REGIONE BASILICATA

PARCO EOLICO *SERRA GAGLIARDI*
GENZANO DI LUCANIA (PZ)

ELABORATO DI PROGETTO

Em./Rev.	Data	Red./Dis.	Verificato	Approvato	Descrizione
2					
1					
0	17/03/2016	Ing. M.Martellucci	Ing. M.Martellucci	Ing. F. Di Chiappari	

Redazione: **EURO INSTALLAZIONI**

Titolo dell'allegato:

ULTERIORE STUDIO ANEMOLOGICO

Pagine: *1 di 60*

Doc.n°: **A.5.**

Committente:

SKYWIND
Euro Installazioni s.r.l.
SKYWIND
S.r.l. Via Marconi, 6
04024 Gaeta (LT) **ITALY**

Parco Eolico "Serra Gagliardi" da 36 Mw

Ulteriore Studio Anemometrico

Confidenziale

Sommario

1. Anemologia del sito

Generalità per la realizzazione di impianti eolici

La prima fase nello sviluppo di un qualsiasi parco di generazione eolica è l'iniziale selezione del sito. La scelta del sito comporta l'esecuzione di tutta una serie di operazioni fondamentali; la prima delle quali è l'esecuzione dei rilievi anemometrici che per essere di ampia validità ed utilizzazione devono rispondere ad alcune caratteristiche minime:

- esecuzione delle misure a diverse quote da terra;
- registrazioni con campionamenti almeno tri – orari per dieci minuti al fine di avere medie significative con una descrizione di spettro alla Van der Hoven Augusti et al. (1984) e Panofsky &Dutton (1984);
- registrazioni contemporanee di pressione, temperatura ed umidità;
- utilizzazioni di strumenti con diverse caratteristiche in funzione delle specifiche situazioni orografiche e meteo – climatiche.

Oltre allo **strumento principale a 10 m** di quota si utilizzano altri anemometri a quote di 30 e 60 m per rilevare la velocità alle altezze tipiche degli hub per WTG (Wind Turbine Generator, aerogeneratori) di media - grande taglia.

Altre operazioni necessarie possono essere così sintetizzate:

- ricerca bibliografica e letteraria per individuare le descrizioni eventualmente fatte di eventi eolici interessanti o descrizioni sitologiche di primo indirizzo e comunque dati storici registrati;
- effettuazioni di interviste ai residenti per individuare microscopicamente località d'interesse e valutare le relazioni con l'ambiente;

- acquisizione dei dati del Servizio Meteorologico Regionale inerenti le registrazioni effettuate presso le stazioni di rilevamento e mappatura delle stesse.

Per operare una scelta ottimale del sito si può poi ricorrere all'inquadramento fornito da Dickenson e Cheremisinoff (Eds. 1980) che consiste nei seguenti punti:

- determinazione della localizzazione, dell'estensione spaziale e dell'intensità della risorsa eolica in una scala opportuna e congruente con l'applicazione e la natura della dipendenza della risorsa dal tempo;
- determinazione dei parametri specifici della risorsa del sito quali intensità, frequenza, tempo di arrivo e/o di ritorno delle raffiche, parametri dello strato limite, modellazione della turbolenza locale;
- acquisizione delle informazioni relative all'impatto ambientale legate all'opposizione di sfruttamento dell'energia eolica sul sito;
- acquisizione delle informazioni relative all'impatto socioeconomico e sul territorio conseguente allo sfruttamento della risorsa sul sito.

La SkyWind Engeneering Departement ha elaborato il presente documento per identificare, con maggiore precisione, la risorsa eolica dell'impianto di Genzano di Lucania (PZ).

Sul sito, sono state installate due nuove torri anemometriche da 50m e 30m di altezza, indicate con la nomenclatura, **T090336** e **T114117**, di riferimento per lo studio che segue.

Lo studio anemologico ha seguito le tappe qui elencate:

- analisi e elaborazione dei dati registrati dalla torre anemometrica;
- disponibilità dei dati rilevati;
- studio sull'intero periodo rilevato;

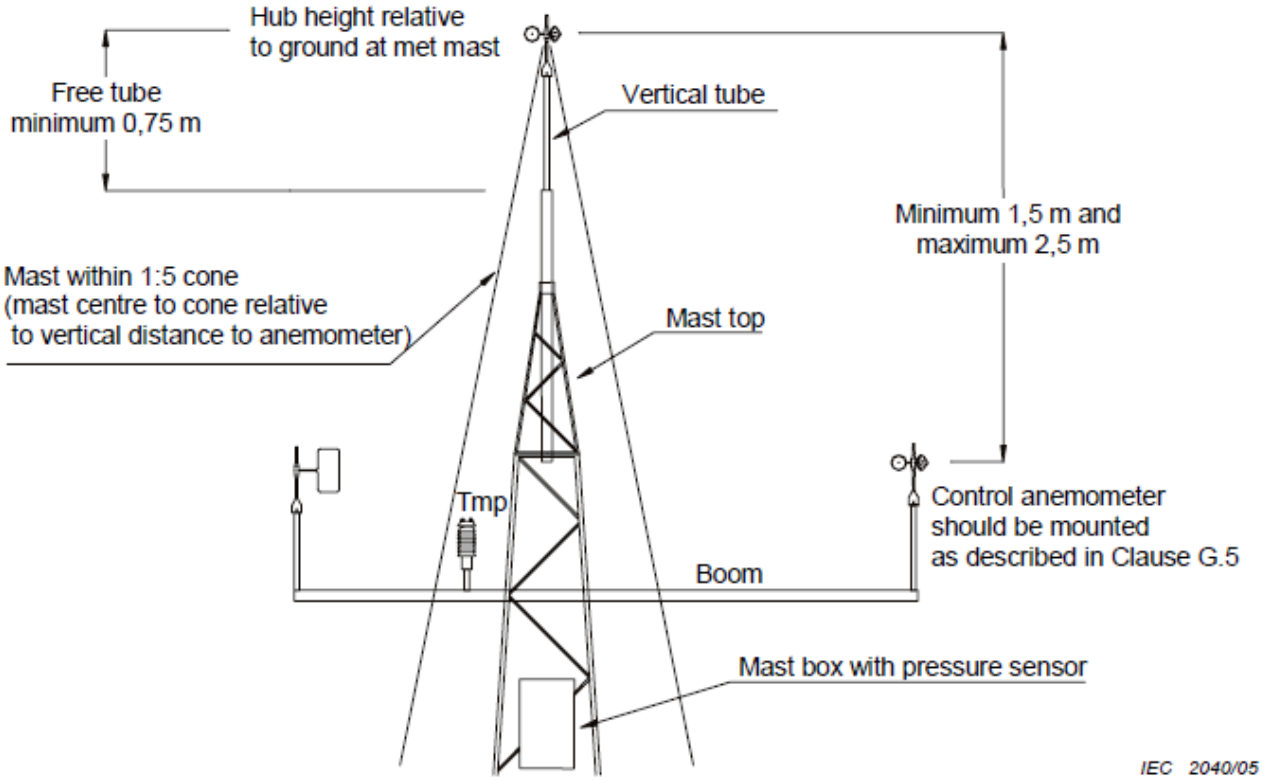
- definizione di un periodo di riferimento come dato di partenza per le simulazioni;
- digitalizzazione della curva di livello delle mappe e definizione della rugosità del terreno;

- studio della densità volumetrica del sito;
- studio delle condizioni anemometriche rilevate e scelta della turbina più appropriata;
- modellazione con WAsP (Wind Atlas Analysis and Application Program) e analisi delle deviazioni e dei calcoli per tarare il modello.

1.1 Strumento di misura

Gli strumenti di misura, di proprietà della SkyWind S.r.l., sono stati posizionati su traliccio tubolare telescopico.

Tutta la strumentazione è stata montata conformemente a quanto previsto nella IEC 61400-12-1.



1.1.1 Caratteristiche principali

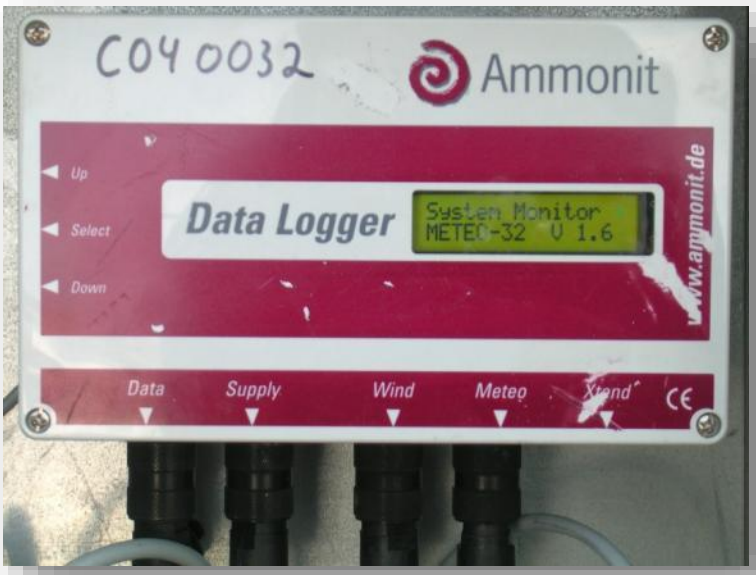
- Il sensore di velocità Vector A100LK a basso consumo di energia della Vector instruments S/N 1263;

- Il sensore di velocità NRG#40 Sine a basso consumo di energia della NRG S/N 179500174535 e S/N 179500167554;

- il sensore di direzione Thies Classic Windvane P 6220 della Ammonit S/N 0305692;

- il sensore di direzione NRG #200P Wind Direction Vane;

- il data logger Ammonit meteo 32 Logger P 2510 della Ammonit S/N T090336;



- il data logger WICOM - 32 della Ammonit S/N T114117;

- La stazione anemometrica è stata corredata con un sensore di temperatura Thermal Sensor P 6311 della Ammonit.

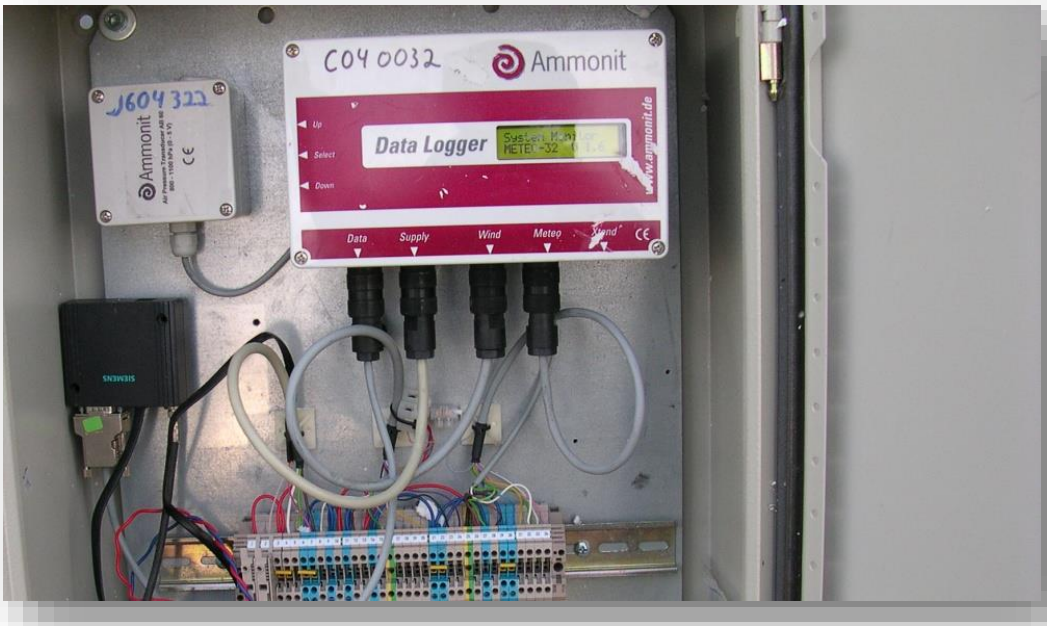
1.2 Report fotografico

Di seguito vengono riportate le immagini delle stazioni anemometriche:

