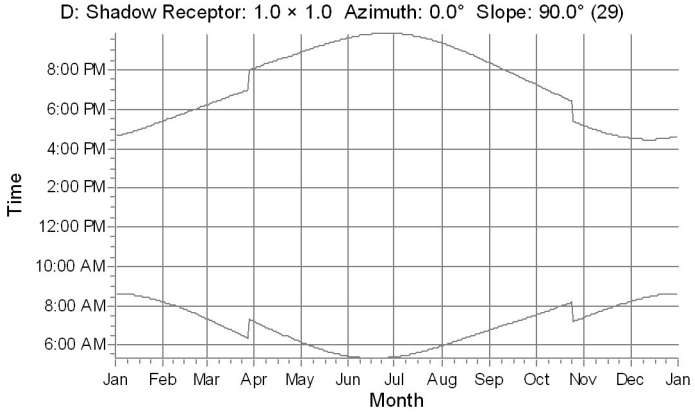
B: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (27)



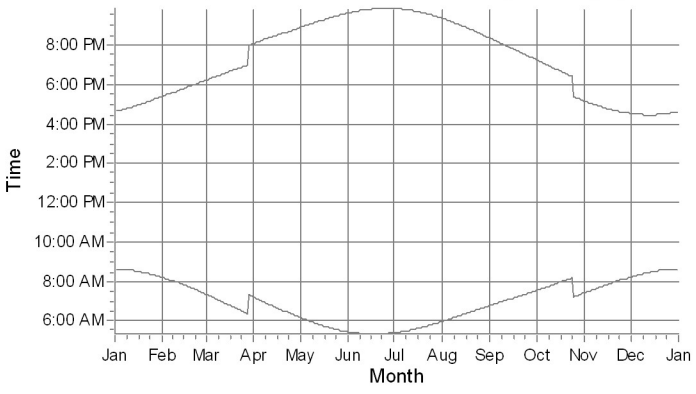
C: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (28)



D: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (29)



E: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (30)



WTGs

1: ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)

2: ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)

4: ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)

