Appendix C

WindPRO METEO Results

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METEO - Main Result

Calculation: Elecon T600

Name SODAR

Site Coordinates
UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

Air density calculation mode	Individual per WTG
Result for WTG at hub altitude	1.238 kg/m³
Air density relative to standard	101.1 %
Hub altitude above sea level (asl)	84.8 m
Annual mean temperature at hub alt.	8.8 ℃
Pressure at WTGs	1,002.0 hPa

Calculation is based on "SODAR", giving the Weibull distribution for the wind speed on the site.
Using the selected power curve, the expected annual energy production is calculated.

Scale 1:25,000

Meteorological Data

Weibull data 40 m above ground level

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	5.81	5.17	1.832	9.9	0.420
1 NNE	6.98	6.19	2.268	3.5	0.420
2 ENE	3.10	3.05	1.039	1.1	0.420
3 E	4.69	4.21	1.592	1.9	0.420
4 ESE	6.84	6.06	2.162	3.8	0.420
5 SSE	5.89	5.22	2.044	4.0	0.420
6 S	4.07	3.60	2.348	3.3	0.420
7 SSW	4.31	3.81	2.246	5.3	0.420
8 WSW	4.68	4.14	2.140	11.0	0.420
9 W	5.24	4.66	2.554	15.7	0.420
10 WNW	6.17	5.47	2.357	27.0	0.420
11 NNW	5.60	4.97	2.484	13.4	0.420
All	5.57	4.93	2.116	100.0	

Calculation Results

Key results for height 60.0 m above ground level
Wind energy: 1,867 kWh/m²; Mean wind speed: 5.9 m/s;

Calculated Annual Energy

WTG type						Power curve		Annual Energy			
Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Creator	Name	Result [MWh]	Result-10.0% [MWh]	Mean wind speed [m/s]	Capacity factor [%]
Yes	TURBOWINDS	T600-48-600/120	600	48.0	60.0	EMD	Level 0 - guaranteed - - 01-2002	1,254.3	1,129	5.85	23.8

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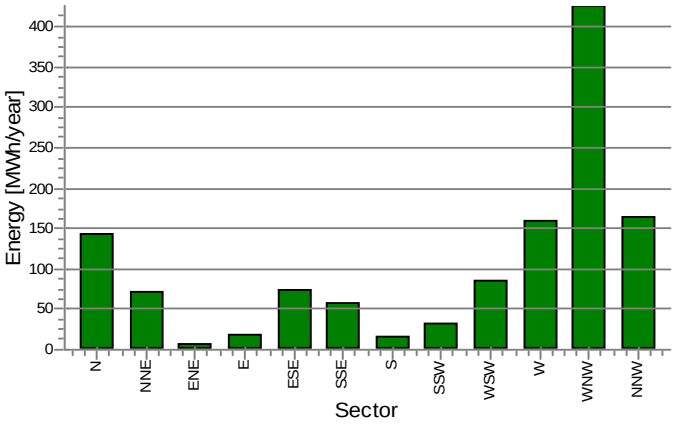
METEO - Production Analysis

Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O!, Hub height: 60.0 m, Air density: 1.238 kg/m³

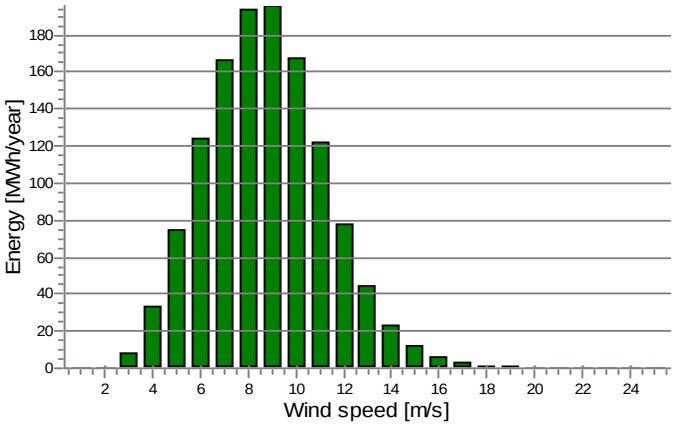
Directional Analysis

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]	143.4	71.3	5.9	17.7	74.3	58.6	16.0	31.5	86.5	158.7	426.1	164.1	1,254.3
Resulting energy	**[MWh]**	**143.4**	**71.3**	**5.9**	**17.7**	**74.3**	**58.6**	**16.0**	**31.5**	**86.5**	**158.7**	**426.1**	**164.1**	**1,254.3**
Specific energy	[kWh/m²]													693
Specific energy	[kWh/kW]													2,091
Directional Distribution	[%]	11.4	5.7	0.5	1.4	5.9	4.7	1.3	2.5	6.9	12.7	34.0	13.1	100.0
Utilization	[%]	33.8	32.8	32.1	35.8	32.4	35.9	39.9	40.3	40.2	40.8	37.3	39.9	37.1
Operational	[Hours/year]	811	285	93	153	309	330	273	434	900	1,289	2,213	1,101	8,191
Full Load Equivalent	[Hours/year]	239	119	10	29	124	98	27	53	144	265	710	274	2,091
A- parameter	[m/s]	6.9	8.3	3.7	5.6	8.1	7.0	4.8	5.1	5.5	6.2	7.3	6.6	6.6
Mean wind speed	[m/s]	6.1	7.3	3.5	5.0	7.2	6.2	4.3	4.5	4.9	5.5	6.5	5.9	5.9
k- parameter		1.99	2.43	1.20	1.75	2.32	2.20	2.51	2.41	2.30	2.71	2.52	2.64	2.26
Frequency	[%]	9.9	3.5	1.1	1.9	3.8	4.0	3.3	5.3	11.0	15.7	27.0	13.4	100.0
Power density	[W/m²]													213

Energy vs. sector



Energy vs. wind speed



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METEO - Power Curve Analysis

Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002, Hub height: 60.0 m

Name: Level 0 - guaranteed - - 01-2002
Source: Manufacturer

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type
1/16/2002	EMD	2/27/2002	6/27/2005	25.0	Active stall	User defined

Guaranteed power curve from manufacturer dated 16/01-2002.

HP curve comparison - Note: For standard air density and weibull k parameter = 2

Vmean	[m/s]	5	6	7	8	9	10
HP value	[MWh]	853	1,346	1,836	2,296	2,692	3,046
TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002	[MWh]	881	1,374	1,868	2,320	2,710	3,029
Check value	[%]	-3	-2	-2	-1	-1	1

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 WindPRO manual chapter 3.5.2.
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 from Windcat, Air density: 1.225 kg/m³

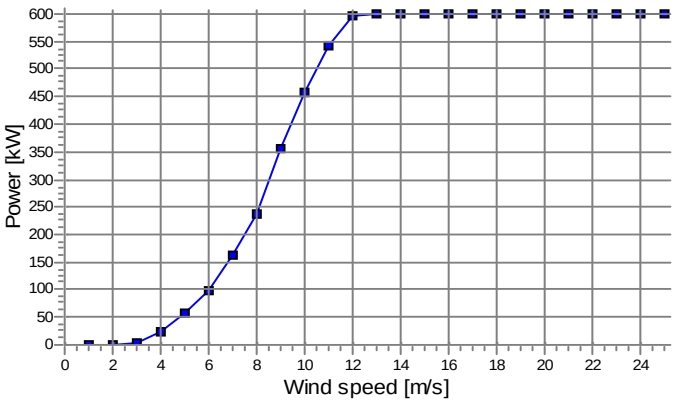
Wind speed [m/s]	Power [kW]	Ce	Wind speed [m/s]	Ct curve
3.0	4.0	0.13	4.0	0.77
4.0	24.0	0.34	5.0	0.75
5.0	56.0	0.40	6.0	0.71
6.0	98.0	0.41	7.0	0.66
7.0	160.0	0.42	8.0	0.61
8.0	234.0	0.41	9.0	0.55
9.0	353.0	0.44	10.0	0.50
10.0	455.0	0.41	11.0	0.45
11.0	540.0	0.37	12.0	0.40
12.0	595.0	0.31	13.0	0.38
13.0	600.0	0.25	14.0	0.36
14.0	600.0	0.20	15.0	0.34
15.0	600.0	0.16	16.0	0.32
16.0	600.0	0.13	17.0	0.30
17.0	600.0	0.11	18.0	0.28
18.0	600.0	0.09	19.0	0.26
19.0	600.0	0.08	20.0	0.24
20.0	600.0	0.07	21.0	0.22
21.0	600.0	0.06	22.0	0.20
22.0	600.0	0.05	23.0	0.18
23.0	600.0	0.04	24.0	0.16
24.0	600.0	0.04	25.0	0.14
25.0	600.0	0.03		