T090336

T090336

T114117



1.3 Dati anemometrici

1.3.1 "Serra Gagliardi" Area 1

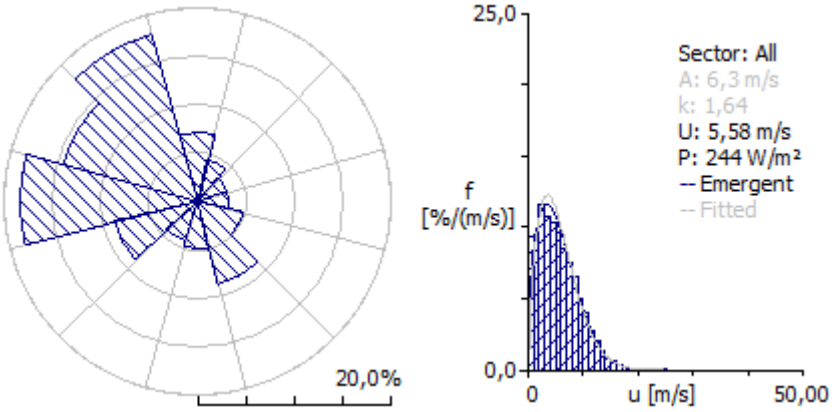
Il periodo di osservazione di un anno è dal 12 agosto 2011 al 31 ottobre 2014 e sono stati elaborati i seguenti modelli di calcolo mediante WASP:

'Vento torre 50m dati a 50m _12_08_2011_31_10_2014_wasp' Observed Wind Climate

Produced on 03/11/2015 at 14:46:12 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Site description: 'Serra Gagliardi'; Position: 40,82°N 16,11°E; Anemometer height: 50,00 m a.g.l.

Parameter	Measured	Emergent	Discrepancy
Mean wind speed [m/s]	5,48 m/s	5,58	1,7%
Mean power density* [W/m²]	243 W/m²	244 W/m²	0,3%



	0	30	60	90	120	150	180	210	240	270	300	330
A	6,5	4,9	3,5	2,9	4,1	5,7	3,3	3,2	6,7	6,9	6,5	8,9
k	2,01	1,71	1,25	1,36	1,52	1,65	1,20	1,07	1,67	1,79	1,90	2,26
U	5,75	4,37	3,26	2,64	3,72	5,10	3,08	3,08	6,00	6,09	5,75	7,87
P*	208	109	74	34	78	182	67	85	292	279	220	479
f	7,2	4,4	3,2	3,3	4,9	8,8	4,8	4,2	8,8	18,2	14,3	18,0

U	0	30	60	90	120	150	180	210	240	270	300	330	All
1,0	79	140	215	245	166	96	201	224	100	47	54	34	93
2,0	53	107	174	204	143	89	193	199	93	53	58	27	84
3,0	75	131	186	219	172	128	201	191	111	104	115	51	116
4,0	95	131	102	125	127	121	140	109	89	116	125	72	108
5,0	134	127	75	90	115	119	79	72	86	118	115	79	103
6,0	148	109	68	59	93	103	52	59	80	108	112	88	97
7,0	127	90	69	32	66	91	41	45	71	95	95	96	86
8,0	101	71	50	12	49	72	31	32	73	87	83	96	75
9,0	69	45	29	5	31	60	26	23	72	74	75	100	65
10,0	42	23	16	4	19	41	16	14	63	58	57	86	50
11,0	30	13	7	3	11	28	10	11	51	46	45	77	40

12,0	15	5	5	1	4	19	5	7	36	31	30	56	27
13,0	10	4	1	0	2	12	3	5	27	24	18	45	20
14,0	7	1	1	1	1	10	1	4	19	16	10	30	13
15,0	5	1	1	0	0	5	0	2	12	9	5	22	8
16,0	4	0	0	0	0	3	1	2	6	5	3	17	6
17,0	4	0	0	0	0	2	1	1	4	4	1	10	4
18,0	3	0	1	0	0	1	0	1	2	2	0	6	2
19,0	1	0	0	0	0	0	0	1	1	2	0	3	1
20,0	0	0	0	0	0	0	0	0	1	1	0	2	1
21,0	0	0	0	0	0	0	0	0	1	1	0	1	0
22,0	0	0	0	0	0	0	0	0	0	0	0	0	0
23,0	0	0	0	0	0	0	0	0	0	0	0	1	0
24,0	0	0	0	0	0	0	0	0	0	0	0	1	0
25,0	0	0	0	0	0	0	0	0	0	0	0	0	0
26,0	0	0	0	0	0	0	0	0	0	0	0	0	0
27,0	0	0	0	0	0	0	0	0	0	0	0	0	0
28,0	0	0	0	0	0	0	0	0	0	0	0	0	0
29,0	0	0	0	0	0	0	0	0	0	0	0	0	0
30,0	0	0	0	0	0	0	0	0	0	0	0	0	0
31,0	0	0	0	0	0	0	0	0	0	0	0	0	0
32,0	0	0	0	0	0	0	0	0	0	0	0	0	0
33,0	0	0	0	0	0	0	0	0	0	0	0	0	0
34,0	0	0	0	0	0	0	0	0	0	0	0	0	0
35,0	0	0	0	0	0	0	0	0	0	0	0	0	0
36,0	0	0	0	0	0	0	0	0	0	0	0	0	0
37,0	0	0	0	0	0	0	0	0	0	0	0	0	0
38,0	0	0	0	0	0	0	0	0	0	0	0	0	0
39,0	0	0	0	0	0	0	0	0	0	0	0	0	0
40,0	0	0	0	0	0	0	0	0	0	0	0	0	0
41,0	0	0	0	0	0	0	0	0	0	0	0	0	0

42,0	0	0	0	0	0	0	0	0	0	0	0	0	0
43,0	0	0	0	0	0	0	0	0	0	0	0	0	0
44,0	0	0	0	0	0	0	0	0	0	0	0	0	0

All-sector statistics

	Weibull-A	Weibull-k	Mean speed	Power density
Source data (169448)	-	-	5,48 m/s	243 W/m²
Fitted	6,3 m/s	1,64	5,62 m/s	244 W/m²
Emergent	-	-	5,58 m/s	244 W/m²
Combined	6,2 m/s	1,62	5,58 m/s	244 W/m²

*Power density values are calculated for air density 1,15 kg/m&sup3 (the WAsP default is 1,225 kg/m&sup3).

A and U are given in m/s, P in W/m² and the frequencies of occurrence in per mille and per cent (f).

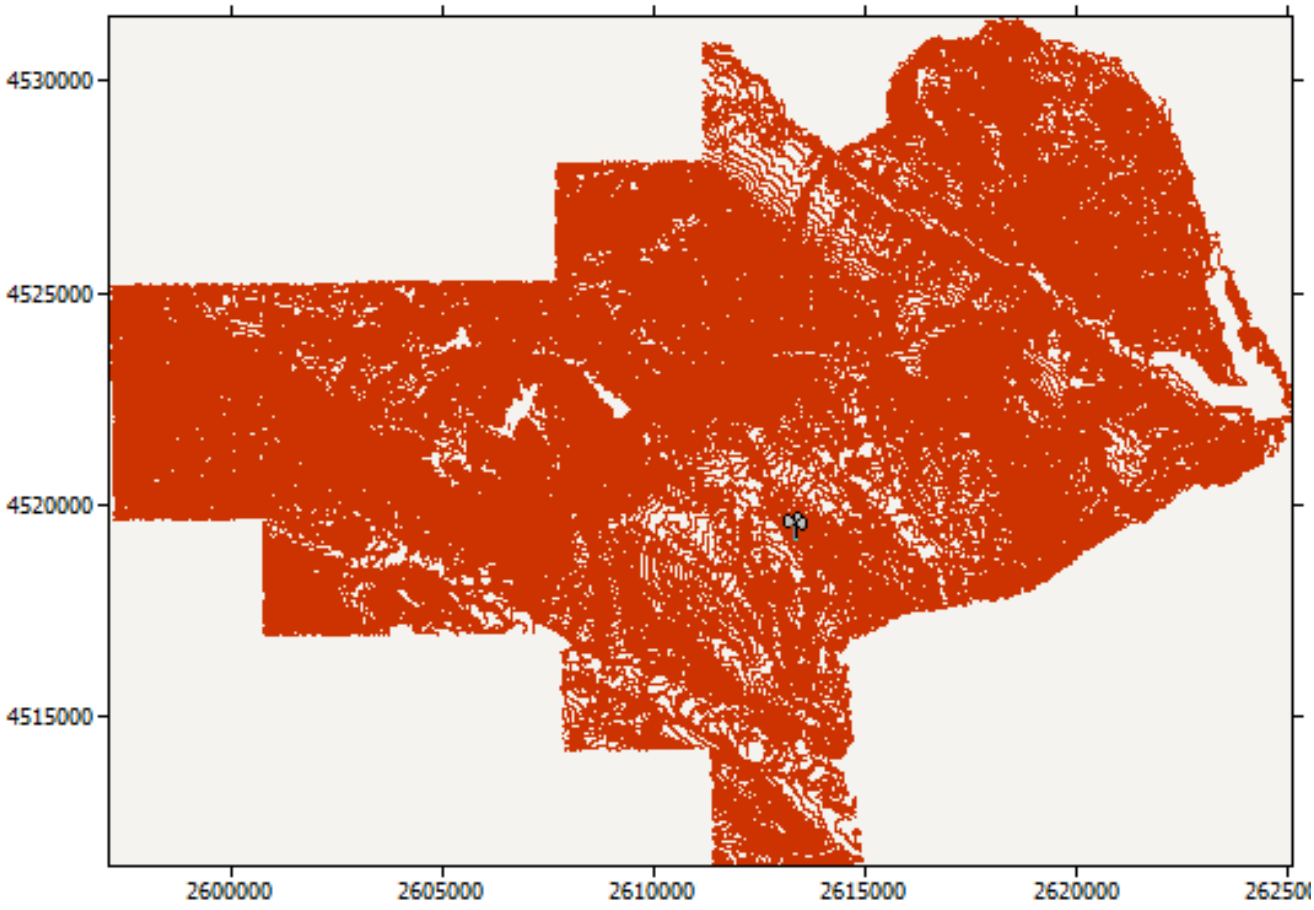
'Serra Gagliardi T090336' Met. Station

Produced on 03/11/2015 at 14:41:44 by licenced user: Skywind S.r.l. using WAsP Version: 10.02.0010

Site information

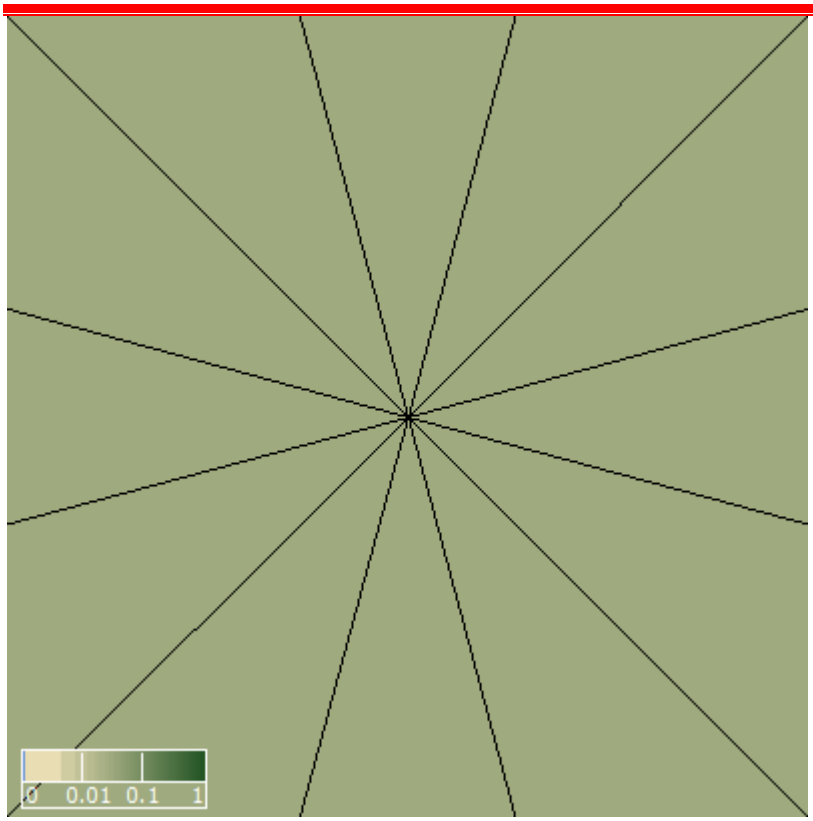
Location in the map

The met. station is located at co-ordinates (2613450,4519180) in a map called 'Genzano'. The associated observed wind climate data were collected at 40,82°N 16,11°E. The site elevation is 387,2 m a.s.l.