SHADOW - Calendar per WTG

WTG: 1 - ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (10)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:11	07:20	07:12	06:09	05:26	05:23	05:58	06:46	07:32 08:06-08:17/11	07:24	08:13
	16:37	17:23	18:13	20:05	20:54	21:38	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09	06:07	05:25	05:24	06:00	06:47	07:34 08:05-08:18/13	07:26	08:15
	16:38	17:25	18:15	20:07	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:31
3	08:36	08:08	07:16	07:07	06:05	05:24	05:24	06:01	06:49	07:36 08:03-08:18/15	07:28	08:16
	16:39	17:27	18:17	20:08	20:57	21:40	21:51	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05	06:03	05:23	05:25	06:02	06:50	07:37 08:03-08:18/15	07:29	08:17
	16:41	17:29	18:18	20:10	20:58	21:41	21:50	21:16	20:14	19:07	17:04	16:30
5	08:36	08:05	07:12 07:34-07:38/4	07:03	06:02	05:23	05:26	06:04	06:52	07:39 08:04-08:18/14	07:31	08:19
	16:42	17:31	18:20	20:11	21:00	21:42	21:50	21:14	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09 07:32-07:40/8	07:01	06:00	05:22	05:27	06:05	06:53	07:41 08:05-08:17/12	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:43	21:49	21:13	20:10	19:03	17:01	16:29
7	08:35	08:02	07:07 07:30-07:41/11	06:58	05:58	05:22	05:28	06:07	06:55	07:42 08:07-08:16/9	07:34	08:21
	16:44	17:34	18:23	20:15	21:03	21:43	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:00	07:05 07:28-07:41/13	06:56	05:57	05:21	05:29	06:08	06:56	07:44 08:09-08:15/6	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:06	18:58	16:58	16:28
9	08:35	07:59	07:03 07:25-07:40/15	06:54	05:55	05:21	05:29	06:10	06:58	07:45 08:10-08:12/2	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:47	21:07	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01 07:25-07:40/15	06:52	05:53	05:20	05:30	06:12	07:00	07:47	07:40	08:24
	16:48	17:40	18:29	20:20	21:08	21:46	21:47	21:06	20:01	18:54	16:55	16:28
11	08:34	07:55	06:59 07:26-07:39/13	06:50	05:52	05:20	05:31	06:13	07:01	07:49	07:41	08:25
	16:49	17:41	18:30	20:21	21:09	21:47	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:53	06:56 07:26-07:38/12	06:47	05:50	05:20	05:32	06:15	07:03	07:50	07:43	08:26
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:49	16:52	16:27
13	08:32	07:52	06:54 07:28-07:37/9	06:45	05:48	05:19	05:33	06:16	07:04	07:52	07:45	08:27
	16:52	17:45	18:34	20:25	21:12	21:48	21:44	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19	05:35	06:18	07:06	07:54	07:46	08:28
	16:54	17:47	18:35	20:26	21:14	21:48	21:44	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19	05:36	06:19	07:07	07:55 08:33-08:39/6	07:48	08:29
	16:55	17:49	18:37	20:28	21:15	21:49	21:43	20:56	19:50	18:43	16:48	16:27
16	08:30	07:46	06:47	06:39	05:44	05:19	05:37	06:21	07:09	07:57 08:30-08:41/11	07:50	08:30
	16:57	17:50	18:39	20:29	21:17	21:50	21:42	20:54	19:48	18:41	16:46	16:28
17	08:29	07:44	06:45	06:37	05:43	05:19	05:38	06:22	07:10	07:59 08:29-08:42/13	07:51	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:28	07:42 08:06-08:08/2	06:43	06:35	05:41	05:19	05:39	06:24	07:12	08:00 08:29-08:42/13	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:50	21:40	20:50	19:43	18:37	16:44	16:28
19	08:27	07:40 08:04-08:10/6	06:41	06:33	05:40	05:19	05:40	06:25	07:14	08:02 08:29-08:43/14	07:55	08:32
	17:01	17:56	18:44	20:34	21:21	21:51	21:38	20:48	19:41	18:35	16:42	16:28
20	08:26	07:38 08:02-08:11/9	06:38	06:31	05:38	05:19	05:42	06:27	07:15	08:04 08:29-08:42/13	07:56	08:33
	17:03	17:57	18:45	20:36	21:23	21:51	21:37	20:46	19:38	18:33	16:41	16:29
21	08:25	07:36 08:00-08:11/11	06:36	06:29	05:37	05:19	05:43	06:28	07:17	08:05 08:31-08:41/10	07:58	08:34
	17:05	17:59	18:47	20:38	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:34 07:58-08:11/13	06:34	06:26	05:36	05:19	05:44	06:30	07:18	08:07 08:33-08:41/8	08:00	08:34
	17:06	18:01	18:49	20:39	21:25	21:52	21:35	20:42	19:34	18:29	16:39	16:29
23	08:23	07:32 07:57-08:11/14	06:32	06:24	05:35	05:20	05:45	06:32	07:20	08:09 08:35-08:40/5	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30 07:58-08:11/13	06:30	06:22	05:34	05:20	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:42	21:28	21:52	21:32	20:38	19:29	18:25	16:37	16:31
25	08:21	07:28 07:58-08:10/12	06:27	06:20	05:32	05:20	05:48	06:35	07:23	07:12	08:04	08:35
	17:11	18:06	18:53	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26 07:59-08:08/9	06:25	06:19	05:31	05:21	05:50	06:36	07:25	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:31	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:18	07:24 08:02-08:04/2	06:23	06:17	05:30	05:21	05:51	06:38	07:26	07:15	08:07	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:28	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:21	06:15	05:29	05:21	05:52	06:39	07:28	07:17	08:09	08:36
	17:16	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18	06:13	05:28	05:22	05:54	06:41	07:29	07:19	08:10	08:36
	17:18		20:00	20:51	21:34	21:52	21:25	20:28	19:18	17:15	16:33	16:34
30	08:14		07:16	06:11	05:27	05:22	05:55	06:42	07:31 08:08-08:14/6	07:21	08:12	08:37
	17:20		20:02	20:52	21:35	21:51	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14		05:26		05:57	06:44		07:22		08:37
	17:22		20:03		21:36		21:22	20:23		17:11		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Sum of minutes with flicker	0	91	100	0	0	0	0	0	6	190	0	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