Power, Efficiency and energy vs. wind speed

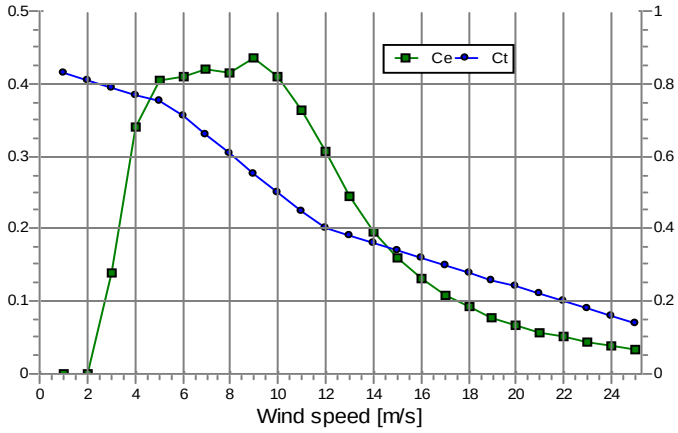
Data used in calculation, Air density: 1.238 kg/m³ New WindPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Ce	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	0.0	0.0	0.0
2.0	0.0	0.00	1.50- 2.50	0.0	0.0	0.0
3.0	4.2	0.14	2.50- 3.50	7.6	7.6	0.6
4.0	24.4	0.34	3.50- 4.50	32.9	40.5	3.2
5.0	56.7	0.41	4.50- 5.50	74.6	115.1	9.2
6.0	99.3	0.41	5.50- 6.50	123.8	238.9	19.0
7.0	161.8	0.42	6.50- 7.50	166.6	405.5	32.3
8.0	237.3	0.41	7.50- 8.50	193.6	599.1	47.8
9.0	356.4	0.44	8.50- 9.50	195.8	794.9	63.4
10.0	458.6	0.41	9.50-10.50	167.4	962.3	76.7
11.0	542.9	0.36	10.50-11.50	122.3	1,084.7	86.5
12.0	595.3	0.31	11.50-12.50	78.2	1,162.9	92.7
13.0	600.0	0.24	12.50-13.50	44.6	1,207.5	96.3
14.0	600.0	0.20	13.50-14.50	23.7	1,231.2	98.2
15.0	600.0	0.16	14.50-15.50	12.1	1,243.2	99.1
16.0	600.0	0.13	15.50-16.50	5.9	1,249.2	99.6
17.0	600.0	0.11	16.50-17.50	2.8	1,252.0	99.8
18.0	600.0	0.09	17.50-18.50	1.3	1,253.3	99.9
19.0	600.0	0.08	18.50-19.50	0.6	1,253.9	100.0
20.0	600.0	0.07	19.50-20.50	0.3	1,254.1	100.0
21.0	600.0	0.06	20.50-21.50	0.1	1,254.2	100.0
22.0	600.0	0.05	21.50-22.50	0.0	1,254.3	100.0
23.0	600.0	0.04	22.50-23.50	0.0	1,254.3	100.0
24.0	600.0	0.04	23.50-24.50	0.0	1,254.3	100.0
25.0	600.0	0.03	24.50-25.50	0.0	1,254.3	100.0

Power curve
Data used in calculation



Ce and Ct curve



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METEO - Wind Data Analysis

Calculation: Elecon T600**Wind data:** A - SODAR; Hub height: 60.0

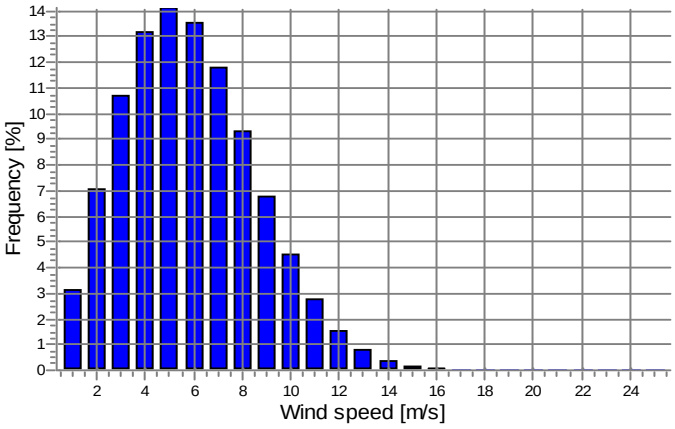
Site Coordinates
UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417
TURBOWINDS T600-48 600-120 48.0 !O!

Meteo data
SODAR

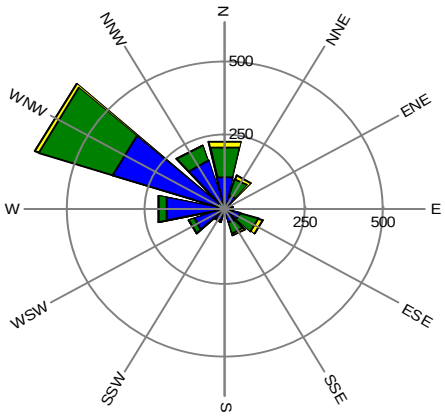
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	6.89	6.11	1.992	9.9	0.420
1 NNE	8.28	7.34	2.428	3.5	0.420
2 ENE	3.67	3.46	1.199	1.1	0.420
3 E	5.56	4.96	1.752	1.9	0.420
4 ESE	8.11	7.19	2.322	3.8	0.420
5 SSE	6.99	6.19	2.204	4.0	0.420
6 S	4.82	4.28	2.508	3.3	0.420
7 SSW	5.10	4.53	2.406	5.3	0.420
8 WSW	5.55	4.92	2.300	11.0	0.420
9 W	6.22	5.53	2.714	15.7	0.420
10 WNW	7.32	6.50	2.517	27.0	0.420
11 NNW	6.64	5.90	2.644	13.4	0.420
All	6.61	5.85	2.259	100.0	

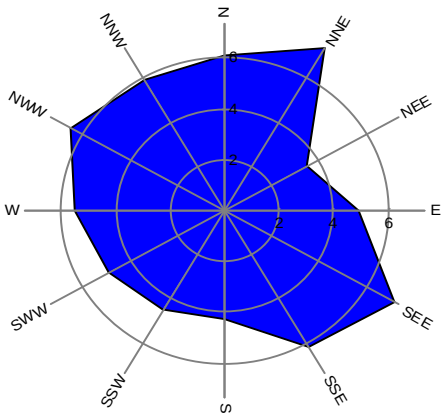
Weibull Distribution



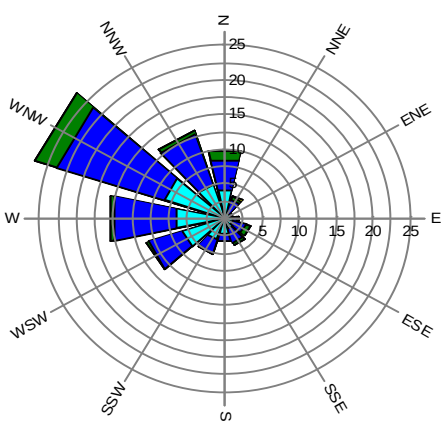
Energy Rose (kWh/m²/year)



Mean wind speed (m/s)



Frequency (%)



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METEO - Wind profile detailed

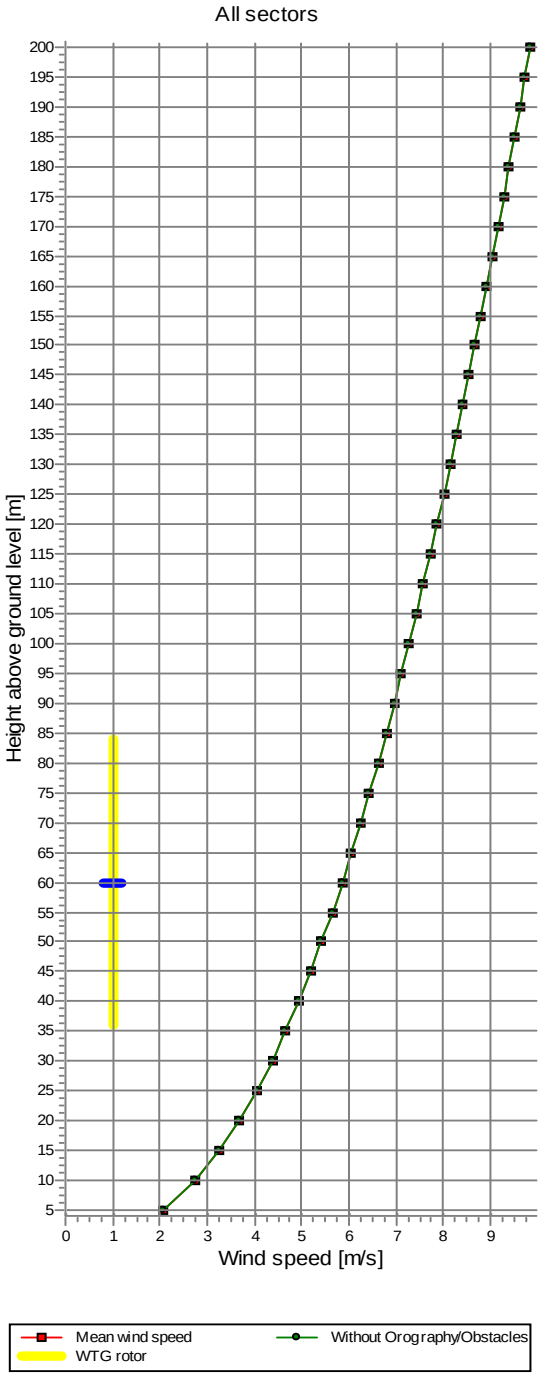
Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002, Hub height: 60.0 m