Site roughness

The site's roughness information is provided from a rose (the map contains no roughness information).



Site effects

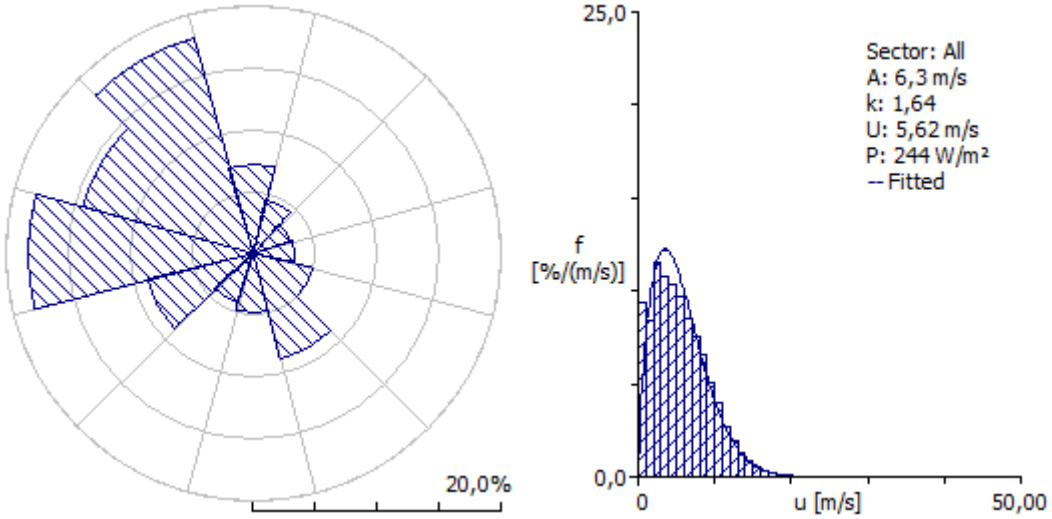
Sector	Angle [°]	Or.Spd [%]	Or.Tur [°]	Obs.Spd [%]	Rgh.Spd [%]	Rix [%]
1	0	16,48	5,9	0,00	0,00	0,1
2	30	25,66	2,2	0,00	0,00	0,3
3	60	24,42	-3,3	0,00	0,00	0,2
4	90	13,79	-6,0	0,00	0,00	0,1
5	120	3,56	-2,7	0,00	0,00	0,1
6	150	5,05	3,9	0,00	0,00	0,0
7	180	16,48	5,9	0,00	0,00	0,5
8	210	25,66	2,2	0,00	0,00	0,4
9	240	24,42	-3,3	0,00	0,00	0,4
10	270	13,79	-6,0	0,00	0,00	0,0

11	300	3,56	-2,7	0,00	0,00	0,0
12	330	5,05	3,9	0,00	0,00	0,0

The all-sector RIX (ruggedness index) for the site is 0,2%

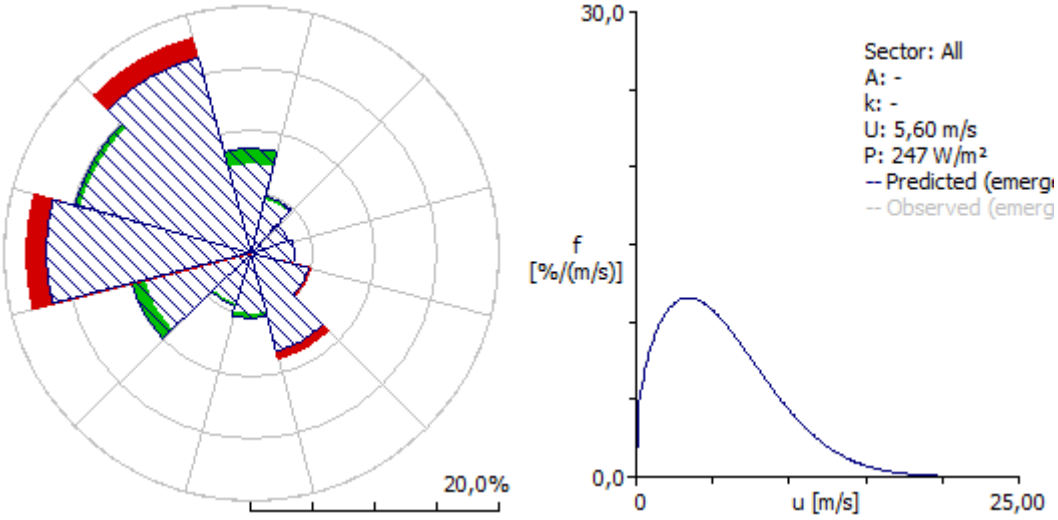
The observed wind climate for the site

-	Weibull fit	Combined	Discrepancy
Mean wind speed	5,62 m/s	5,58 m/s	-0,70%
Mean power density	244 W/m²	244 W/m²	-0,11%



The self-prediction for the met. station

-	Observed	Observed	Predicted	Discrepancy
Mean wind speed	5,62 m/s	5,60 m/s	-0,32%	
Mean power density	244 W/m²	247 W/m²	1,05%	



Project parameters

The met station is in a project called Serra Gagliardi.

Here is a list of all the parameters with non-default values:

Air density: 1,15 (default is 1,23).

'Serra Gagliardi T090336' wind atlas

Produced on 03/11/2015 at 14:53:50 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Reference conditions

The wind atlas contains data for 5 reference roughness lengths (0,000 m, 0,030 m, 0,100 m, 0,400 m, 1,500 m) and 5 reference heights (10 m, 25 m, 50 m, 100 m, 200 m) above ground level. The roses of Weibull parameters have 12 sectors each.

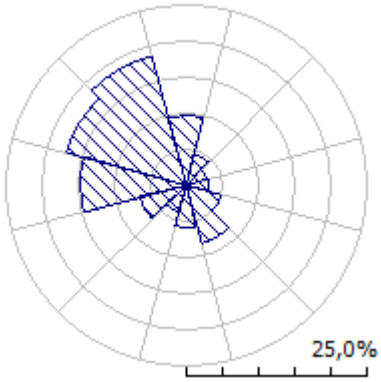
Regional wind climate summary

Height	Parameter	0,00 m	0,03 m	0,10 m	0,40 m	1,50 m
10,0 m	Weibull A [m/s]	5,6	4,0	3,5	2,8	1,9
	Weibull k	1,51	1,37	1,37	1,38	1,37
	Mean speed [m/s]	5,07	3,70	3,22	2,54	1,69
	Power density [W/m²]	203	91	60	29	9
25,0 m	Weibull A [m/s]	6,2	4,9	4,4	3,7	2,8
	Weibull k	1,54	1,45	1,44	1,44	1,43
	Mean speed [m/s]	5,55	4,42	3,97	3,35	2,56
	Power density [W/m²]	257	141	104	62	28

50,0 m	Weibull A [m/s]	6,6	5,7	5,2	4,5	3,6
	Weibull k	1,58	1,59	1,56	1,55	1,52
	Mean speed [m/s]	5,97	5,09	4,65	4,04	3,28
	Power density [W/m²]	308	191	148	98	54
100,0 m	Weibull A [m/s]	7,2	6,7	6,2	5,5	4,6
	Weibull k	1,55	1,68	1,69	1,71	1,68
	Mean speed [m/s]	6,47	6,00	5,52	4,88	4,12
	Power density [W/m²]	403	290	223	152	93
200,0 m	Weibull A [m/s]	7,9	8,2	7,5	6,7	5,7
	Weibull k	1,49	1,63	1,65	1,67	1,67
	Mean speed [m/s]	7,10	7,30	6,70	5,97	5,13
	Power density [W/m²]	564	539	413	287	183

Detailed descriptions

Wind rose for roughness length 0,00 m



Sector frequencies for roughness length 0,00 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	9,6	4,4	3,0	3,1	4,9	8,4	5,8	3,8	6,5	14,5	17,2	18,6

Sector-wise Weibull distributions for roughness length 0,00 m

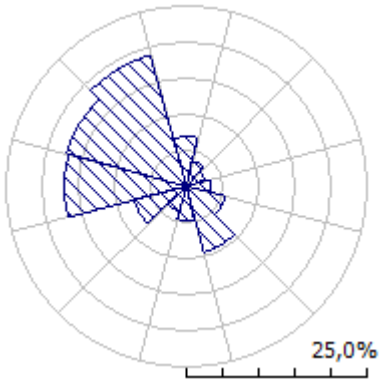
H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	6,5	4,4	3,1	2,6	3,6	5,0	3,6	2,6	5,0	6,0	6,2	7,9
	k	1,70	1,66	1,32	1,24	1,34	1,47	1,20	1,08	1,46	1,69	1,74	1,98
	U	5,84	3,96	2,90	2,46	3,32	4,52	3,41	2,53	4,51	5,33	5,57	7,02
	E	263	84	47	32	69	148	91	47	149	202	221	384
25,0	A	7,2	4,9	3,5	2,9	4,0	5,5	4,0	2,9	5,5	6,6	6,9	8,7
	k	1,75	1,71	1,36	1,28	1,38	1,52	1,24	1,11	1,50	1,74	1,79	2,04
	U	6,40	4,33	3,17	2,70	3,64	4,95	3,73	2,77	4,94	5,84	6,10	7,68
	E	333	106	58	40	86	186	112	58	188	255	280	488
50,0	A	7,7	5,2	3,7	3,1	4,3	5,9	4,3	3,1	5,9	7,1	7,4	9,3
	k	1,80	1,76	1,40	1,31	1,42	1,56	1,27	1,13	1,54	1,79	1,85	2,10
	U	6,88	4,66	3,41	2,90	3,91	5,32	4,01	2,98	5,31	6,28	6,55	8,25
	E	400	128	69	48	102	222	133	68	224	307	337	588
100,0	A	8,4	5,7	4,0	3,4	4,6	6,4	4,7	3,4	6,4	7,6	8,0	10,1
	k	1,75	1,71	1,36	1,28	1,38	1,52	1,24	1,11	1,50	1,74	1,79	2,04
	U	7,46	5,05	3,70	3,15	4,24	5,77	4,35	3,23	5,76	6,81	7,11	8,91
	E	527	169	93	64	136	294	179	92	298	404	443	761
200,0	A	9,2	6,2	4,4	3,7	5,1	7,0	5,1	3,6	7,0	8,4	8,8	11,0
	k	1,68	1,64	1,30	1,22	1,32	1,46	1,19	1,06	1,44	1,67	1,72	1,96
	U	8,20	5,56	4,07	3,46	4,67	6,35	4,79	3,56	6,33	7,49	7,82	9,76
	E	740	237	132	92	195	419	256	134	422	567	622	1040