WTG: 2 - ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (11)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:12	07:20	07:12 07:42-08:03/21	06:09 06:44-07:07/23	05:26	05:23	05:58	06:46	07:33	07:24	08:13
	16:37	17:24	18:13	20:05	20:54	21:38	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09 07:41-08:03/22	06:07 06:44-07:06/22	05:25	05:24	06:00	06:47	07:34	07:26	08:15
	16:38	17:25	18:15	20:07	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:31
3	08:37	08:08	07:16	07:07 07:40-08:02/22	06:05 06:44-07:05/21	05:24	05:24	06:01	06:49 07:44-07:51/7	07:36	07:28	08:16
	16:39	17:27	18:17	20:08	20:57	21:40	21:51	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05 07:40-08:02/22	06:03 06:46-07:05/19	05:23	05:25	06:02 07:02-07:07/5	06:50 07:41-07:54/13	07:37	07:29	08:17
	16:41	17:29	18:18	20:10	20:59	21:41	21:50	21:16	20:14	19:07	17:04	16:30
5	08:36	08:05	07:12	07:03 07:41-08:01/20	06:02 06:46-07:04/18	05:23	05:26	06:04 07:00-07:10/10	06:52 07:39-07:55/16	07:39	07:31	08:19
	16:42	17:31	18:20	20:12	21:00	21:42	21:50	21:14	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09	07:01 07:42-08:00/18	06:00 06:47-07:02/15	05:22	05:27	06:05 06:57-07:12/15	06:53 07:38-07:56/18	07:41	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:43	21:49	21:13	20:10	19:03	17:01	16:29
7	08:36	08:02	07:07	06:58 07:43-07:59/16	05:58 06:48-07:02/14	05:22	05:28	06:07 06:56-07:12/16	06:55 07:36-07:56/20	07:42	07:34	08:21
	16:44	17:34	18:23	20:15	21:03	21:43	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:00	07:05	06:56 07:43-07:56/13	05:57 06:50-06:59/9	05:21	05:29	06:08 06:55-07:14/19	06:56 07:36-07:57/21	07:44	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:06	18:58	16:58	16:28
9	08:35	07:59	07:03	06:54 07:46-07:53/7	05:55	05:21	05:29	06:10 06:54-07:14/20	06:58 07:34-07:56/22	07:45	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:47	21:07	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01	06:52	05:53	05:20	05:30	06:12 06:54-07:15/21	07:00 07:35-07:56/21	07:47	07:40	08:24
	16:48	17:40	18:29	20:20	21:08	21:46	21:47	21:06	20:01	18:54	16:55	16:28
11	08:34	07:55	06:59	06:50	05:52	05:20	05:31	06:13 06:53-07:15/22	07:01 07:34-07:55/21	07:49	07:41	08:26
	16:49	17:41	18:30	20:21	21:09	21:47	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:53	06:56	06:47	05:50	05:20	05:32	06:15 06:53-07:16/23	07:03 07:34-07:55/21	07:50	07:43	08:27
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:49	16:52	16:27
13	08:32	07:52	06:54	06:45	05:48	05:19	05:33	06:16 06:52-07:15/23	07:04 07:34-07:55/21	07:52	07:45	08:28
	16:52	17:45	18:34	20:25	21:12	21:48	21:44	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19	05:35	06:18 06:53-07:15/22	07:06 07:35-07:56/21	07:54	07:46	08:28
	16:54	17:47	18:35	20:26	21:14	21:49	21:44	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19	05:36	06:19 06:52-07:15/23	07:07 07:35-07:55/20	07:55	07:48	08:29
	16:55	17:49	18:37	20:28	21:15	21:49	21:43	20:56	19:50	18:43	16:48	16:27
16	08:30	07:46	06:47	06:39	05:44	05:19	05:37	06:21 06:52-07:14/22	07:09 07:38-07:56/18	07:57	07:50	08:30
	16:57	17:50	18:39	20:29	21:17	21:50	21:42	20:54	19:48	18:41	16:46	16:28
17	08:29	07:44	06:45	06:37	05:43	05:19	05:38	06:22 06:53-07:14/21	07:10 07:38-07:55/17	07:59	07:52	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:28	07:42	06:43	06:35	05:41	05:19	05:39	06:24 06:53-07:12/19	07:12 07:39-07:54/15	08:00	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:50	21:40	20:50	19:43	18:37	16:44	16:28
19	08:27	07:40	06:41	06:33	05:40	05:19	05:40	06:25 06:54-07:11/17	07:14 07:39-07:52/13	08:02	07:55	08:32
	17:01	17:56	18:44	20:34	21:21	21:51	21:39	20:48	19:41	18:35	16:42	16:28
20	08:27	07:38	06:39	06:31	05:38	05:19	05:42	06:27 06:54-07:09/15	07:15 07:40-07:51/11	08:04	07:56	08:33
	17:03	17:57	18:45	20:36	21:23	21:51	21:37	20:46	19:39	18:33	16:41	16:29
21	08:25	07:36	06:36	06:29 06:54-07:00/6	05:37	05:19	05:43	06:28 06:57-07:08/11	07:17 07:42-07:48/6	08:05	07:58	08:34
	17:05	17:59	18:47	20:38	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:34	06:34 06:57-07:01/4	06:27 06:52-07:04/12	05:36	05:19	05:44	06:30 07:00-07:03/3	07:18	08:07	08:00	08:34
	17:06	18:01	18:49	20:39	21:25	21:52	21:35	20:42	19:34	18:29	16:39	16:29
23	08:23	07:32	06:32 06:54-07:04/10	06:24 06:49-07:05/16	05:35	05:20	05:45	06:32	07:20	08:09	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30	06:30 06:53-07:06/13	06:22 06:48-07:06/18	05:34	05:20	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:42	21:28	21:52	21:32	20:38	19:29	18:25	16:37	16:31
25	08:21	07:28	06:27 06:51-07:06/15	06:20 06:47-07:07/20	05:32	05:20	05:48	06:35	07:23	07:12	08:04	08:36
	17:11	18:06	18:53	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26	06:25 06:50-07:06/16	06:19 06:46-07:07/21	05:31	05:21	05:50	06:36	07:25	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:31	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:18	07:24	06:23 06:49-07:06/17	06:17 06:45-07:07/22	05:30	05:21	05:51	06:38	07:26	07:16	08:07	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:28	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:21 06:46-07:06/20	06:15 06:44-07:07/23	05:29	05:21	05:52	06:39	07:28	07:17	08:09	08:36
	17:16	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18 07:44-08:05/21	06:13 06:44-07:07/23	05:28	05:22	05:54	06:41	07:29	07:19	08:10	08:37
	17:18		20:00	20:51	21:34	21:52	21:26	20:28	19:18	17:15	16:33	16:34
30	08:14		07:16 07:43-08:03/20	06:11 06:45-07:07/22	05:27	05:22	05:55	06:42	07:31	07:21	08:12	08:37
	17:20		20:02	20:52	21:35	21:51	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14 07:42-08:03/21		05:26		05:57	06:44		07:22		08:37
	17:22		20:03		21:37		21:23	20:23		17:12		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Sum of minutes with flicker	0	0	157	344	141	0	0	327	322	0	0	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