Site Data SODAR
Site Coordinates UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

Air density calculation mode	Individual per WTG
Result for WTG at hub altitude	1.238 kg/m³
Air density relative to standard	101.1 %
Hub altitude above sea level (asl)	84.8 m
Annual mean temperature at hub alt.	8.8 ℃
Pressure at WTGs	1,002.0 hPa

All sectors

Height	Mean wind speed	A- parameter	k- parameter	Wind energy	Yield	Yield change
	[m/s]	[m/s]		[kWh/m²]	[MWh]	[MWh]
5	2.07	2.3	1.85	101	46	-1,208
10	2.76	3.1	1.89	236	145	-1,110
15	3.27	3.7	1.93	383	257	-998
20	3.69	4.2	1.97	537	373	-882
25	4.05	4.6	2.00	696	489	-765
30	4.37	4.9	2.04	858	605	-649
35	4.67	5.3	2.08	1,022	720	-535
40	4.93	5.6	2.12	1,189	832	-423
45	5.19	5.9	2.15	1,357	941	-313
50	5.42	6.1	2.19	1,526	1,048	-206
55	5.64	6.4	2.22	1,696	1,152	-102
60	5.85	6.6	2.26	1,867	1,254	0
65	6.05	6.8	2.29	2,038	1,354	99
70	6.25	7.1	2.33	2,211	1,451	196
75	6.43	7.3	2.36	2,384	1,545	291
80	6.61	7.5	2.40	2,558	1,638	384
85	6.79	7.7	2.43	2,733	1,728	474
90	6.95	7.8	2.47	2,908	1,817	562
95	7.12	8.0	2.50	3,085	1,903	648
100	7.27	8.2	2.53	3,262	1,987	733
105	7.43	8.4	2.57	3,439	2,069	815
110	7.58	8.5	2.60	3,618	2,150	896
115	7.73	8.7	2.64	3,797	2,229	974
120	7.87	8.9	2.67	3,977	2,306	1,051
125	8.01	9.0	2.70	4,158	2,381	1,127
130	8.15	9.2	2.73	4,340	2,455	1,200
135	8.28	9.3	2.77	4,522	2,527	1,272
140	8.41	9.5	2.80	4,706	2,597	1,343
145	8.54	9.6	2.83	4,890	2,666	1,412
150	8.67	9.7	2.86	5,075	2,733	1,479
155	8.80	9.9	2.90	5,261	2,799	1,545
160	8.92	10.0	2.93	5,448	2,862	1,608
165	9.04	10.1	2.96	5,635	2,926	1,672
170	9.16	10.3	2.99	5,824	2,989	1,734
175	9.28	10.4	3.02	6,013	3,050	1,795
180	9.40	10.5	3.05	6,204	3,107	1,853
185	9.51	10.6	3.08	6,395	3,164	1,910
190	9.62	10.8	3.11	6,587	3,220	1,966
195	9.73	10.9	3.14	6,780	3,275	2,021
200	9.84	11.0	3.18	6,974	3,329	2,074



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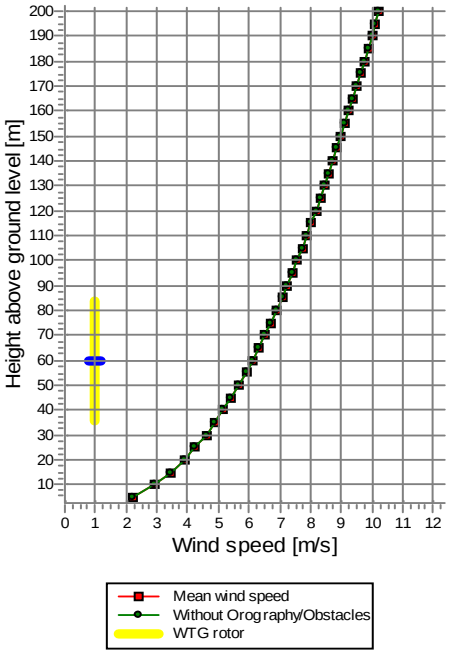
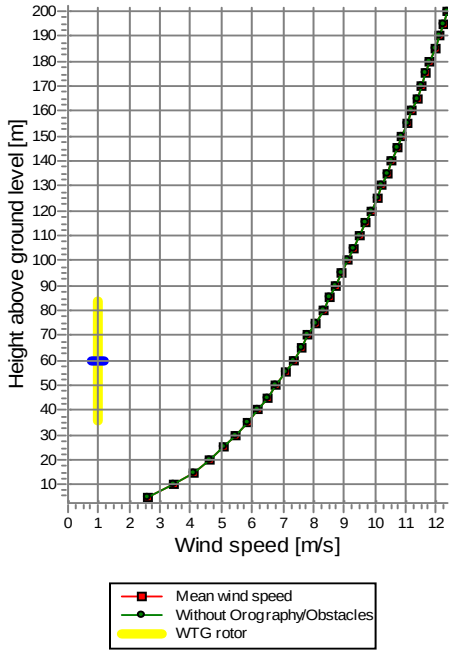
METEO - Wind profile detailed

Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002, Hub height: 60.0 m

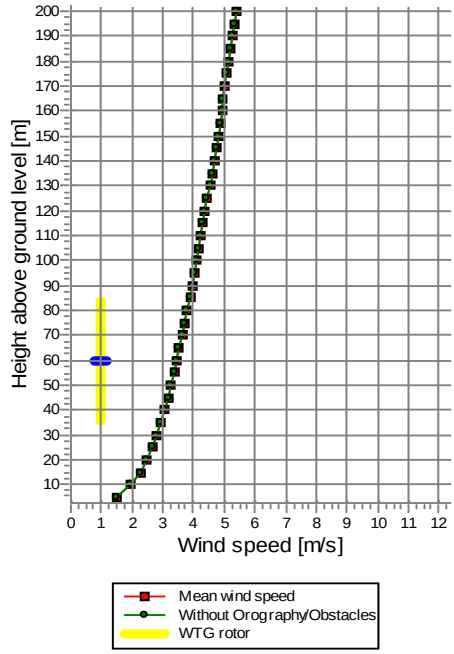
Sector: 0 - N, f: 9.9%



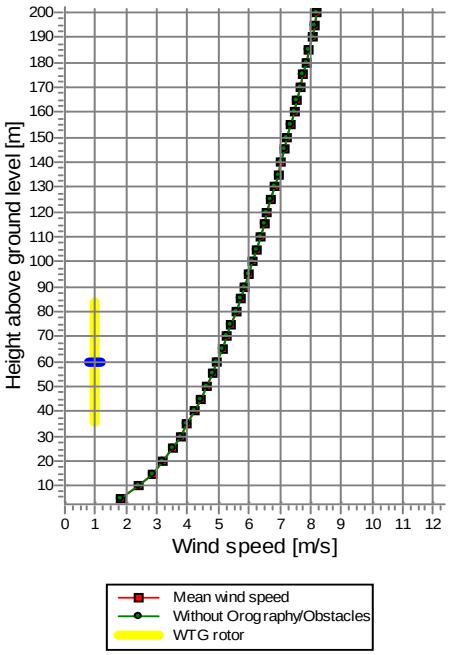
Sector: 1 - NNE, f: 3.5%



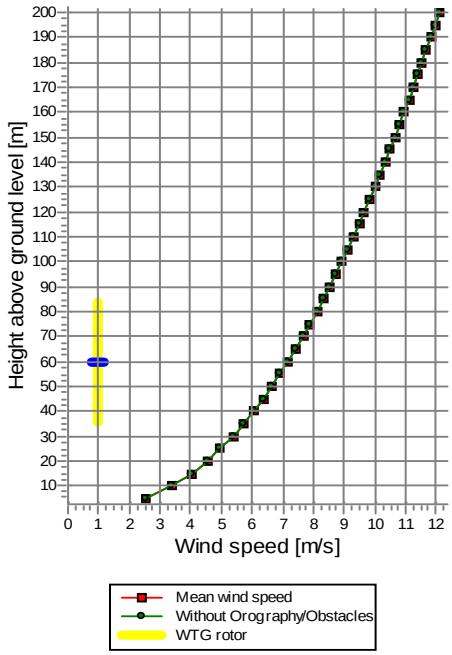
Sector: 2 - ENE, f: 1.1%



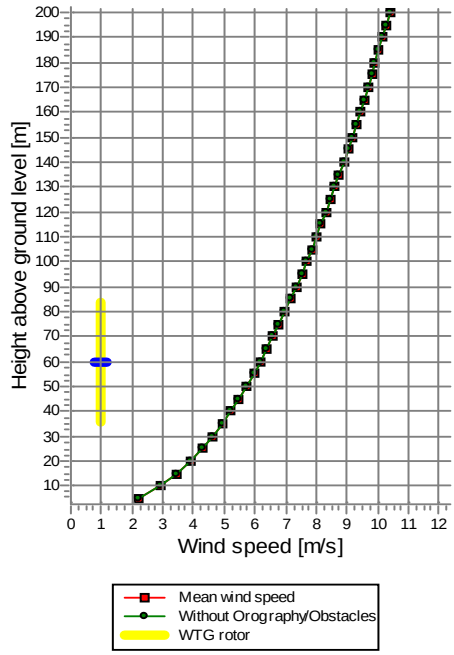
Sector: 3 - E, f: 1.9%



Sector: 4 - ESE, f: 3.8%



Sector: 5 - SSE, f: 4.0%



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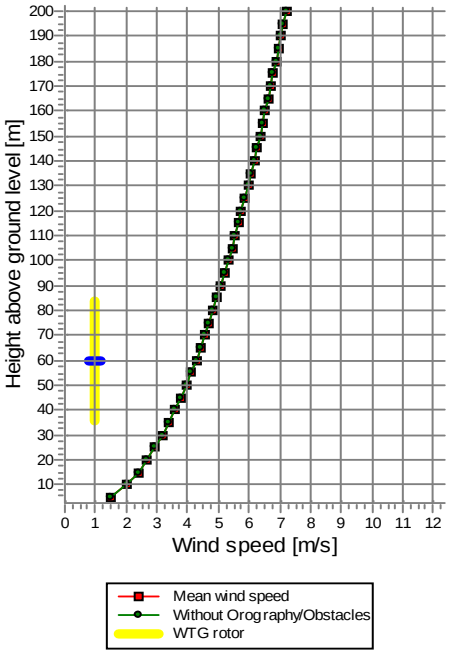
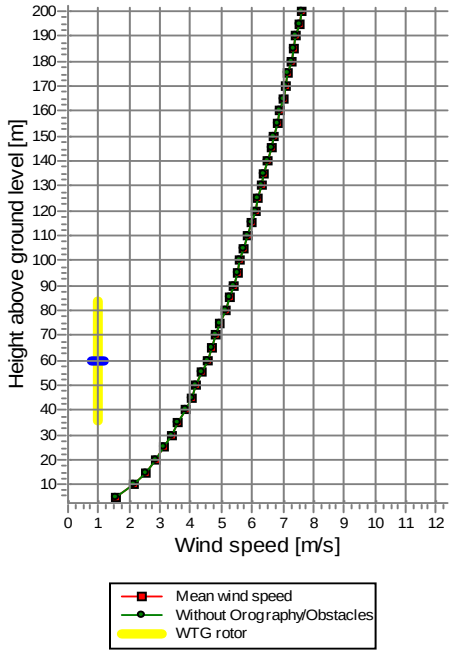
METEO - Wind profile detailed

Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002, Hub height: 60.0 m

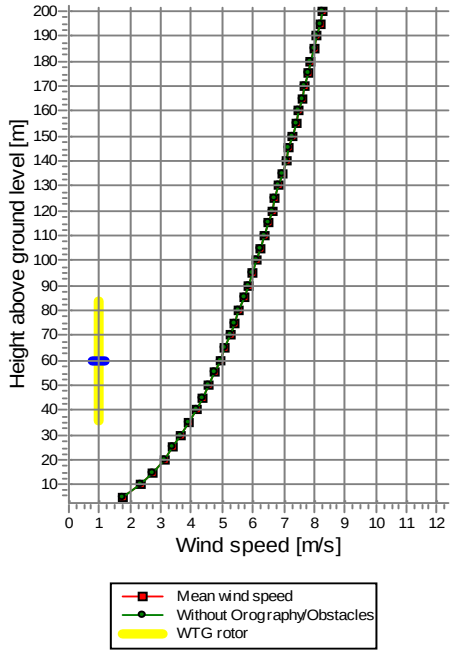
Sector: 6 - S, f: 3.3%



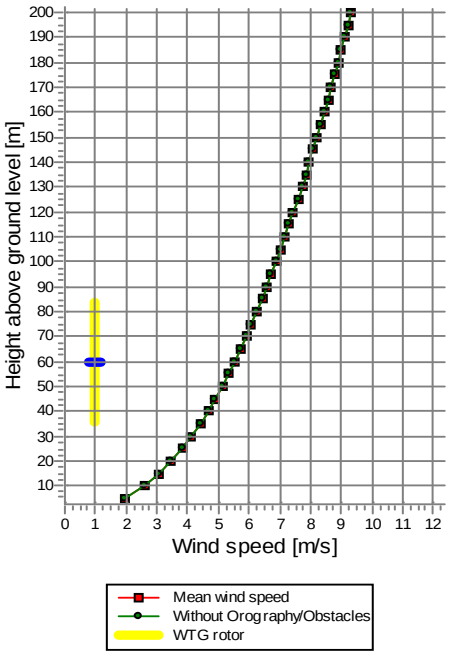
Sector: 7 - SSW, f: 5.3%



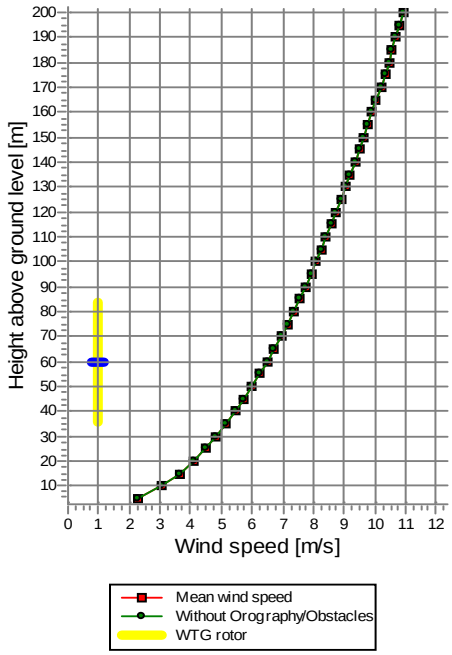
Sector: 8 - WSW, f: 11.0%



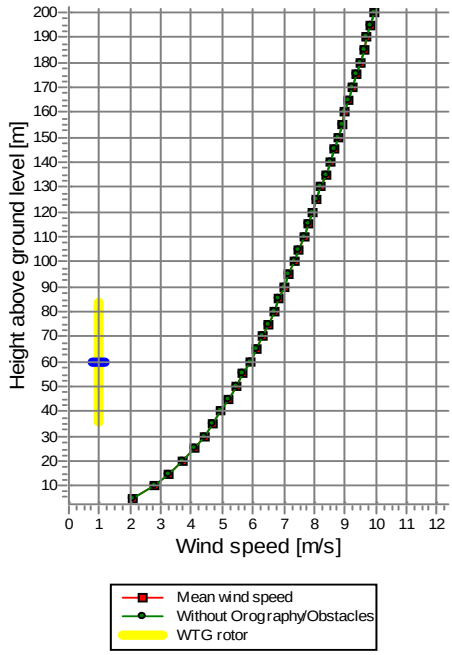
Sector: 9 - W, f: 15.7%



Sector: 10 - WNW, f: 27.0%



Sector: 11 - NNW, f: 13.4%



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METEO - Map

Calculation: Elecon T600**WTG:** TURBOWINDS T600-48 600-120 48.0 !O! Level 0 - guaranteed - - 01-2002, Hub height: 60.0 m

0 100 200 300 400 m

Map: , Print scale 1:10,000, Map center UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

New WTG Meteorological Data

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METEO - Main Result

Calculation: GE 1.5sle

Name SODAR

Site Coordinates
UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

Air density calculation mode	Individual per WTG
Result for WTG at hub altitude	1.236 kg/m³
Air density relative to standard	100.9 %
Hub altitude above sea level (asl)	104.8 m
Annual mean temperature at hub alt.	8.7 ℃
Pressure at WTGs	999.6 hPa

Calculation is based on "SODAR", giving the Weibull distribution for the wind speed on the site.
Using the selected power curve, the expected annual energy production is calculated.