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Here is a list of all the parameters with non-default values:

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,03 m



Sector frequencies for roughness length 0,03 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	6,8	3,7	2,8	3,3	5,5	9,3	4,6	3,6	7,4	17,0	17,2	18,8

Sector-wise Weibull distributions for roughness length 0,03 m

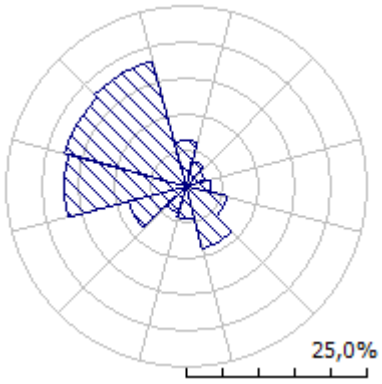
H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	3,9	2,8	2,0	1,8	2,8	3,7	1,9	1,7	3,8	4,3	4,6	6,1
	k	1,61	1,41	1,06	1,07	1,24	1,33	0,99	0,90	1,38	1,48	1,56	1,87
	U	3,53	2,52	1,93	1,73	2,58	3,42	1,94	1,80	3,49	3,88	4,11	5,39
	E	62	28	22	15	37	76	26	26	76	94	102	184
25,0	A	4,7	3,3	2,4	2,2	3,4	4,5	2,4	2,1	4,6	5,2	5,5	7,2
	k	1,73	1,52	1,13	1,15	1,33	1,43	1,07	0,97	1,48	1,60	1,68	1,99
	U	4,22	3,02	2,31	2,07	3,09	4,09	2,33	2,16	4,17	4,65	4,91	6,41
	E	97	42	32	22	55	115	37	38	115	144	158	290
50,0	A	5,5	3,9	2,9	2,6	3,9	5,3	2,9	2,6	5,4	6,0	6,4	8,3
	k	1,94	1,70	1,27	1,28	1,49	1,60	1,19	1,08	1,66	1,79	1,88	2,19
	U	4,88	3,49	2,68	2,39	3,57	4,73	2,69	2,49	4,82	5,37	5,68	7,35
	E	131	56	40	28	72	150	46	45	152	192	214	400

100,0	A	6,5	4,6	3,5	3,1	4,7	6,3	3,4	3,1	6,4	7,2	7,6	9,7
	k	2,08	1,81	1,35	1,37	1,59	1,71	1,26	1,14	1,77	1,91	2,01	2,36
	U	5,77	4,13	3,17	2,83	4,22	5,59	3,18	2,95	5,70	6,35	6,72	8,58
	E	204	86	59	41	108	228	67	65	232	296	331	600
200,0	A	8,0	5,7	4,2	3,8	5,7	7,6	4,1	3,7	7,8	8,7	9,2	11,6
	k	1,99	1,74	1,30	1,31	1,53	1,64	1,22	1,10	1,70	1,83	1,94	2,27
	U	7,05	5,04	3,86	3,46	5,15	6,82	3,88	3,60	6,96	7,76	8,20	10,31
	E	385	164	114	80	208	438	131	128	444	562	626	1071

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,10 m



Sector frequencies for roughness length 0,10 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	6,4	3,6	2,8	3,5	5,9	9,0	4,5	3,9	8,3	16,9	17,4	17,9

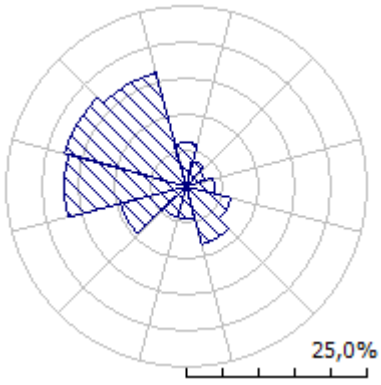
Sector-wise Weibull distributions for roughness length 0,10 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	3,4	2,4	1,7	1,7	2,5	3,2	1,7	1,7	3,4	3,8	4,1	5,2
	k	1,63	1,39	1,08	1,10	1,24	1,31	1,00	0,94	1,40	1,49	1,56	1,85
	U	3,04	2,18	1,69	1,63	2,34	2,93	1,69	1,80	3,09	3,41	3,65	4,64
	E	39	18	14	12	28	49	17	24	52	62	72	120
25,0	A	4,2	3,0	2,2	2,1	3,1	4,0	2,1	2,2	4,2	4,7	5,0	6,4
	k	1,74	1,49	1,15	1,17	1,32	1,39	1,06	0,99	1,49	1,60	1,66	1,96
	U	3,75	2,69	2,09	2,01	2,89	3,61	2,09	2,22	3,82	4,21	4,51	5,70
	E	67	31	23	20	46	83	27	38	87	106	124	209
50,0	A	5,0	3,5	2,6	2,5	3,7	4,7	2,6	2,7	5,0	5,5	5,9	7,5
	k	1,93	1,64	1,26	1,28	1,45	1,54	1,17	1,09	1,65	1,76	1,84	2,13
	U	4,39	3,16	2,45	2,35	3,38	4,23	2,45	2,60	4,48	4,93	5,29	6,64
	E	97	43	31	26	64	114	36	50	123	151	177	304
100,0	A	5,9	4,2	3,2	3,1	4,5	5,6	3,1	3,3	6,0	6,6	7,1	8,8
	k	2,12	1,81	1,39	1,40	1,60	1,69	1,28	1,19	1,81	1,94	2,02	2,34
	U	5,23	3,76	2,92	2,80	4,03	5,04	2,92	3,09	5,33	5,87	6,29	7,82
	E	148	65	44	38	93	170	50	69	185	229	270	456
200,0	A	7,2	5,1	3,9	3,7	5,4	6,9	3,8	4,0	7,3	8,1	8,6	10,6
	k	2,04	1,74	1,33	1,35	1,53	1,62	1,23	1,15	1,74	1,87	1,94	2,26
	U	6,37	4,58	3,56	3,41	4,91	6,14	3,55	3,77	6,49	7,15	7,67	9,40
	E	279	123	85	73	179	324	98	135	349	433	510	818

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,40 m



Sector frequencies for roughness length 0,40 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	6,0	3,5	2,9	3,8	6,4	8,4	4,3	4,4	9,5	16,9	17,5	16,4

Sector-wise Weibull distributions for roughness length 0,40 m

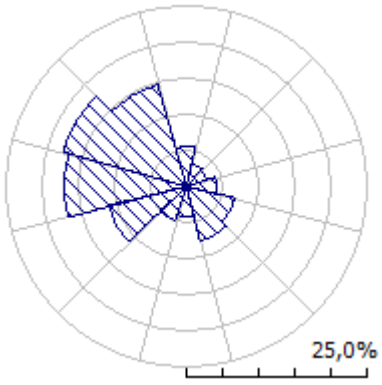
H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	2,6	1,8	1,4	1,5	2,1	2,4	1,4	1,7	2,7	3,0	3,3	4,0
	k	1,60	1,35	1,14	1,15	1,24	1,28	1,06	1,03	1,43	1,50	1,60	1,81
	U	2,34	1,68	1,37	1,42	1,94	2,25	1,39	1,66	2,49	2,70	2,99	3,59
	E	18	9	6	7	16	23	8	15	26	31	38	57
25,0	A	3,5	2,4	1,9	2,0	2,8	3,2	1,9	2,3	3,6	4,0	4,4	5,3
	k	1,69	1,43	1,21	1,22	1,31	1,36	1,12	1,09	1,52	1,59	1,69	1,90
	U	3,08	2,22	1,80	1,87	2,55	2,96	1,82	2,19	3,28	3,55	3,94	4,71
	E	39	18	13	15	32	48	16	29	54	64	81	121
50,0	A	4,2	3,0	2,4	2,5	3,4	4,0	2,3	2,8	4,4	4,8	5,4	6,4
	k	1,85	1,56	1,31	1,32	1,42	1,48	1,21	1,18	1,65	1,73	1,85	2,04
	U	3,72	2,68	2,17	2,26	3,08	3,58	2,21	2,64	3,96	4,29	4,77	5,66
	E	62	29	20	22	50	73	24	44	85	102	129	195

100,0	A	5,1	3,6	2,9	3,0	4,2	4,9	2,9	3,5	5,4	5,9	6,5	7,7
	k	2,09	1,76	1,47	1,49	1,61	1,67	1,36	1,33	1,87	1,96	2,09	2,31
	U	4,51	3,25	2,63	2,73	3,73	4,34	2,67	3,20	4,79	5,20	5,77	6,80
	E	96	43	29	32	74	110	35	62	130	157	202	303
200,0	A	6,2	4,5	3,5	3,7	5,1	5,9	3,5	4,2	6,6	7,2	8,0	9,3
	k	2,01	1,69	1,42	1,44	1,55	1,60	1,31	1,28	1,79	1,88	2,01	2,22
	U	5,52	3,98	3,22	3,35	4,57	5,31	3,27	3,92	5,87	6,37	7,07	8,24
	E	184	83	57	63	143	213	68	122	250	302	386	556

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Air density: 1,15 (default is 1,23)Wind rose for roughness length 1,50 m



Sector frequencies for roughness length 1,50 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	5,6	3,4	3,0	4,1	6,9	7,7	4,2	5,0	11,0	16,9	17,6	14,7

Sector-wise Weibull distributions for roughness length 1,50 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	1,7	1,2	0,9	1,0	1,5	1,6	0,9	1,3	1,9	2,0	2,3	2,6
	k	1,52	1,30	1,04	1,11	1,30	1,26	0,96	1,13	1,45	1,50	1,64	1,76
	U	1,51	1,10	0,85	0,98	1,38	1,46	0,87	1,25	1,68	1,81	2,08	2,33
	E	5	3	2	3	5	6	3	5	8	9	12	16
25,0	A	2,5	1,8	1,3	1,6	2,3	2,4	1,3	2,0	2,8	3,1	3,5	4,0
	k	1,60	1,37	1,09	1,16	1,37	1,33	1,01	1,19	1,53	1,58	1,73	1,84
	U	2,29	1,67	1,29	1,48	2,09	2,21	1,32	1,90	2,55	2,74	3,15	3,52
	E	17	8	6	8	16	20	8	16	25	30	40	52
50,0	A	3,3	2,4	1,7	2,0	3,0	3,1	1,7	2,6	3,7	3,9	4,5	5,1
	k	1,72	1,47	1,17	1,24	1,47	1,43	1,08	1,27	1,64	1,70	1,86	1,96
	U	2,93	2,14	1,65	1,90	2,68	2,84	1,69	2,43	3,27	3,51	4,04	4,50
	E	33	16	11	15	31	38	14	30	48	57	78	102
100,0	A	4,2	3,0	2,2	2,6	3,8	4,0	2,3	3,4	4,6	5,0	5,7	6,3
	k	1,94	1,66	1,31	1,40	1,65	1,61	1,21	1,43	1,85	1,92	2,10	2,19
	U	3,68	2,68	2,07	2,39	3,36	3,56	2,12	3,05	4,11	4,41	5,07	5,62
	E	56	26	17	24	52	64	22	48	82	98	137	179
200,0	A	5,2	3,7	2,8	3,3	4,7	5,0	2,8	4,2	5,8	6,2	7,1	7,9
	k	1,91	1,63	1,29	1,38	1,63	1,59	1,19	1,41	1,83	1,89	2,07	2,18
	U	4,59	3,35	2,59	2,98	4,19	4,44	2,65	3,81	5,13	5,50	6,33	6,96
	E	112	52	34	47	102	126	44	95	163	194	269	341

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Air density: 1,15 (default is 1,23)

1.3.2 "La Mattina Grande" Area 2

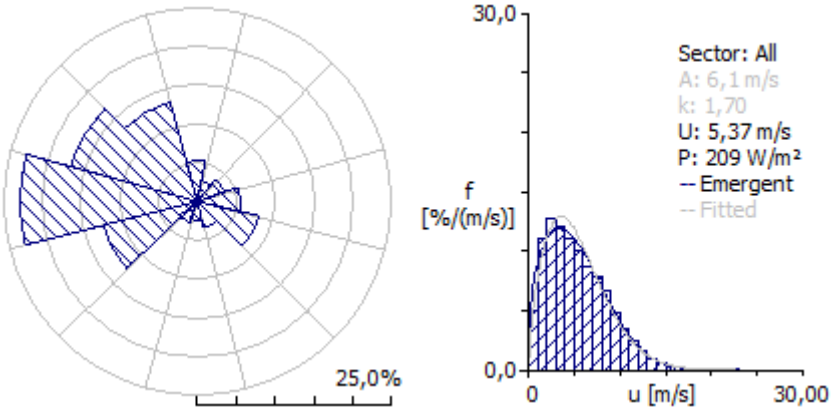
Il periodo di osservazione di un anno è dal 10 settembre 2011 al 31 ottobre 2014 e sono stati elaborati i seguenti modelli di calcolo mediante WASP:

'Vento torre 30m dati a 25m_10_09_2011_31_10_2014_wasp' Observed Wind Climate

Produced on 03/11/2015 at 14:58:33 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Site description: 'La Mattina Grande'; Position: 40,82°N 16,06°E; Anemometer height: 25,00 m a.g.l.