WTG: 3 - ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (12)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:12	07:20	07:12	06:09	05:26	05:23	05:58	06:46	07:33	07:24	08:13
	16:37	17:24	18:13	20:05	20:54	21:38	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09	06:07	05:25	05:24	06:00	06:47	07:34	07:26	08:15
	16:38	17:25	18:15	20:07	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:31
3	08:37	08:09	07:16	07:07	06:05	05:24	05:24	06:01	06:49	07:36	07:28	08:16
	16:39	17:27	18:17	20:08	20:57	21:40	21:51	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05	06:04	05:23	05:25	06:02	06:50	07:37	07:29	08:17
	16:41	17:29	18:18	20:10	20:59	21:41	21:50	21:16	20:15	19:07	17:04	16:30
5	08:36	08:05	07:12	07:03	06:02	05:23	05:26	06:04	06:52	07:39	07:31	08:19
	16:42	17:31	18:20	20:12	21:00	21:42	21:50	21:15	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09	07:01	06:00	05:22	05:27	06:05	06:53	07:41	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:43	21:49	21:13	20:10	19:03	17:01	16:29
7	08:36	08:02	07:07	06:58	05:58	05:22	05:28	06:07	06:55	07:42	07:35	08:21
	16:44	17:34	18:24	20:15	21:03	21:44	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:01	07:05	06:56	05:57	05:21	05:29	06:09	06:57	07:44	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:06	18:58	16:58	16:28
9	08:35	07:59	07:03	06:54	05:55	05:21	05:29	06:10	06:58	07:45	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:48	21:08	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01	06:52	05:53	05:20	05:30	06:12	07:00	07:47	07:40	08:25
	16:48	17:40	18:29	20:20	21:08	21:46	21:47	21:06	20:01	18:54	16:55	16:28
11	08:34	07:55	06:59	06:50	05:52	05:20	05:31	06:13	07:01	07:49	07:41	08:26
	16:49	17:41	18:30	20:21	21:10	21:47	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:54	06:56	06:48	05:50	05:20	05:32	06:15	07:03	07:50	07:43	08:27
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:50	16:52	16:27
13	08:33	07:52	06:54	06:45	05:48	05:19	05:33	06:16	07:04	07:52	07:45	08:28
	16:52	17:45	18:34	20:25	21:13	21:48	21:45	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19	05:35	06:18	07:06	07:54	07:47	08:29
	16:54	17:47	18:35	20:26	21:14	21:49	21:44	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19	05:36	06:19	07:07	07:55	07:48	08:29
	16:55	17:49	18:37	20:28	21:16	21:49	21:43	20:56	19:50	18:43	16:48	16:27
16	08:30	07:46	06:48	06:39	05:44	05:19	05:37	06:21	07:09	07:57	07:50	08:30
	16:57	17:50	18:39	20:30	21:17	21:50	21:42	20:54	19:48	18:41	16:46	16:28
17	08:29	07:44	06:45	06:37	05:43	05:19	05:38	06:22	07:11	07:59	07:52	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:29	07:42	06:43	06:35	05:41	05:19	05:39	06:24	07:12	08:00	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:51	21:40	20:50	19:43	18:37	16:44	16:28
19	08:28	07:40	06:41	06:33	05:40	05:19	05:40	06:25	07:14	08:02	07:55	08:33
	17:01	17:56	18:44	20:34	21:21	21:51	21:39	20:48	19:41	18:35	16:42	16:28
20	08:27	07:38	06:39	06:31	05:38	05:19	05:42	06:27	07:15	08:04	07:57	08:33
	17:03	17:57	18:45	20:36	21:23	21:51	21:38	20:46	19:39	18:33	16:41	16:29
21	08:26	07:37	06:36	06:29	05:37	05:19	05:43	06:29	07:17	08:05	07:58	08:34
	17:05	17:59	18:47	20:38	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:35	06:34	06:27	05:36	05:19	05:44	06:30	07:18	08:07	08:00	08:34
	17:06	18:01	18:49	20:39	21:25	21:52	21:35	20:42	19:34	18:29	16:39	16:30
23	08:23	07:33	06:32	06:25	05:35	05:20	05:46	06:32	07:20	08:09	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30	06:30	06:23	05:34	05:20	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:43	21:28	21:52	21:33	20:38	19:30	18:25	16:37	16:31
25	08:21	07:28	06:27	06:21	05:32	05:20	05:48	06:35	07:23	07:12	08:04	08:36
	17:11	18:06	18:54	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26	06:25	06:19	05:31	05:21	05:50	06:36	07:25	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:31	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:19	07:24	06:23	06:17	05:30	05:21	05:51	06:38	07:26	07:16	08:08	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:29	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:21	06:15	05:29	05:21	05:52	06:39	07:28	07:17	08:09	08:36
	17:17	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18	06:13	05:28	05:22	05:54	06:41	07:29	07:19	08:10	08:37
	17:18		20:00	20:51	21:34	21:52	21:26	20:28	19:18	17:15	16:33	16:34
30	08:14		07:16	06:11	05:27	05:22	05:55	06:43	07:31	07:21	08:12	08:37
	17:20		20:02	20:52	21:35	21:52	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14		05:27		05:57	06:44		07:22		08:37
	17:22		20:03		21:37		21:23	20:23		17:12		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	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