Scale 1:25,000

Meteorological Data

Weibull data 40 m above ground level

Sector	A- parameter [m/s]	Wind speed [m/s]	k- parameter	Frequency [%]	Wind gradient exponent
0 N	5.81	5.17	1.832	9.9	0.420
1 NNE	6.98	6.19	2.268	3.5	0.420
2 ENE	3.10	3.05	1.039	1.1	0.420
3 E	4.69	4.21	1.592	1.9	0.420
4 ESE	6.84	6.06	2.162	3.8	0.420
5 SSE	5.89	5.22	2.044	4.0	0.420
6 S	4.07	3.60	2.348	3.3	0.420
7 SSW	4.31	3.81	2.246	5.3	0.420
8 WSW	4.68	4.14	2.140	11.0	0.420
9 W	5.24	4.66	2.554	15.7	0.420
10 WNW	6.17	5.47	2.357	27.0	0.420
11 NNW	5.60	4.97	2.484	13.4	0.420
All	5.57	4.93	2.116	100.0	

Calculation Results

Key results for height 50.0 m above ground level
Wind energy: 1,526 kWh/m²; Mean wind speed: 5.4 m/s;

Calculated Annual Energy

WTG type						Power curve		Annual Energy			
Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Result	Result-10.0%	Mean wind speed	Capacity factor
			[kW]	[m]	[m]			[MWh]	[MWh]	[m/s]	[%]
Yes	GE WIND ENERGY	GE 1.5sle-1,500	1,500	77.0	80.0	EMD	Level 0 - Calculated - 10%<TI<15% - 2006	4,172.3	3,755	6.61	31.7

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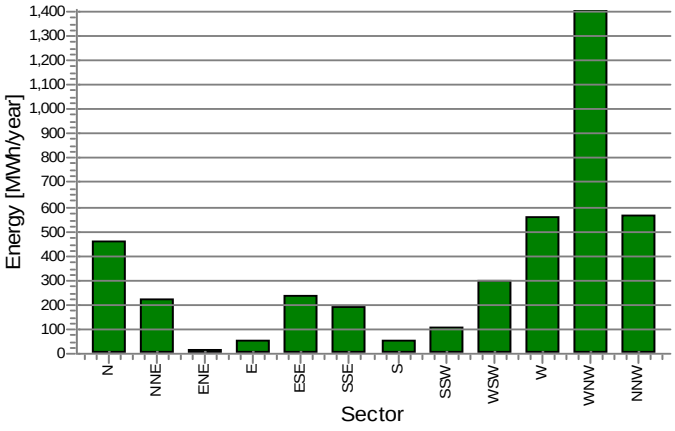
METEO - Production Analysis

Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O!, Hub height: 80.0 m, Air density: 1.236 kg/m³

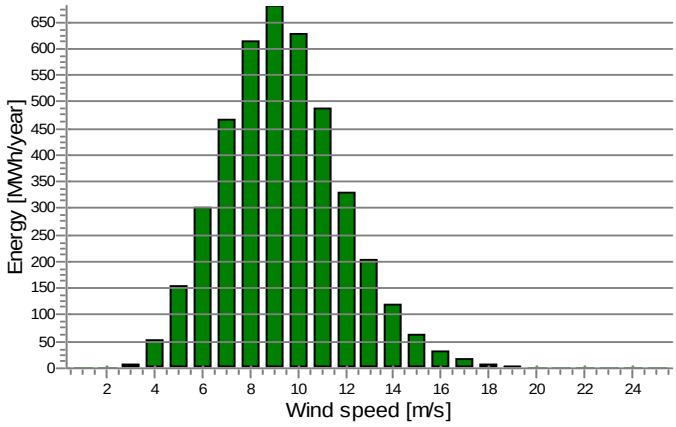
Directional Analysis

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]	458.3	225.0	16.6	56.5	234.2	190.9	56.2	110.0	297.6	556.4	1,407.1	563.5	4,172.3
Resulting energy	**[MWh]**	**458.3**	**225.0**	**16.6**	**56.5**	**234.2**	**190.9**	**56.2**	**110.0**	**297.6**	**556.4**	**1,407.1**	**563.5**	**4,172.3**
Specific energy	[kWh/m²]													896
Specific energy	[kWh/kW]													2,782
Directional Distribution	[%]	11.0	5.4	0.4	1.4	5.6	4.6	1.3	2.6	7.1	13.3	33.7	13.5	100.0
Utilization	[%]	31.6	29.2	33.2	34.7	29.1	33.5	39.3	39.7	39.3	39.8	34.7	38.3	35.0
Operational	[Hours/year]	775	272	89	146	295	315	260	415	861	1,232	2,115	1,052	7,828
Full Load Equivalent	[Hours/year]	306	150	11	38	156	127	37	73	198	371	938	376	2,782
A- parameter	[m/s]	7.8	9.3	4.1	6.3	9.2	7.9	5.4	5.8	6.3	7.0	8.3	7.5	7.5
Mean wind speed	[m/s]	6.9	8.3	3.8	5.6	8.1	7.0	4.8	5.1	5.6	6.3	7.3	6.7	6.6
k- parameter		2.15	2.59	1.36	1.91	2.48	2.36	2.67	2.57	2.46	2.87	2.68	2.80	2.40
Frequency	[%]	9.9	3.5	1.1	1.9	3.8	4.0	3.3	5.3	11.0	15.7	27.0	13.4	100.0
Power density	[W/m²]													292

Energy vs. sector



Energy vs. wind speed



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METEO - Power Curve Analysis

Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006, Hub height: 80.0 m

Name: Level 0 - Calculated - 10%<TI<15% - 2006
Source: Manufacturer

Source/Date	Created by	Created	Edited	Stop wind speed [m/s]	Power control	CT curve type
12/31/2006	EMD	11/21/2000	1/10/2007	25.0	Pitch	User defined

Based on GE document 1.5sl_sle_PCD_allComp_xxxxxxxx.ENxx.03.pdf. Special adapted power curves for air densities 1.02-1.20 kg/m³ available from manufacturer. When using this PC, WindPRO's standard algorithm for air density adaptation will be used.

HP curve comparison - Note: For standard air density and weibull k parameter = 2

Vmean	[m/s]	5	6	7	8	9	10
HP value	[MWh]	2,126	3,366	4,628	5,833	6,826	7,716
GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006	[MWh]	2,230	3,492	4,738	5,867	6,837	7,627
Check value	[%]	-5	-4	-2	-1	0	1

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 WindPRO manual chapter 3.5.2.
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 from Windcat, Air density: 1.225 kg/m³

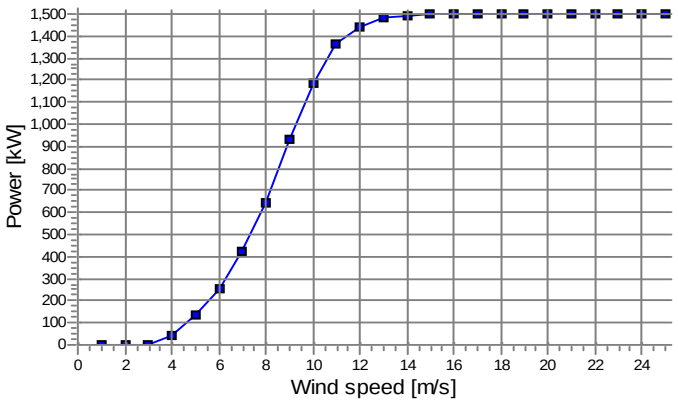
Wind speed [m/s]	Power [kW]	Ce	Wind speed [m/s]	Ct curve
3.0	0.0	0.00	3.0	1.27
3.5	20.0	0.16	4.0	1.03
4.0	43.0	0.24	5.0	0.91
4.5	83.0	0.32	6.0	0.89
5.0	131.0	0.37	7.0	0.89
5.5	185.0	0.39	8.0	0.87
6.0	250.0	0.41	9.0	0.80
6.5	326.0	0.42	10.0	0.69
7.0	416.0	0.43	11.0	0.55
7.5	521.0	0.43	12.0	0.42
8.0	640.0	0.44	13.0	0.32
8.5	785.0	0.45	14.0	0.25
9.0	924.0	0.44	15.0	0.20
9.5	1,062.0	0.43	16.0	0.17
10.0	1,181.0	0.41	17.0	0.14
10.5	1,283.0	0.39	18.0	0.12
11.0	1,359.0	0.36	19.0	0.10
11.5	1,402.0	0.32	20.0	0.09
12.0	1,436.0	0.29	21.0	0.07
12.5	1,463.0	0.26	22.0	0.07
13.0	1,481.0	0.24	23.0	0.06
13.5	1,488.0	0.21	24.0	0.05
14.0	1,494.0	0.19	25.0	0.05
14.5	1,500.0	0.17		
15.0	1,500.0	0.16		
15.5	1,500.0	0.14		
16.0	1,500.0	0.13		
16.5	1,500.0	0.12		
17.0	1,500.0	0.11		
17.5	1,500.0	0.10		
18.0	1,500.0	0.09		
18.5	1,500.0	0.08		
19.0	1,500.0	0.08		
19.5	1,500.0	0.07		
20.0	1,500.0	0.07		
20.5	1,500.0	0.06		
21.0	1,500.0	0.06		
21.5	1,500.0	0.05		
22.0	1,500.0	0.05		
22.5	1,500.0	0.05		
23.0	1,500.0	0.04		
23.5	1,500.0	0.04		
24.0	1,500.0	0.04		
24.5	1,500.0	0.04		
25.0	1,500.0	0.03		