Parameter	Measured	Emergent	Discrepancy
Mean wind speed [m/s]	5,36 m/s	5,37	0,2%
Mean power density* [W/m²]	208 W/m²	209 W/m²	0,3%



	0	30	60	90	120	150	180	210	240	270	300	330
A	5,4	3,7	2,9	3,1	5,0	3,6	2,8	3,5	7,2	5,9	7,9	8,1
k	2,24	1,54	1,24	1,44	1,62	1,30	1,10	1,13	1,87	1,69	2,43	2,36
U	4,78	3,34	2,72	2,78	4,47	3,28	2,69	3,35	6,41	5,24	6,96	7,18

P*	108	56	44	36	125	70	53	97	312	191	313	349
f	5,4	2,8	3,8	5,5	8,1	3,6	2,4	3,0	12,4	22,8	16,8	13,2

U	0	30	60	90	120	150	180	210	240	270	300	330	All
1,0	54	106	101	90	65	131	178	127	36	21	23	23	49
2,0	72	220	286	264	150	246	299	263	88	71	48	31	111
3,0	96	201	272	280	169	181	194	186	109	132	68	39	128
4,0	164	133	136	163	130	129	111	112	103	163	76	73	120
5,0	190	126	71	93	115	90	64	85	91	147	86	102	111
6,0	161	84	52	49	98	77	50	65	87	115	108	120	101
7,0	119	59	37	26	79	51	30	48	81	88	121	118	88
8,0	73	36	19	15	66	39	27	34	84	74	121	121	79
9,0	33	17	11	9	50	23	20	22	77	62	111	110	66
10,0	17	9	7	5	32	12	9	17	66	42	83	81	48
11,0	8	3	4	3	21	8	6	11	58	31	57	62	35
12,0	4	2	2	1	13	5	5	10	44	20	39	45	25
13,0	3	1	1	0	6	4	2	7	30	14	24	29	16
14,0	3	1	0	0	4	2	2	3	19	9	15	18	10
15,0	2	0	0	0	2	2	2	3	13	5	10	11	6
16,0	1	0	1	0	0	0	0	2	7	3	5	6	3
17,0	0	0	0	0	0	0	0	1	4	2	2	5	2
18,0	0	0	0	0	0	0	0	1	1	1	1	2	1
19,0	0	0	0	0	0	0	0	1	1	1	1	0	1
20,0	0	0	0	0	0	0	0	0	1	0	0	1	0
21,0	0	0	0	0	0	0	0	0	0	0	0	0	0
22,0	0	0	0	0	0	0	0	0	0	0	0	0	0
23,0	0	0	0	0	0	0	0	0	0	0	0	0	0

24,0	0	0	0	0	0	0	0	0	0	0	0	0	0
25,0	0	0	0	0	0	0	0	0	0	0	0	0	0
26,0	0	0	0	0	0	0	0	0	0	0	0	0	0
27,0	0	0	0	0	0	0	0	0	0	0	0	0	0

All-sector statistics

	Weibull-A	Weibull-k	Mean speed	Power density
Source data (165312)	-	-	5,36 m/s	208 W/m²
Fitted	6,1 m/s	1,70	5,41 m/s	209 W/m²
Emergent	-	-	5,37 m/s	209 W/m²
Combined	6,0 m/s	1,67	5,37 m/s	209 W/m²

*Power density values are calculated for air density 1,15 kg/m&sup3 (the WAsP default is 1,225 kg/m&sup3).

A and U are given in m/s, P in W/m² and the frequencies of occurrence in per mille and per cent (f).

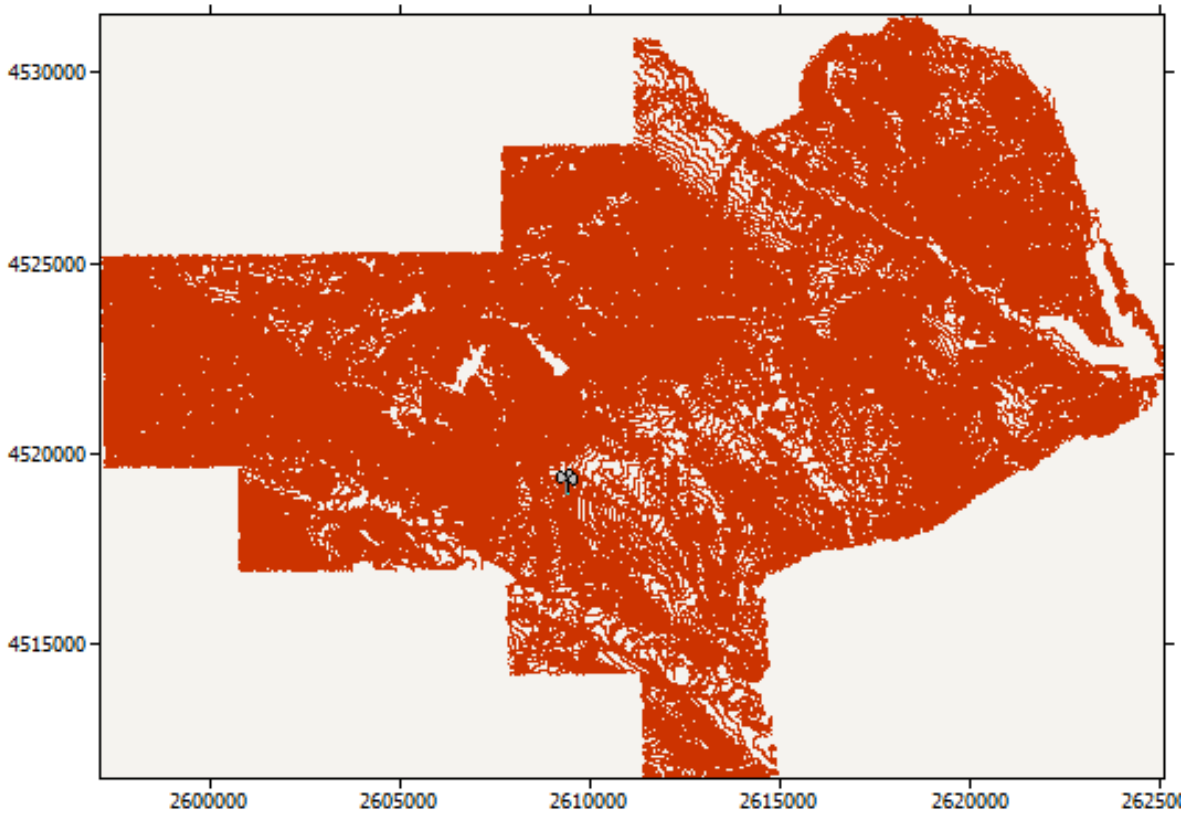
'La Mattina Grande T114117' Met. Station

Produced on 03/11/2015 at 15:01:17 by licenced user: Skywind S.r.l. using WAsP Version: 10.02.0010

Site information

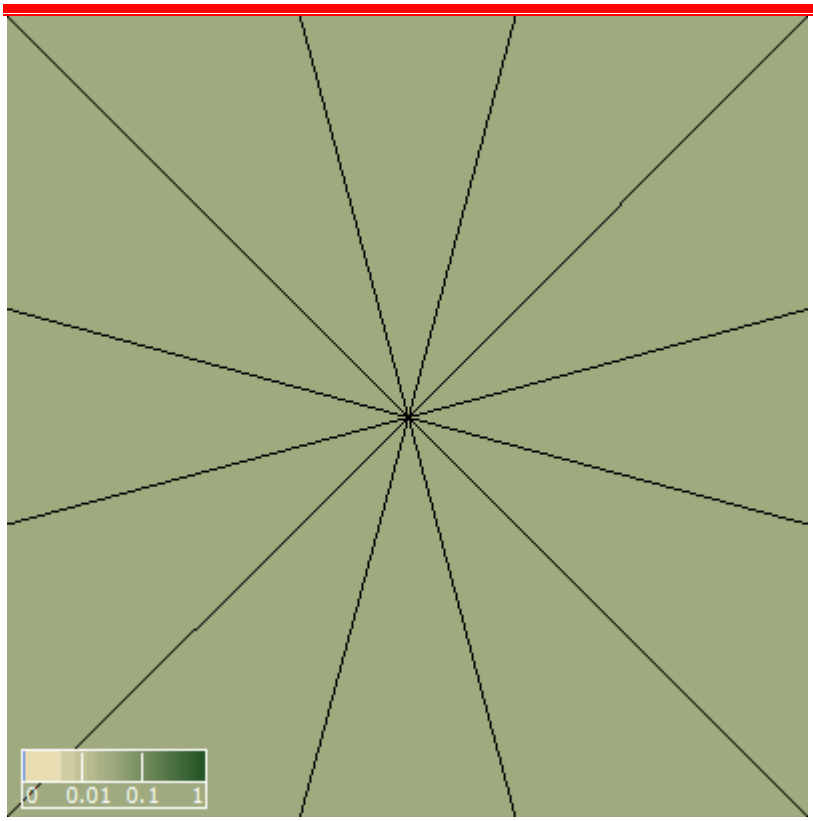
Location in the map

The met. station is located at co-ordinates (2609475,4518923) in a map called 'Genzano'. The associated observed wind climate data were collected at 40,82°N 16,06°E. The site elevation is 398,7 m a.s.l.



Site roughness

The site's roughness information is provided from a rose (the map contains no roughness information).