WTG: 4 - ENERCON E-101 3050 101.0 !-! hub: 99.0 m (TOT: 149.5 m) (13)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

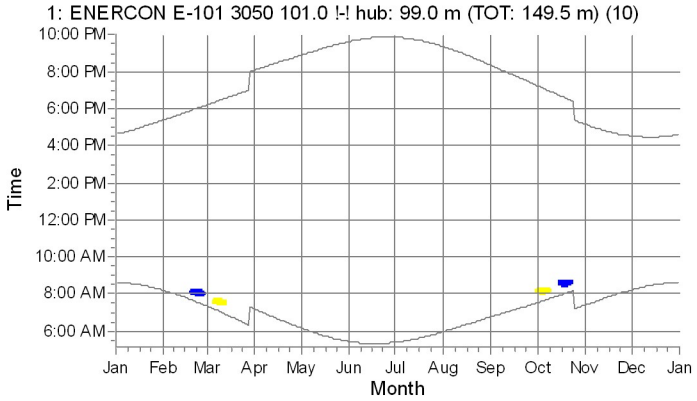
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

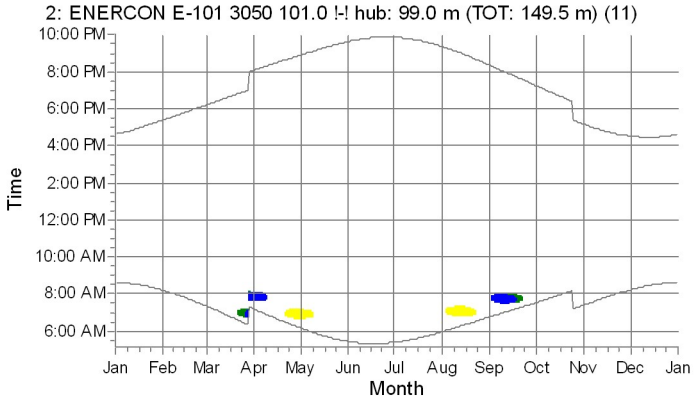
	January	February	March	April	May	June	July	August	September	October	November	December
1	08:37	08:12	07:20	07:12	06:09	05:26 06:03-06:14/11	05:23 06:04-06:26/22	05:58	06:46	07:33	07:24	08:13
	16:37	17:24	18:13	20:05	20:54	21:38	21:51	21:21	20:21	19:14	17:10	16:31
2	08:37	08:10	07:18	07:09	06:07	05:25 06:03-06:16/13	05:24 06:04-06:25/21	06:00	06:47	07:34	07:26	08:15
	16:38	17:25	18:15	20:07	20:55	21:39	21:51	21:19	20:19	19:11	17:08	16:31
3	08:37	08:09	07:16	07:07	06:05	05:24 06:02-06:17/15	05:24 06:05-06:25/20	06:01	06:49	07:36	07:28	08:16
	16:39	17:27	18:17	20:08	20:57	21:40	21:51	21:18	20:17	19:09	17:06	16:30
4	08:36	08:07	07:14	07:05	06:04	05:23 06:02-06:18/16	05:25 06:06-06:26/20	06:02	06:50	07:37	07:29	08:17
	16:41	17:29	18:18	20:10	20:59	21:41	21:50	21:16	20:15	19:07	17:04	16:30
5	08:36	08:05	07:12	07:03	06:02	05:23 06:01-06:18/17	05:26 06:06-06:26/20	06:04	06:52	07:39	07:31	08:19
	16:42	17:31	18:20	20:12	21:00	21:42	21:50	21:14	20:12	19:05	17:03	16:29
6	08:36	08:04	07:09	07:01	06:00	05:22 06:01-06:19/18	05:27 06:06-06:25/19	06:05	06:53	07:41	07:33	08:20
	16:43	17:32	18:22	20:13	21:02	21:43	21:49	21:13	20:10	19:03	17:01	16:29
7	08:36	08:02	07:07	06:58	05:58	05:22 06:00-06:19/19	05:28 06:07-06:25/18	06:07	06:55	07:42	07:35	08:21
	16:44	17:34	18:23	20:15	21:03	21:44	21:49	21:11	20:08	19:00	16:59	16:28
8	08:35	08:00	07:05	06:56	05:57	05:21 06:00-06:20/20	05:29 06:08-06:25/17	06:08	06:57	07:44	07:36	08:22
	16:45	17:36	18:25	20:16	21:05	21:44	21:48	21:09	20:06	18:58	16:58	16:28
9	08:35	07:59	07:03	06:54	05:55	05:21 06:00-06:20/20	05:29 06:09-06:24/15	06:10	06:58	07:45	07:38	08:23
	16:47	17:38	18:27	20:18	21:06	21:45	21:48	21:07	20:03	18:56	16:56	16:28
10	08:34	07:57	07:01	06:52	05:53	05:20 06:00-06:21/21	05:30 06:10-06:24/14	06:12	07:00	07:47	07:40	08:25
	16:48	17:40	18:29	20:20	21:08	21:46	21:47	21:06	20:01	18:54	16:55	16:28
11	08:34	07:55	06:59	06:50	05:52	05:20 06:00-06:22/22	05:31 06:11-06:23/12	06:13	07:01	07:49	07:41	08:26
	16:49	17:41	18:30	20:21	21:10	21:47	21:46	21:04	19:59	18:52	16:53	16:27
12	08:33	07:54	06:56	06:47	05:50	05:20 06:00-06:22/22	05:32 06:12-06:22/10	06:15	07:03	07:50	07:43	08:27
	16:51	17:43	18:32	20:23	21:11	21:47	21:45	21:02	19:57	18:50	16:52	16:27
13	08:32	07:52	06:54	06:45	05:48	05:19 06:00-06:22/22	05:33 06:14-06:21/7	06:16	07:04	07:52	07:45	08:28
	16:52	17:45	18:34	20:25	21:13	21:48	21:44	21:00	19:54	18:47	16:50	16:27
14	08:32	07:50	06:52	06:43	05:47	05:19 06:00-06:22/22	05:35	06:18	07:06	07:54	07:47	08:28
	16:54	17:47	18:35	20:26	21:14	21:49	21:44	20:58	19:52	18:45	16:49	16:27