Power, Efficiency and energy vs. wind speed

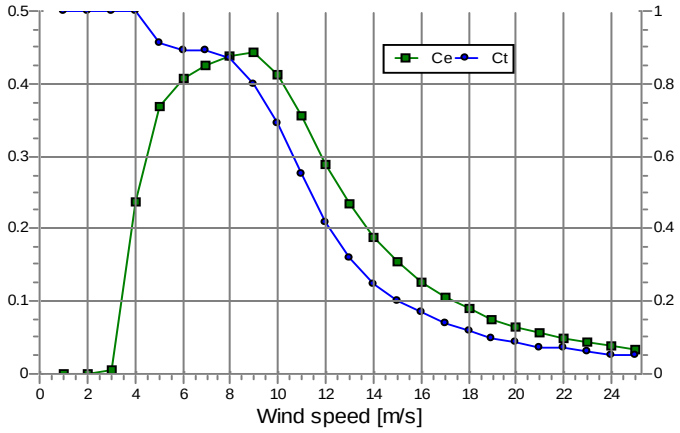
Data used in calculation, Air density: 1.236 kg/m³ New WindPRO method (adjusted IEC method, improved to match turbine control) <RECOMMENDED>

Wind speed [m/s]	Power [kW]	Ce	Interval [m/s]	Energy [MWh]	Acc.Energy [MWh]	Relative [%]
1.0	0.0	0.00	0.50- 1.50	0.0	0.0	0.0
2.0	0.0	0.00	1.50- 2.50	0.0	0.0	0.0
3.0	0.3	0.00	2.50- 3.50	8.5	8.5	0.2
4.0	43.9	0.24	3.50- 4.50	52.9	61.3	1.5
5.0	132.5	0.37	4.50- 5.50	154.2	215.5	5.2
6.0	252.6	0.41	5.50- 6.50	301.7	517.2	12.4
7.0	420.1	0.43	6.50- 7.50	466.7	983.9	23.6
8.0	646.6	0.44	7.50- 8.50	612.6	1,596.5	38.3
9.0	931.5	0.44	8.50- 9.50	679.8	2,276.4	54.6
10.0	1,188.0	0.41	9.50-10.50	628.1	2,904.4	69.6
11.0	1,362.7	0.36	10.50-11.50	488.1	3,392.5	81.3
12.0	1,438.8	0.29	11.50-12.50	330.5	3,723.0	89.2
13.0	1,481.8	0.23	12.50-13.50	203.9	3,926.9	94.1
14.0	1,494.7	0.19	13.50-14.50	117.4	4,044.3	96.9
15.0	1,500.0	0.15	14.50-15.50	64.0	4,108.3	98.5
16.0	1,500.0	0.13	15.50-16.50	33.2	4,141.5	99.3
17.0	1,500.0	0.11	16.50-17.50	16.5	4,158.1	99.7
18.0	1,500.0	0.09	17.50-18.50	7.9	4,166.0	99.8
19.0	1,500.0	0.08	18.50-19.50	3.6	4,169.6	99.9
20.0	1,500.0	0.07	19.50-20.50	1.6	4,171.2	100.0
21.0	1,500.0	0.06	20.50-21.50	0.7	4,171.9	100.0
22.0	1,500.0	0.05	21.50-22.50	0.3	4,172.2	100.0
23.0	1,500.0	0.04	22.50-23.50	0.1	4,172.3	100.0
24.0	1,500.0	0.04	23.50-24.50	0.0	4,172.3	100.0
25.0	1,500.0	0.03	24.50-25.50	0.0	4,172.3	100.0

Power curve
Data used in calculation



Ce and Ct curve



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METEO - Wind Data Analysis

Calculation: GE 1.5sle**Wind data:** A - SODAR; Hub height: 50.0

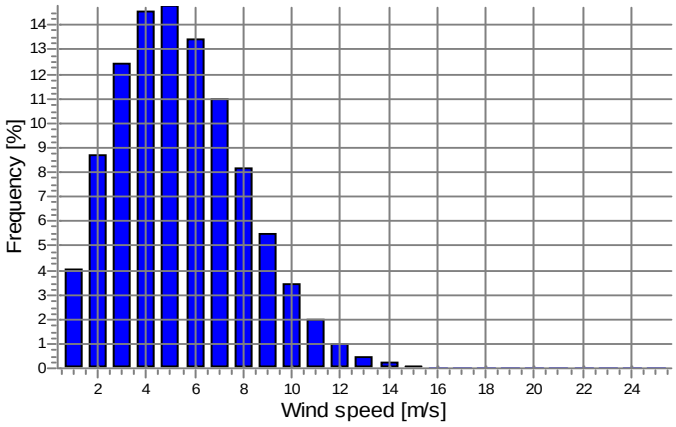
Site Coordinates
UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

Meteo data
SODAR

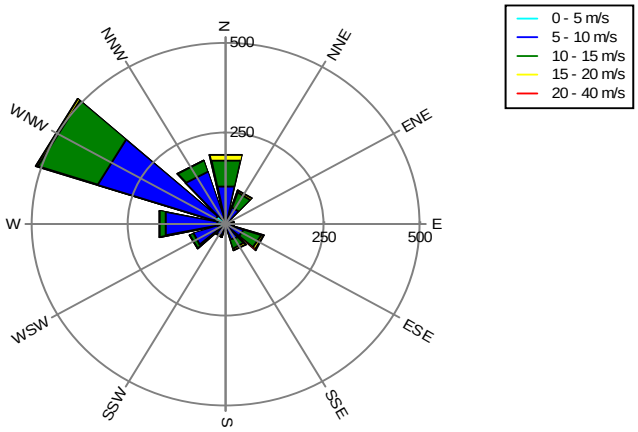
Weibull Data

Sector	A- parameter	Wind speed	k- parameter	Frequency	Wind gradient exponent
	[m/s]	[m/s]		[%]	
0 N	6.38	5.66	1.912	9.9	0.420
1 NNE	7.67	6.80	2.348	3.5	0.420
2 ENE	3.40	3.26	1.119	1.1	0.420
3 E	5.15	4.60	1.672	1.9	0.420
4 ESE	7.51	6.65	2.242	3.8	0.420
5 SSE	6.47	5.73	2.124	4.0	0.420
6 S	4.46	3.96	2.428	3.3	0.420
7 SSW	4.73	4.19	2.326	5.3	0.420
8 WSW	5.14	4.55	2.220	11.0	0.420
9 W	5.76	5.12	2.634	15.7	0.420
10 WNW	6.78	6.01	2.437	27.0	0.420
11 NNW	6.15	5.46	2.564	13.4	0.420
All	6.12	5.42	2.188	100.0	

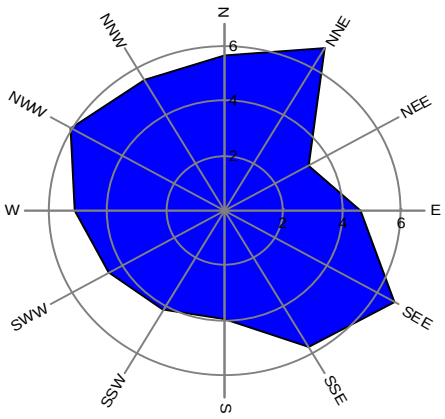
Weibull Distribution



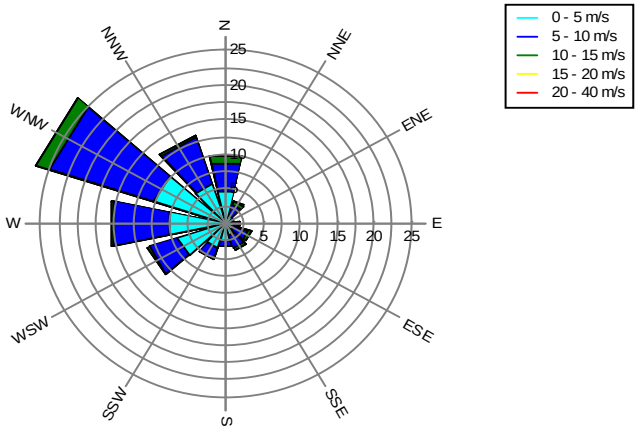
Energy Rose (kWh/m²/year)



Mean w ind speed (m/s)



Frequency (%)



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METEO - Wind profile detailed