Site effects

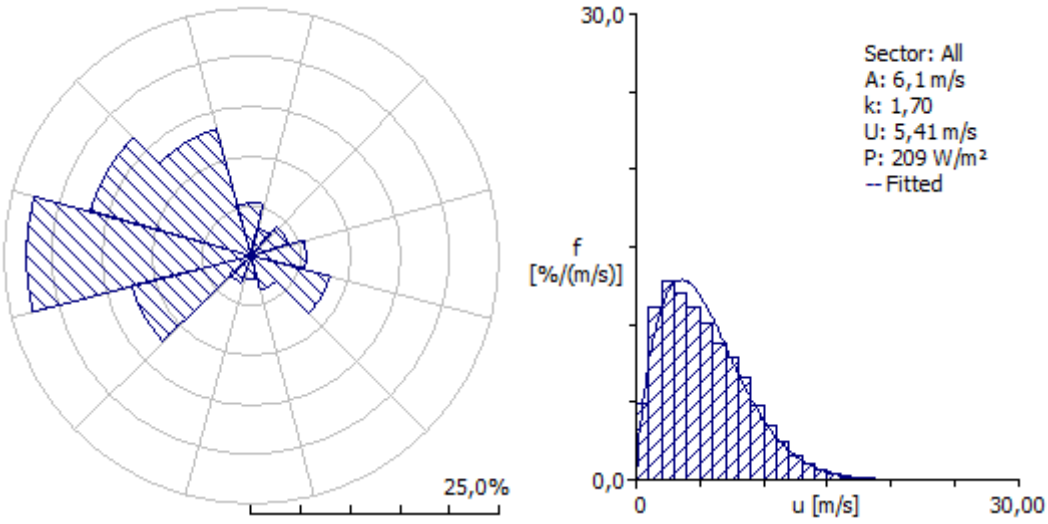
Sector	Angle [°]	Or.Spd [%]	Or.Tur [°]	Obs.Spd [%]	Rgh.Spd [%]	Rix [%]
1	0	3,72	3,9	0,00	0,00	1,1
2	30	15,71	6,4	0,00	0,00	0,4
3	60	25,87	2,6	0,00	0,00	0,2
4	90	25,16	-3,3	0,00	0,00	0,0
5	120	14,17	-6,5	0,00	0,00	0,0
6	150	2,86	-3,2	0,00	0,00	0,1
7	180	3,72	3,9	0,00	0,00	0,9
8	210	15,71	6,4	0,00	0,00	0,9
9	240	25,87	2,6	0,00	0,00	2,9
10	270	25,16	-3,3	0,00	0,00	5,1
11	300	14,17	-6,5	0,00	0,00	2,9

12	330	2,86	-3,2	0,00	0,00	2,2

The all-sector RIX (ruggedness index) for the site is 1,4%

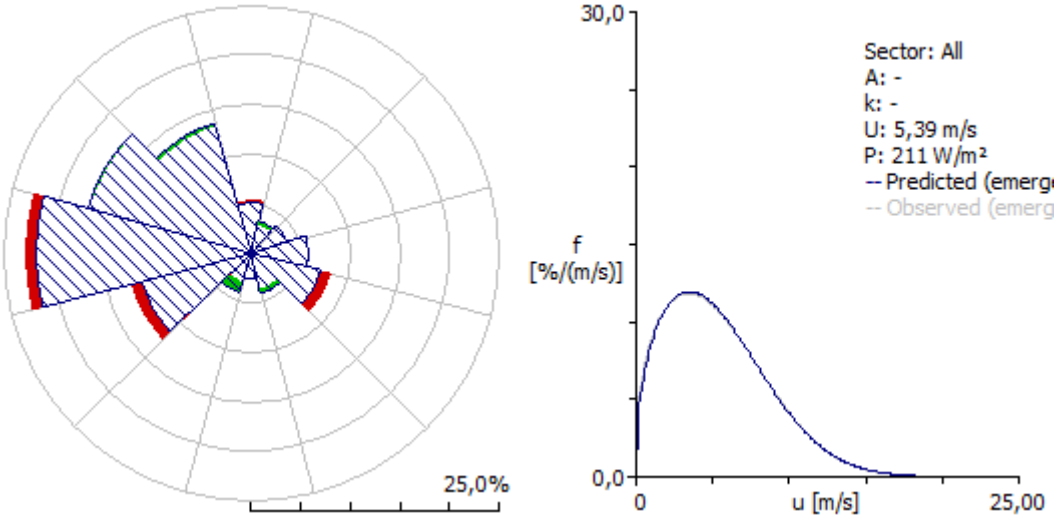
The observed wind climate for the site

-	Weibull fit	Combined	Discrepancy
Mean wind speed	5,41 m/s	5,37 m/s	-0,75%
Mean power density	209 W/m²	209 W/m²	-0,13%



The self-prediction for the met. station

-	Observed	Observed	Predicted	Discrepancy
Mean wind speed	5,41 m/s	5,39 m/s	-0,31%	
Mean power density	209 W/m²	212 W/m²	1,20%	



Project parameters

The met station is in a project called Serra Gagliardi.

Here is a list of all the parameters with non-default values:

Air density: 1,15 (default is 1,23)

'La Mattina Grande T114117' wind atlas

Produced on 03/11/2015 at 15:03:27 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Reference conditions

The wind atlas contains data for 5 reference roughness lengths (0,000 m, 0,030 m, 0,100 m, 0,400 m, 1,500 m) and 5 reference heights (10 m, 25 m, 50 m, 100 m, 200 m) above ground level. The roses of Weibull parameters have 12 sectors each.

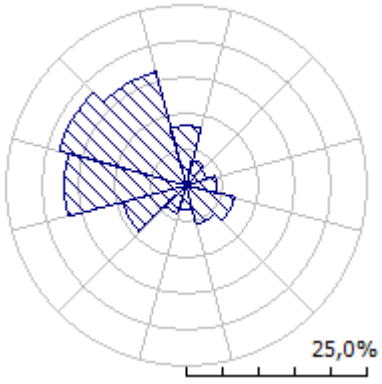
Regional wind climate summary

Height	Parameter	0,00 m	0,03 m	0,10 m	0,40 m	1,50 m
10,0 m	Weibull A [m/s]	6,1	4,4	3,8	3,0	2,0
	Weibull k	1,71	1,54	1,55	1,56	1,56
	Mean speed [m/s]	5,44	3,96	3,45	2,72	1,82
	Power density [W/m²]	212	93	61	30	9
25,0 m	Weibull A [m/s]	6,7	5,3	4,8	4,0	3,1
	Weibull k	1,75	1,64	1,63	1,63	1,63

	Mean speed [m/s]	5,96	4,73	4,25	3,58	2,75
	Power density [W/m²]	269	146	107	64	29
50,0 m	Weibull A [m/s]	7,2	6,1	5,6	4,9	4,0
	Weibull k	1,79	1,78	1,76	1,75	1,72
	Mean speed [m/s]	6,40	5,46	4,98	4,32	3,52
	Power density [W/m²]	326	202	156	103	57
100,0 m	Weibull A [m/s]	7,8	7,2	6,7	5,9	5,0
	Weibull k	1,75	1,88	1,90	1,92	1,90
	Mean speed [m/s]	6,94	6,43	5,91	5,22	4,42
	Power density [W/m²]	425	311	239	163	100
200,0 m	Weibull A [m/s]	8,5	8,8	8,1	7,2	6,2
	Weibull k	1,69	1,84	1,85	1,88	1,88
	Mean speed [m/s]	7,62	7,82	7,18	6,39	5,50
	Power density [W/m²]	587	575	441	306	195

Detailed descriptions

Wind rose for roughness length 0,00 m



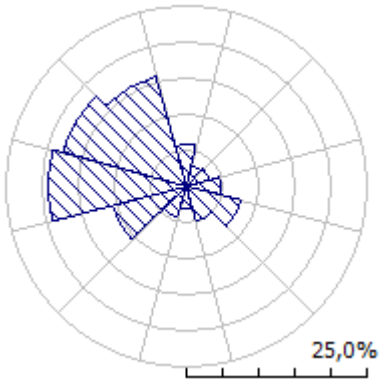
Sector frequencies for roughness length 0,00 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	8,3	3,7	3,1	4,3	6,9	5,6	3,4	4,0	9,0	17,0	18,2	16,4

Sector-wise Weibull distributions for roughness length 0,00 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	7,2	4,5	2,9	2,9	4,4	4,5	3,7	4,7	6,5	5,6	7,1	8,7
	k	2,05	1,80	1,38	1,53	1,51	1,49	1,26	1,33	1,91	1,79	2,17	2,41
	U	6,39	4,04	2,68	2,60	3,96	4,08	3,43	4,35	5,79	4,99	6,25	7,70
	E	280	81	34	27	95	108	85	155	224	154	249	427
25,0	A	7,9	5,0	3,2	3,2	4,8	5,0	4,1	5,2	7,2	6,2	7,7	9,5
	k	2,12	1,86	1,42	1,57	1,56	1,53	1,29	1,38	1,97	1,85	2,24	2,48
	U	7,00	4,42	2,93	2,85	4,33	4,47	3,76	4,76	6,34	5,47	6,85	8,43
	E	356	102	43	34	120	135	106	193	284	195	318	546
50,0	A	8,5	5,4	3,5	3,4	5,2	5,3	4,4	5,6	7,7	6,6	8,3	10,2
	k	2,18	1,91	1,46	1,62	1,60	1,58	1,33	1,41	2,03	1,90	2,30	2,55
	U	7,53	4,75	3,15	3,06	4,66	4,80	4,04	5,12	6,82	5,88	7,36	9,04
	E	432	124	51	40	144	161	125	230	344	235	386	661
100,0	A	9,2	5,8	3,8	3,7	5,6	5,8	4,7	6,1	8,3	7,2	9,0	11,0
	k	2,12	1,86	1,42	1,57	1,56	1,53	1,29	1,38	1,97	1,85	2,23	2,48
	U	8,16	5,15	3,42	3,32	5,05	5,21	4,38	5,55	7,39	6,38	7,98	9,77
	E	566	163	68	53	190	214	168	305	450	308	505	851
200,0	A	10,1	6,4	4,1	4,0	6,2	6,3	5,2	6,6	9,2	7,9	9,9	12,1
	k	2,03	1,78	1,36	1,51	1,49	1,47	1,24	1,32	1,88	1,78	2,14	2,38
	U	8,98	5,67	3,76	3,65	5,56	5,73	4,82	6,10	8,13	7,01	8,78	10,70
	E	785	227	97	76	270	303	241	438	628	431	698	1150

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,03 m



Sector frequencies for roughness length 0,03 m

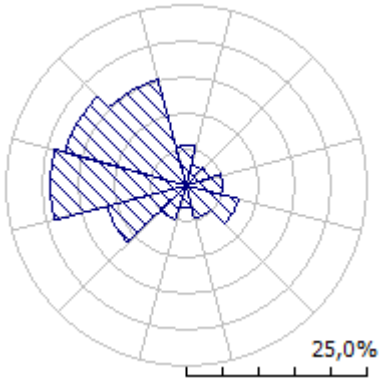
i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	5,9	3,0	3,2	4,6	7,7	4,9	2,9	4,4	10,5	19,1	17,8	15,9

Sector-wise Weibull distributions for roughness length 0,03 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	4,3	2,6	1,9	2,0	3,4	3,2	2,4	3,6	4,8	3,9	5,5	6,6
	k	1,97	1,39	1,14	1,31	1,43	1,26	1,06	1,24	1,72	1,58	2,08	2,21
	U	3,82	2,38	1,81	1,86	3,12	2,93	2,34	3,37	4,26	3,54	4,87	5,84
	E	62	24	15	13	51	52	38	82	100	64	122	199
25,0	A	5,2	3,2	2,3	2,5	4,1	3,8	2,9	4,4	5,7	4,7	6,6	7,8
	k	2,13	1,50	1,22	1,42	1,54	1,36	1,13	1,33	1,86	1,71	2,24	2,35
	U	4,57	2,84	2,17	2,23	3,73	3,51	2,79	4,03	5,10	4,23	5,82	6,94
	E	99	36	23	19	78	79	56	124	157	99	195	317
50,0	A	6,0	3,7	2,7	2,9	4,8	4,5	3,5	5,2	6,7	5,5	7,6	9,0
	k	2,39	1,68	1,37	1,58	1,72	1,52	1,27	1,49	2,08	1,92	2,51	2,59
	U	5,28	3,29	2,51	2,58	4,31	4,06	3,23	4,66	5,89	4,89	6,73	7,95
	E	138	48	28	25	104	102	70	160	216	135	276	445
100,0	A	7,0	4,4	3,3	3,4	5,7	5,4	4,2	6,1	7,9	6,5	9,0	10,4

	k	2,55	1,79	1,46	1,69	1,84	1,62	1,35	1,59	2,23	2,05	2,69	2,78
	U	6,25	3,89	2,97	3,05	5,10	4,80	3,82	5,51	6,97	5,79	7,96	9,28
	E	218	73	43	38	159	155	103	240	336	208	435	674
200,0	A	8,6	5,3	4,0	4,2	7,0	6,5	5,1	7,5	9,6	8,0	10,9	12,5
	k	2,45	1,72	1,40	1,63	1,77	1,56	1,30	1,53	2,14	1,97	2,58	2,68
	U	7,63	4,75	3,62	3,72	6,23	5,86	4,67	6,73	8,51	7,07	9,72	11,13
	E	408	139	82	72	303	297	201	463	635	394	814	1191