15	08:31	07:48	06:50	06:41	05:45	05:19 06:00-06:23/23	05:36	06:19	07:07	07:55	07:48	08:29
	16:55	17:49	18:37	20:28	21:16	21:49	21:43	20:56	19:50	18:43	16:48	16:27
16	08:30	07:46	06:47	06:39	05:44	05:19 06:00-06:23/23	05:37	06:21	07:09	07:57	07:50	08:30
	16:57	17:50	18:39	20:30	21:17	21:50	21:42	20:54	19:48	18:41	16:46	16:28
17	08:29	07:44	06:45	06:37	05:43	05:19 06:00-06:23/23	05:38	06:22	07:11	07:59	07:52	08:31
	16:58	17:52	18:40	20:31	21:18	21:50	21:41	20:52	19:45	18:39	16:45	16:28
18	08:28	07:42	06:43	06:35	05:41	05:19 06:00-06:23/23	05:39	06:24	07:12	08:00	07:53	08:32
	17:00	17:54	18:42	20:33	21:20	21:50	21:40	20:50	19:43	18:37	16:44	16:28
19	08:28	07:40	06:41	06:33	05:40	05:19 06:00-06:24/24	05:40	06:25	07:14	08:02	07:55	08:32
	17:01	17:56	18:44	20:34	21:21	21:51	21:39	20:48	19:41	18:35	16:42	16:28
20	08:27	07:38	06:39	06:31	05:38	05:19 06:01-06:24/23	05:42	06:27	07:15	08:04	07:56	08:33
	17:03	17:57	18:45	20:36	21:23	21:51	21:37	20:46	19:39	18:33	16:41	16:29
21	08:26	07:36	06:36	06:29	05:37	05:19 06:02-06:25/23	05:43	06:29	07:17	08:05	07:58	08:34
	17:05	17:59	18:47	20:38	21:24	21:51	21:36	20:44	19:36	18:31	16:40	16:29
22	08:24	07:34	06:34	06:27	05:36	05:19 06:02-06:25/23	05:44	06:30	07:18	08:07	08:00	08:34
	17:06	18:01	18:49	20:39	21:25	21:52	21:35	20:42	19:34	18:29	16:39	16:30
23	08:23	07:32	06:32	06:25	05:35	05:20 06:01-06:25/24	05:45	06:32	07:20	08:09	08:01	08:35
	17:08	18:03	18:50	20:41	21:27	21:52	21:34	20:40	19:32	18:27	16:38	16:30
24	08:22	07:30	06:30	06:22	05:34	05:20 06:01-06:24/23	05:47	06:33	07:21	08:10	08:03	08:35
	17:10	18:04	18:52	20:43	21:28	21:52	21:33	20:38	19:29	18:25	16:37	16:31
25	08:21	07:28	06:27	06:21	05:32	05:20 06:02-06:25/23	05:48	06:35	07:23	07:12	08:04	08:36
	17:11	18:06	18:54	20:44	21:29	21:52	21:31	20:36	19:27	17:23	16:36	16:31
26	08:20	07:26	06:25	06:19	05:31	05:21 06:02-06:25/23	05:50	06:36	07:25	07:14	08:06	08:36
	17:13	18:08	18:55	20:46	21:31	21:52	21:30	20:34	19:25	17:21	16:35	16:32
27	08:18	07:24	06:23	06:17	05:30	05:21 06:03-06:26/23	05:51	06:38	07:26	07:16	08:07	08:36
	17:15	18:10	18:57	20:47	21:32	21:52	21:28	20:32	19:23	17:19	16:34	16:33
28	08:17	07:22	06:21	06:15	05:29	05:21 06:03-06:25/22	05:52	06:39	07:28	07:17	08:09	08:36
	17:17	18:11	18:58	20:49	21:33	21:52	21:27	20:30	19:20	17:17	16:33	16:33
29	08:16		07:18	06:13	05:28	05:22 06:04-06:26/22	05:54	06:41	07:29	07:19	08:10	08:37
	17:18		20:00	20:51	21:34	21:52	21:26	20:28	19:18	17:15	16:33	16:34
30	08:14		07:16	06:11	05:27 06:07-06:11/4	05:22 06:03-06:25/22	05:55	06:43	07:31	07:21	08:12	08:37
	17:20		20:02	20:52	21:35	21:51	21:24	20:25	19:16	17:13	16:32	16:35
31	08:13		07:14		05:27 06:04-06:13/9		05:57	06:44		07:22		08:37
	17:22		20:03		21:37		21:23	20:23		17:12		16:36
Potential sun hours	263	280	367	414	481	493	497	451	380	333	270	249
Sum of minutes with flicker	0	0	0	0	13	625	215	0	0	0	0	0