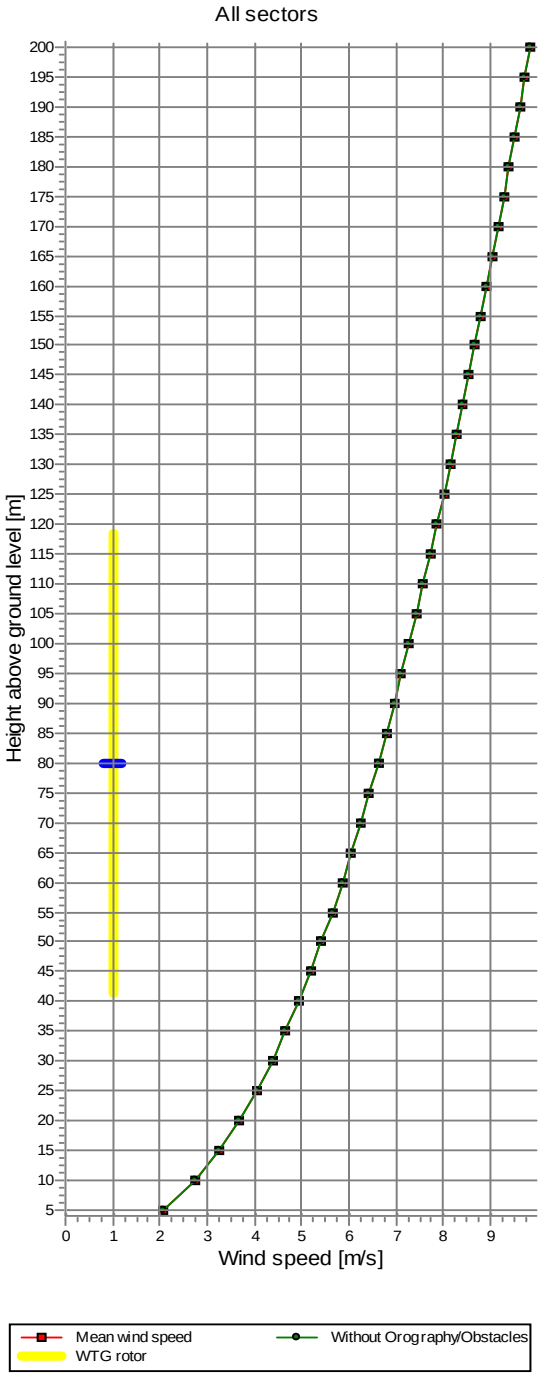
Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006, Hub height: 80.0 m

Site Data SODAR
Site Coordinates UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

Air density calculation mode	Individual per WTG
Result for WTG at hub altitude	1.236 kg/m³
Air density relative to standard	100.9 %
Hub altitude above sea level (asl)	104.8 m
Annual mean temperature at hub alt.	8.7 ℃
Pressure at WTGs	999.6 hPa

All sectors

Height	Mean wind speed	A- parameter	k- parameter	Wind energy	Yield	Yield change
	[m/s]	[m/s]		[kWh/m²]	[MWh]	[MWh]
5	2.07	2.3	1.85	101	92	-4,080
10	2.76	3.1	1.89	236	321	-3,851
15	3.27	3.7	1.93	383	599	-3,573
20	3.69	4.2	1.97	537	895	-3,277
25	4.05	4.6	2.00	696	1,197	-2,975
30	4.37	4.9	2.04	858	1,499	-2,674
35	4.67	5.3	2.08	1,022	1,796	-2,377
40	4.93	5.6	2.12	1,189	2,087	-2,085
45	5.19	5.9	2.15	1,357	2,372	-1,800
50	5.42	6.1	2.19	1,526	2,650	-1,523
55	5.64	6.4	2.22	1,696	2,920	-1,252
60	5.85	6.6	2.26	1,867	3,184	-988
65	6.05	6.8	2.29	2,038	3,441	-732
70	6.25	7.1	2.33	2,211	3,691	-481
75	6.43	7.3	2.36	2,384	3,935	-238
80	6.61	7.5	2.40	2,558	4,172	0
85	6.79	7.7	2.43	2,733	4,404	232
90	6.95	7.8	2.47	2,908	4,630	457
95	7.12	8.0	2.50	3,085	4,850	678
100	7.27	8.2	2.53	3,262	5,065	893
105	7.43	8.4	2.57	3,439	5,275	1,102
110	7.58	8.5	2.60	3,618	5,479	1,307
115	7.73	8.7	2.64	3,797	5,679	1,507
120	7.87	8.9	2.67	3,977	5,874	1,702
125	8.01	9.0	2.70	4,158	6,065	1,892
130	8.15	9.2	2.73	4,340	6,251	2,078
135	8.28	9.3	2.77	4,522	6,432	2,260
140	8.41	9.5	2.80	4,706	6,610	2,437
145	8.54	9.6	2.83	4,890	6,783	2,611
150	8.67	9.7	2.86	5,075	6,952	2,780
155	8.80	9.9	2.90	5,261	7,117	2,945
160	8.92	10.0	2.93	5,448	7,275	3,103
165	9.04	10.1	2.96	5,635	7,435	3,262
170	9.16	10.3	2.99	5,824	7,590	3,418
175	9.28	10.4	3.02	6,013	7,742	3,570
180	9.40	10.5	3.05	6,204	7,885	3,712
185	9.51	10.6	3.08	6,395	8,027	3,855
190	9.62	10.8	3.11	6,587	8,166	3,994
195	9.73	10.9	3.14	6,780	8,302	4,129
200	9.84	11.0	3.18	6,974	8,434	4,261



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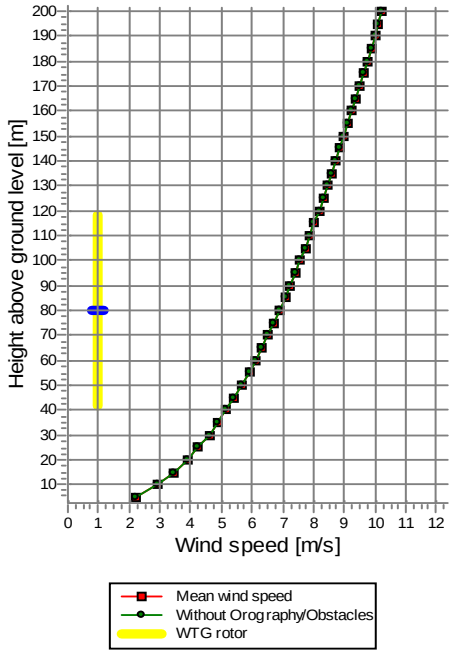
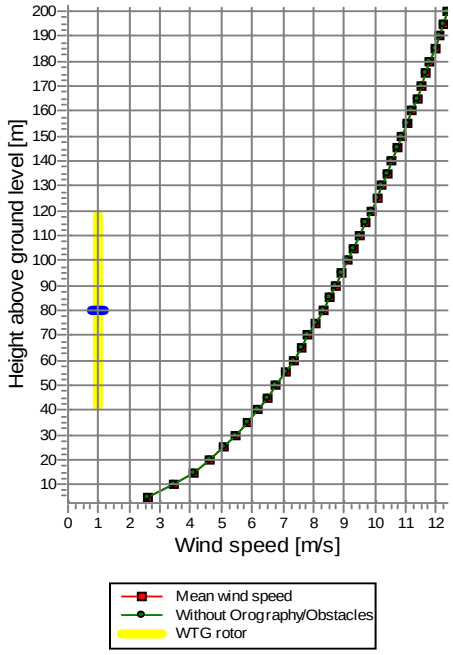
METEO - Wind profile detailed

Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006, Hub height: 80.0 m

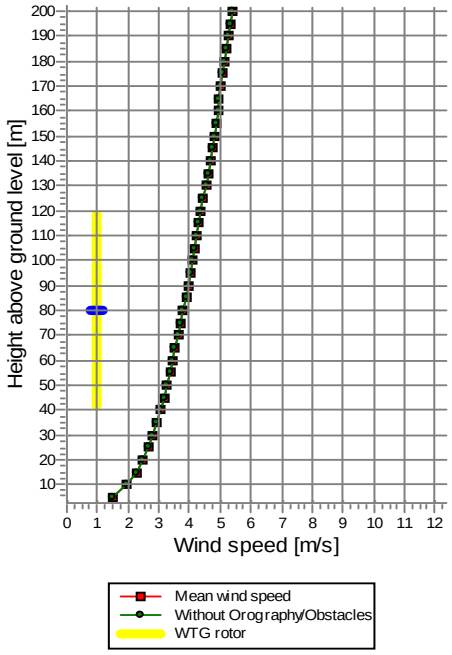
Sector: 0 - N, f: 9.9%



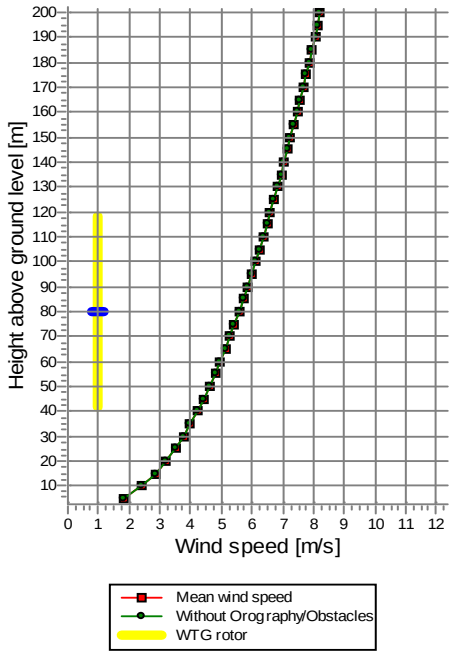
Sector: 1 - NNE, f: 3.5%



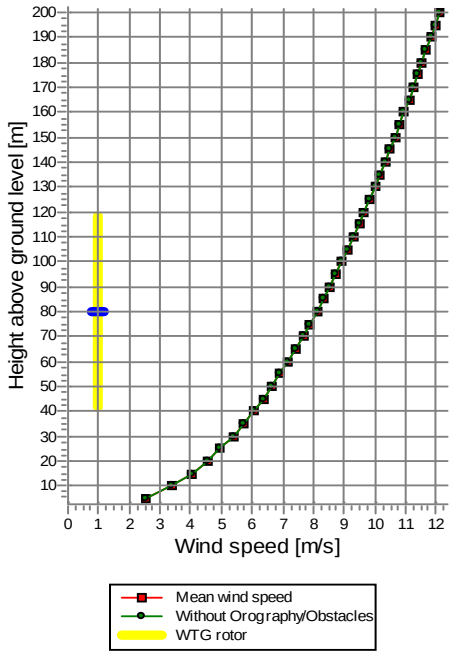
Sector: 2 - ENE, f: 1.1%



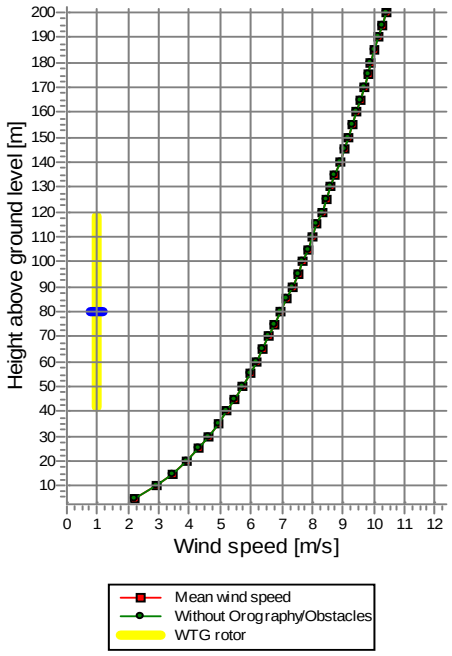
Sector: 3 - E, f: 1.9%



Sector: 4 - ESE, f: 3.8%



Sector: 5 - SSE, f: 4.0%



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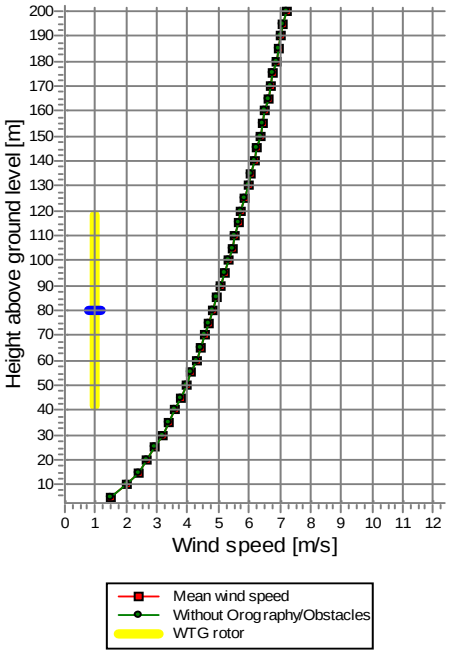
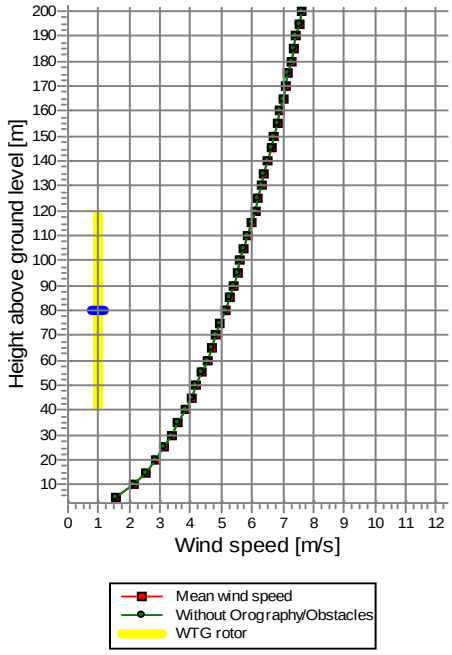
METEO - Wind profile detailed

Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006, Hub height: 80.0 m

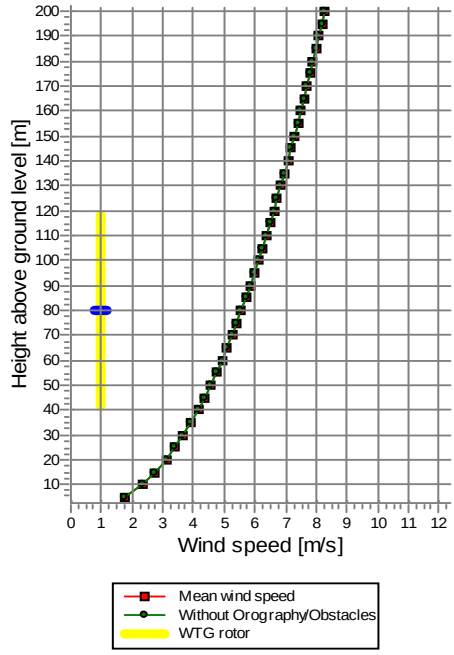
Sector: 6 - S, f: 3.3%



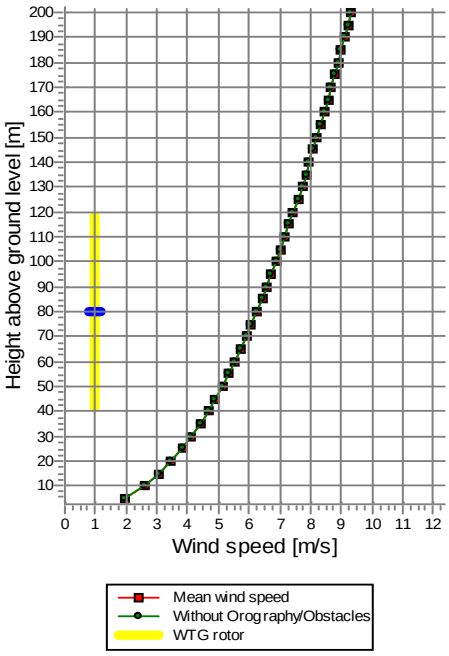
Sector: 7 - SSW, f: 5.3%



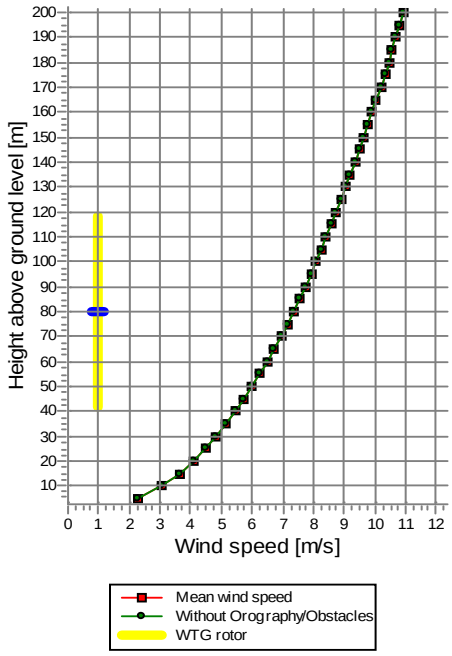
Sector: 8 - WSW, f: 11.0%



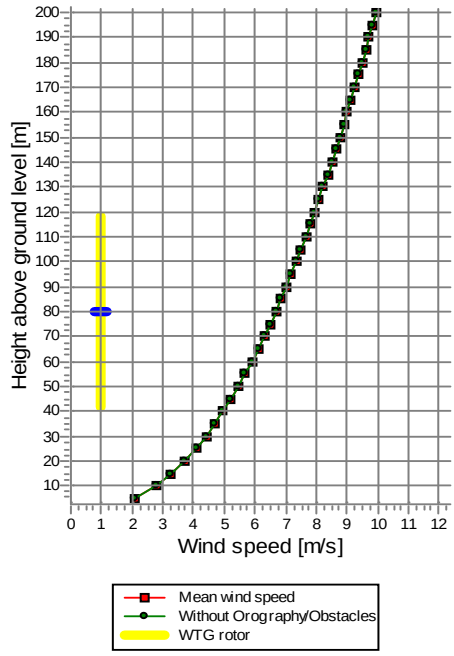
Sector: 9 - W, f: 15.7%



Sector: 10 - WNW, f: 27.0%



Sector: 11 - NNW, f: 13.4%



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METEO - Map

Calculation: GE 1.5sle**WTG:** GE WIND ENERGY GE 1.5sle 1500 77.0 !O! Level 0 - Calculated - 10%<TI<15% - 2006, Hub height: 80.0 m

0 100 200 300 400 m

Map: , Print scale 1:10,000, Map center UTM NAD 83 Zone: 19 East: 343,657 North: 4,704,417

New WTG Meteorological Data