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,10 m



Sector frequencies for roughness length 0,10 m

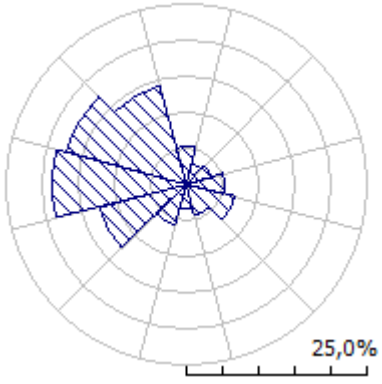
i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	5,6	3,0	3,4	4,9	7,4	4,8	3,1	5,0	11,3	18,9	17,5	15,2

Sector-wise Weibull distributions for roughness length 0,10 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	3,7	2,1	1,8	1,9	3,0	2,7	2,2	3,3	4,0	3,5	4,9	5,7
	k	2,01	1,31	1,25	1,25	1,43	1,27	1,05	1,31	1,67	1,61	2,08	2,18

	U	3,27	1,97	1,67	1,78	2,72	2,55	2,11	3,07	3,59	3,18	4,30	5,03
	E	38	15	10	12	34	34	29	56	62	46	84	129
25,0	A	4,6	2,7	2,2	2,4	3,7	3,4	2,7	4,2	5,0	4,4	6,0	7,0
	k	2,15	1,40	1,34	1,34	1,53	1,35	1,12	1,40	1,79	1,72	2,22	2,31
	U	4,04	2,43	2,06	2,19	3,36	3,15	2,61	3,79	4,44	3,92	5,30	6,17
	E	68	25	16	20	58	58	47	95	108	79	149	227
50,0	A	5,3	3,2	2,7	2,8	4,4	4,1	3,3	4,9	5,9	5,2	7,0	8,1
	k	2,38	1,54	1,47	1,47	1,69	1,49	1,23	1,55	1,98	1,90	2,46	2,51
	U	4,73	2,85	2,42	2,57	3,94	3,69	3,06	4,45	5,20	4,60	6,22	7,19
	E	100	35	23	27	81	79	63	132	156	113	221	336
100,0	A	6,3	3,8	3,2	3,4	5,3	4,9	4,0	5,9	7,0	6,2	8,3	9,5
	k	2,62	1,69	1,62	1,62	1,85	1,63	1,35	1,70	2,18	2,09	2,71	2,76
	U	5,63	3,40	2,87	3,06	4,69	4,39	3,64	5,30	6,19	5,47	7,40	8,46
	E	157	52	33	40	122	117	89	196	241	173	348	513
200,0	A	7,7	4,6	3,9	4,1	6,4	6,0	4,8	7,2	8,5	7,5	10,2	11,4
	k	2,51	1,63	1,56	1,56	1,78	1,57	1,29	1,63	2,09	2,01	2,60	2,67
	U	6,87	4,14	3,50	3,73	5,71	5,35	4,43	6,45	7,55	6,67	9,02	10,15
	E	292	99	64	77	232	224	173	373	452	325	648	908

Air density: 1,15 (default is 1,23)Wind rose for roughness length 0,40 m



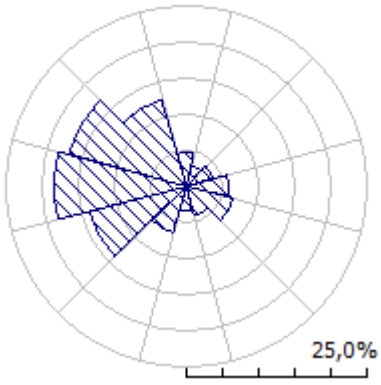
Sector frequencies for roughness length 0,40 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	5,3	3,0	3,6	5,3	7,0	4,5	3,2	5,7	12,5	18,6	17,2	14,0

Sector-wise Weibull distributions for roughness length 0,40 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	2,8	1,7	1,5	1,7	2,4	2,1	1,8	2,8	3,0	2,9	3,9	4,4
	k	1,92	1,39	1,37	1,30	1,42	1,23	1,07	1,41	1,63	1,67	2,08	2,13
	U	2,50	1,58	1,38	1,59	2,15	1,97	1,77	2,54	2,72	2,62	3,45	3,88
	E	18	7	5	8	17	17	16	28	28	24	43	60
25,0	A	3,7	2,3	2,0	2,3	3,1	2,8	2,4	3,7	4,0	3,9	5,1	5,7
	k	2,04	1,47	1,46	1,38	1,51	1,31	1,13	1,49	1,73	1,76	2,21	2,24
	U	3,29	2,08	1,81	2,10	2,83	2,59	2,33	3,34	3,59	3,45	4,55	5,09
	E	39	14	10	16	35	34	33	59	60	52	94	130
50,0	A	4,5	2,8	2,4	2,8	3,8	3,4	3,0	4,5	4,9	4,7	6,2	6,9
	k	2,22	1,60	1,58	1,50	1,64	1,42	1,23	1,62	1,88	1,92	2,41	2,41
	U	3,98	2,51	2,19	2,53	3,42	3,13	2,82	4,04	4,34	4,18	5,50	6,11
	E	63	23	15	25	55	52	49	92	95	83	155	213
100,0	A	5,4	3,4	3,0	3,4	4,7	4,2	3,7	5,5	5,9	5,7	7,5	8,2
	k	2,51	1,81	1,78	1,69	1,86	1,60	1,38	1,83	2,13	2,17	2,72	2,71
	U	4,82	3,04	2,65	3,07	4,14	3,79	3,41	4,89	5,25	5,05	6,65	7,33
	E	101	34	23	38	84	78	70	141	150	131	252	338
200,0	A	6,7	4,2	3,6	4,2	5,7	5,2	4,5	6,7	7,3	7,0	9,2	10,0
	k	2,42	1,74	1,72	1,63	1,79	1,54	1,33	1,76	2,05	2,09	2,62	2,62
	U	5,91	3,73	3,25	3,76	5,07	4,65	4,18	5,99	6,43	6,19	8,15	8,88
	E	192	66	45	74	162	151	138	271	285	250	475	615

Air density: 1,15 (default is 1,23)Wind rose for roughness length 1,50 m



Sector frequencies for roughness length 1,50 m

i	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
[°]	0	30	60	90	120	150	180	210	240	270	300	330
f [%]	4,8	3,1	3,9	5,7	6,6	4,2	3,4	6,7	14,0	18,2	16,8	12,6

Sector-wise Weibull distributions for roughness length 1,50 m

H	i	1	2	3	4	5	6	7	8	9	10	11	12
	°	0	30	60	90	120	150	180	210	240	270	300	330
10,0	A	1,8	1,0	0,9	1,2	1,6	1,4	1,4	2,0	2,0	2,1	2,7	2,8
	k	1,80	1,22	1,21	1,29	1,47	1,28	1,16	1,50	1,62	1,71	2,10	2,07
	U	1,60	0,97	0,85	1,15	1,46	1,34	1,30	1,76	1,76	1,84	2,36	2,52
	E	5	2	1	3	5	5	5	9	8	8	14	17
25,0	A	2,7	1,6	1,4	1,9	2,5	2,2	2,1	3,0	3,0	3,1	4,0	4,3
	k	1,89	1,28	1,27	1,36	1,54	1,35	1,22	1,58	1,71	1,80	2,21	2,17
	U	2,42	1,46	1,29	1,73	2,21	2,02	1,97	2,67	2,67	2,78	3,58	3,81
	E	17	6	4	10	16	15	17	28	25	26	46	56
50,0	A	3,5	2,1	1,8	2,5	3,2	2,9	2,7	3,8	3,9	4,0	5,2	5,5
	k	2,03	1,38	1,36	1,46	1,66	1,45	1,31	1,70	1,83	1,94	2,38	2,31
	U	3,11	1,88	1,65	2,23	2,83	2,60	2,52	3,42	3,43	3,57	4,59	4,87
	E	33	12	8	18	31	29	31	53	49	51	91	111
100,0	A	4,4	2,6	2,3	3,1	4,0	3,6	3,5	4,8	4,9	5,1	6,5	6,8

	k	2,30	1,55	1,53	1,64	1,88	1,63	1,47	1,92	2,07	2,19	2,69	2,57
	U	3,90	2,35	2,07	2,79	3,56	3,26	3,17	4,30	4,30	4,47	5,76	6,07
	E	57	19	13	30	53	48	51	91	85	90	164	199
200,0	A	5,5	3,3	2,9	3,9	5,0	4,5	4,4	6,0	6,1	6,3	8,1	8,5
	k	2,27	1,53	1,51	1,62	1,85	1,61	1,45	1,89	2,04	2,16	2,65	2,56
	U	4,87	2,94	2,59	3,49	4,44	4,07	3,96	5,36	5,37	5,59	7,19	7,51
	E	113	39	27	59	104	95	102	179	167	178	323	377

Project parameters

The wind atlas is in a project called Serra Gagliardi.

Air density: 1,15 (default is 1,23).

2. Modello di simulazione del campo eolico

2.1. 'Serra Gagliardi T090336' Met. Station

'Turbine La Mattina Grande Vestas V112-3.6MW' wind farm

Produced on 17/03/2016 at 11:12:00 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Summary results

Parameter	Total	Average	Minimum	Maximum
Net AEP [GWh]	87,304	8,730	8,164	9,479
Gross AEP [GWh]	94,998	9,500	9,074	9,792
Wake loss [%]	8,1	-	-	-