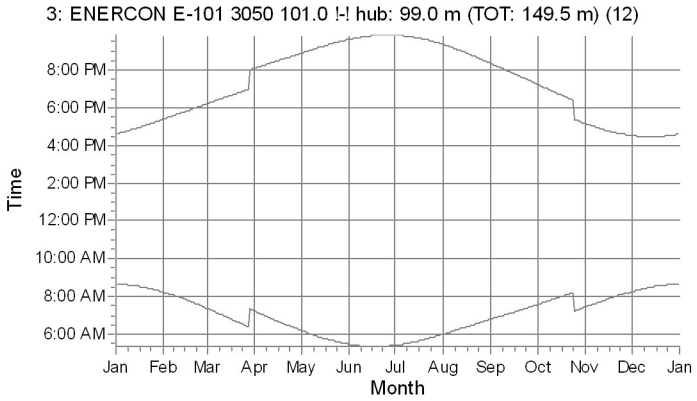
Table layout: For each day in each month the following matrix apply

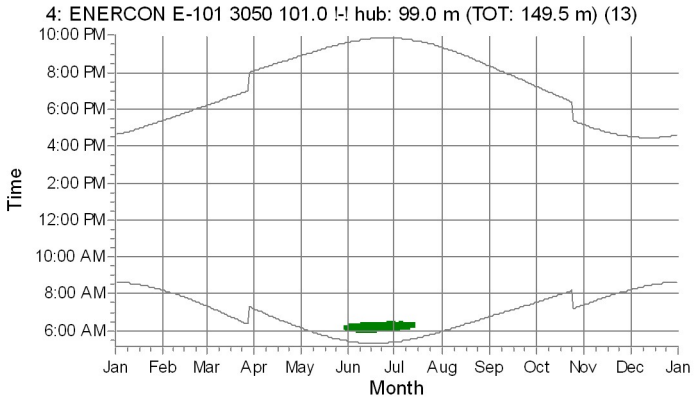
Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG, graphical





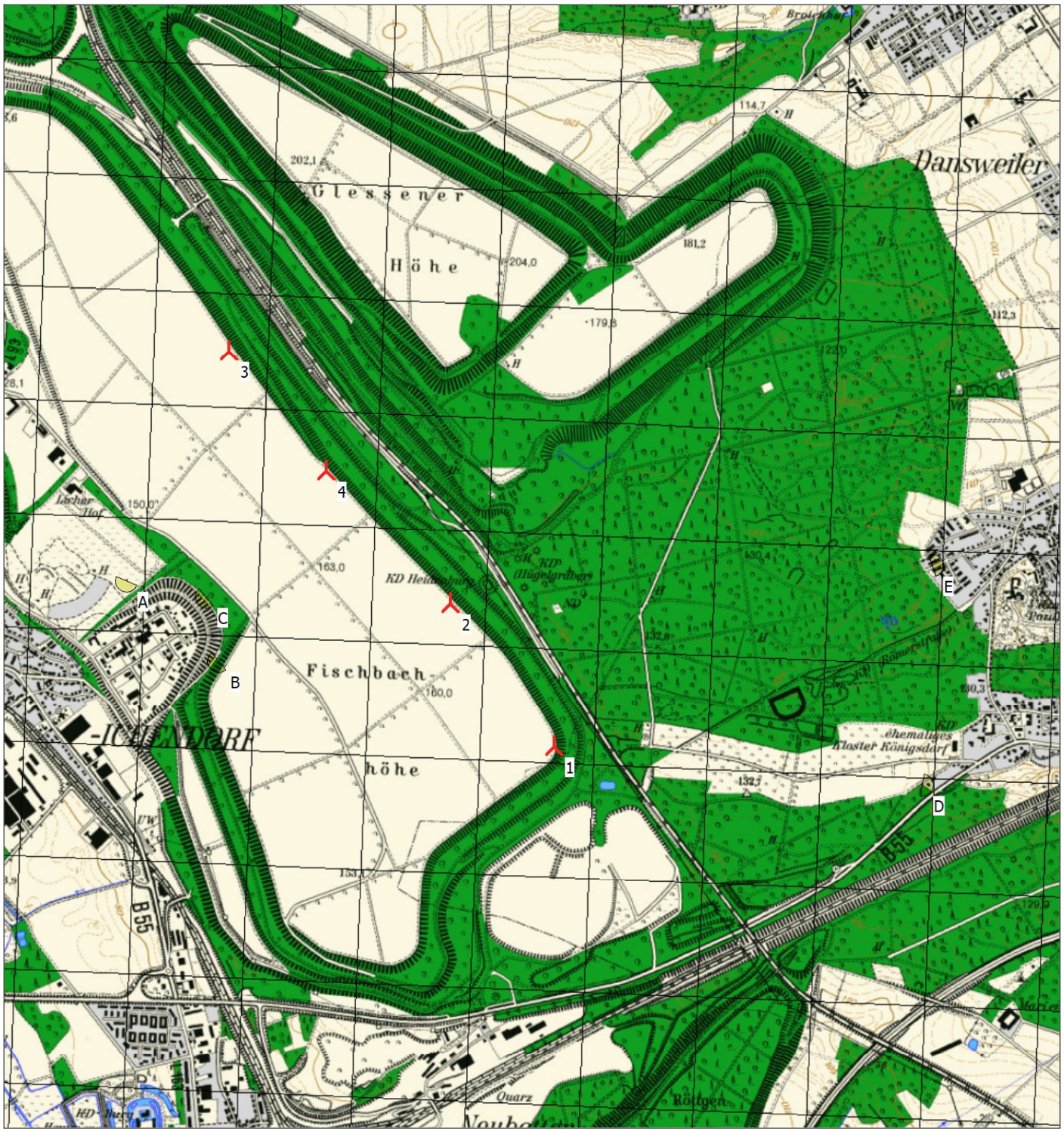




Shadow receptors

- A: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (26)
- B: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (27)
- C: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (28)

SHADOW - Map



0 250 500 750 1000m

Map: SelfReferrencedMap , Print scale 1:25,000, Map center GK (3 deg)-DHDN/PD/Bessel (DE 1995 <±5m) Zone: 2 East: 2,551,195 North: 5,645,365

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Projekt_0.wpo (1)