Site results

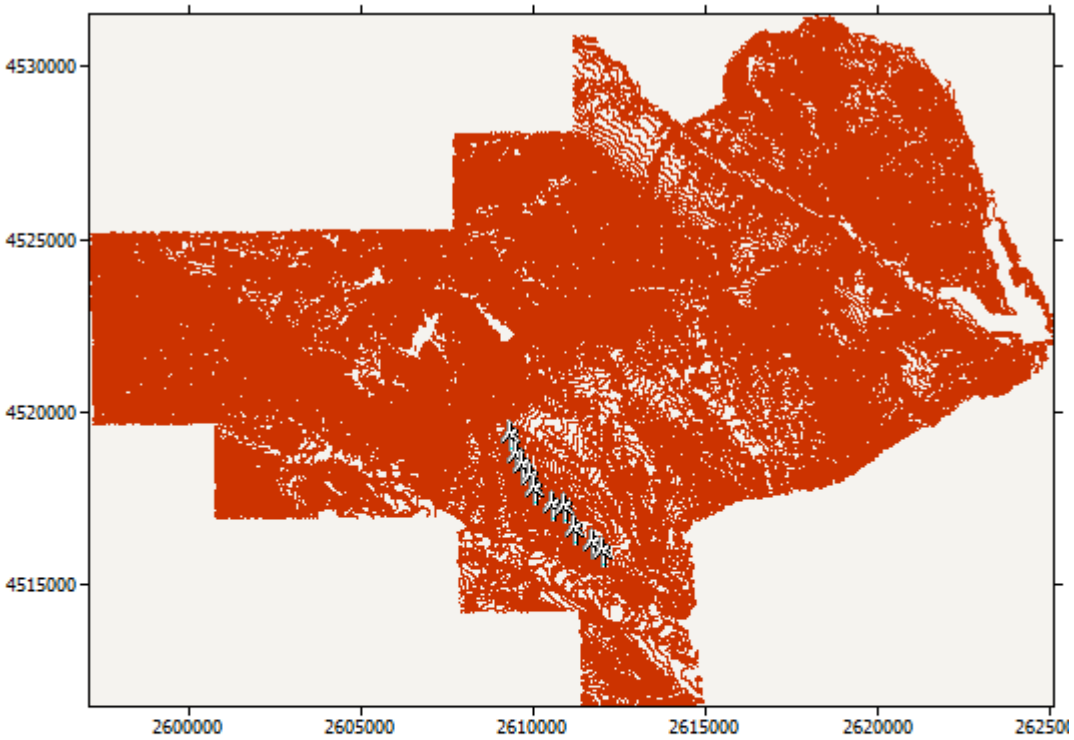
Site	Location [m]	Turbine	Elevation [m a.s.l.]	Height [m a.g.l.]	Net AEP [GWh]	Wake loss [%]
Turbine site TR11	(2609432, 4518916)	Vestas V112 (3.6 MW)	399,891	119	9,479	2,07
Turbine site TR10	(2609632, 4518376)	Vestas V112 (3.6 MW)	376,0018	119	8,615	6,69
Turbine site TR12	(2609803, 4518038)	Vestas V112 (3.6 MW)	375,7961	119	8,375	10,93
Turbine site TR13	(2609987, 4517703)	Vestas V112 (3.6 MW)	376,8201	119	8,490	12,31
Turbine site TR14	(2610151, 4517363)	Vestas V112 (3.6 MW)	371,223	119	8,676	11,4
Turbine site TR01	(2610639,0, 4516924,0)	Vestas V112 (3.6 MW)	350,9225	119	8,825	6,81
Turbine site	(2611024,	Vestas V112	332,6517	119	8,164	10,03

TR02	4516827)	(3.6 MW)				
Turbine site	(2611275,0,	Vestas V112	327,4169	119	8,796	6,93
TR03	4516198,0)	(3.6 MW)				
Turbine site	(2611800,	Vestas V112	325,9323	119	9,016	6,39
TR04	4515814)	(3.6 MW)				
Turbine site	(2612100,	Vestas V112	322,0629	119	8,867	7,44
TR05	4515541)	(3.6 MW)				

Site wind climates

Site	Location [m]	Height [m a.g.l.]	A [m/s]	k	U [m/s]	E [W/m²]	RIX [%]	dRIX [%]
Turbine site TR11	(2609432, 4518916)	119	7,3	1,69	6,55	374	1,5	1,3
Turbine site TR10	(2609632, 4518376)	119	7,1	1,69	6,38	344	1,0	0,9
Turbine site TR12	(2609803, 4518038)	119	7,2	1,69	6,44	354	0,8	0,6
Turbine site TR13	(2609987, 4517703)	119	7,3	1,69	6,55	373	0,6	0,4
Turbine site TR14	(2610151, 4517363)	119	7,4	1,69	6,59	381	0,6	0,5
Turbine site TR01	(2610639,0, 4516924,0)	119	7,2	1,68	6,47	361	0,5	0,3
Turbine site TR02	(2611024, 4516827)	119	7,1	1,68	6,32	336	0,6	0,4
Turbine site TR03	(2611275,0, 4516198,0)	119	7,2	1,68	6,46	360	0,7	0,6
Turbine site TR04	(2611800, 4515814)	119	7,3	1,68	6,53	372	0,7	0,5
Turbine site TR05	(2612100, 4515541)	119	7,3	1,69	6,51	367	0,7	0,5

The wind farm lies in a map called 'Genzano'.



The wind farm is in a project called 'Serra Gagliardi'
A wind atlas called 'Serra Gagliardi T090336' was used to calculate the predicted wind climates

Project parameters

The wind farm is in a project called Serra Gagliardi.

Here is a list of all the parameters with non-default values:
Air density: 1,15 (default is 1,23)

2.2. 'La Mattina Grande T114117' Met. Station

'Turbine La Mattina Grande Vestas V112-3.6MW' wind farm

Produced on 17/03/2016 at 11:20:17 by licenced user: Skywind S.r.l. using WAsP version: 10.02.0010.

Summary results

Parameter	Total	Average	Minimum	Maximum
Net AEP [GWh]	100,964	10,096	9,312	10,980
Gross AEP [GWh]	108,277	10,828	10,292	11,162
Wake loss [%]	6,75	-	-	-

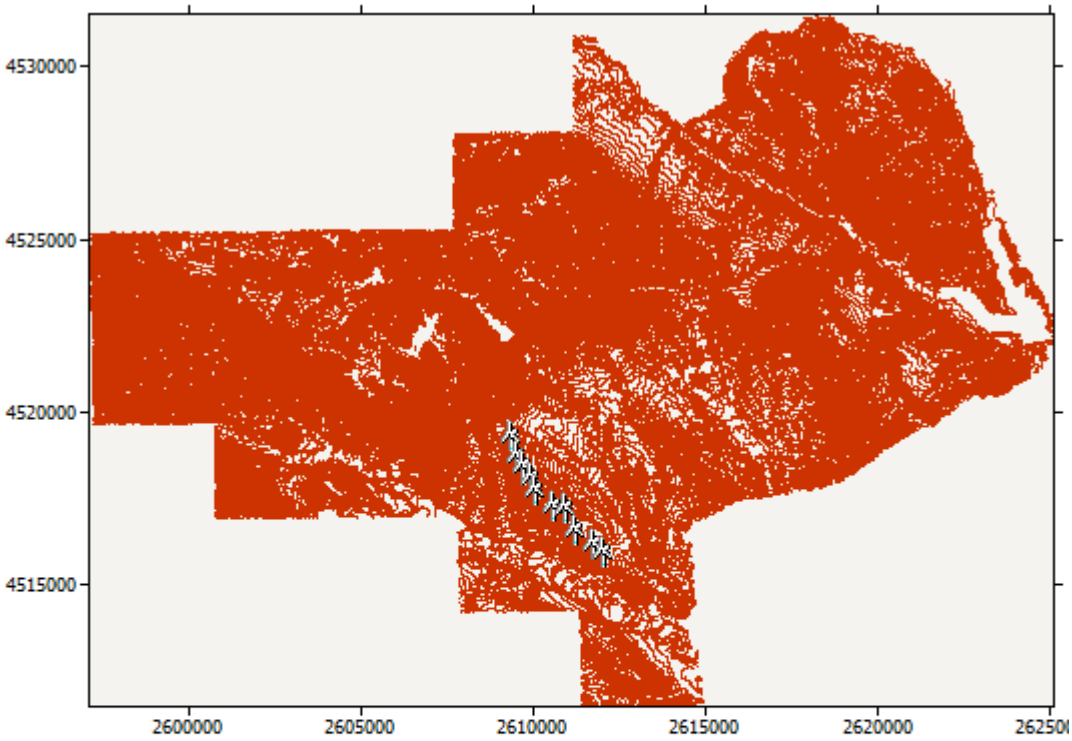
Site results

Site	Location [m]	Turbine	Elevation [m a.s.l.]	Height [m a.g.l.]	Net AEP [GWh]	Wake loss [%]
Turbine site TR11	(2609432, 4518916)	Vestas V112 (3.6 MW)	399,891	119	10,980	0,78
Turbine site TR10	(2609632, 4518376)	Vestas V112 (3.6 MW)	376,0018	119	10,137	4,05
Turbine site TR12	(2609803, 4518038)	Vestas V112 (3.6 MW)	375,7961	119	9,948	7,67
Turbine site TR13	(2609987, 4517703)	Vestas V112 (3.6 MW)	376,8201	119	10,040	9,19
Turbine site TR14	(2610151, 4517363)	Vestas V112 (3.6 MW)	371,223	119	10,084	9,66
Turbine site TR01	(2610639,0, 4516924,0)	Vestas V112 (3.6 MW)	350,9225	119	10,078	6,51
Turbine site TR02	(2611024, 4516827)	Vestas V112 (3.6 MW)	332,6517	119	9,312	9,52
Turbine site TR03	(2611275,0, 4516198,0)	Vestas V112 (3.6 MW)	327,4169	119	10,066	6,32
Turbine site TR04	(2611800, 4515814)	Vestas V112 (3.6 MW)	325,9323	119	10,272	6,28
Turbine site TR05	(2612100, 4515541)	Vestas V112 (3.6 MW)	322,0629	119	10,047	7,62

Site wind climates

Site	Location [m]	Height [m a.g.l.]	A [m/s]	k	U [m/s]	E [W/m²]	RIX [%]	dRIX [%]
Turbine site TR11	(2609432, 4518916)	119	8,0	1,90	7,07	408	1,5	0,1
Turbine site TR10	(2609632, 4518376)	119	7,8	1,91	6,89	377	1,0	-0,4
Turbine site TR12	(2609803, 4518038)	119	7,9	1,91	6,97	389	0,8	-0,6
Turbine site TR13	(2609987, 4517703)	119	8,0	1,90	7,07	408	0,6	-0,8
Turbine site TR14	(2610151, 4517363)	119	8,0	1,90	7,10	415	0,6	-0,7
Turbine site TR01	(2610639,0, 4516924,0)	119	7,8	1,90	6,96	392	0,5	-0,9
Turbine site TR02	(2611024, 4516827)	119	7,7	1,89	6,79	364	0,6	-0,8
Turbine site TR03	(2611275,0, 4516198,0)	119	7,8	1,89	6,95	391	0,7	-0,7
Turbine site TR04	(2611800, 4515814)	119	7,9	1,90	7,03	403	0,7	-0,7
Turbine site TR05	(2612100, 4515541)	119	7,9	1,89	7,00	399	0,7	-0,7

The wind farm lies in a map called 'Genzano'.



The wind farm is in a project called 'Serra Gagliardi'
A wind atlas called 'La Mattina Grande T114117' was used to calculate the predicted wind climates

Project parameters

The wind farm is in a project called Serra Gagliardi.

Here is a list of all the parameters with non-default values:
Air density: 1,15 (default is 1,23)

3. Certificazioni

Alla pagine seguente, si riporta la certificazione di installazione delle torri anemometriche, da parte del Comune di Genzano di Lucania (PZ) ed i certificati di taratura degli anemometri.

COMUNE DI GENZANO DI LUCANIA

PROVINCIA DI POTENZA
Cod. Fisc. 80001970765 - Serv. tesoreria c/c p. n. 14313852
Tel. 0971-1933038 Fax. 0971-1933048

AREA TECNICA

Genzano di Lucania lì 18 aprile 2012

Prot. n. 1597

Spett.le Ing. MARTELLUCCI Mariano
Legale rappresentante della
Società SKYWIND S.r.l.
Via Unnici, 1
4026 MINTURNO (LT)

Oggetto: installazione apparecchiatura per rilevazioni anemometriche.

In riferimento all'oggetto ed alla Vs. istanza del 28/02/2012 acquisita agli atti di questo Ente in data 01/03/2012 prot. n. 1597;

Vista:

- la S.C.I.A. n. 07 del 27/06/2011, avente ad oggetto " Installazione Tralicci per anemologia" sui terreni distinti in catasto al fg. 75 p.lla 471 e al fg. 73 p.lla 483;
- la comunicazione inizio lavori, a firma del Geom. Di Santi Fabrizio acquisita agli atti di questo Ente il 17/08/2011 al prot. n. 7468;
- il certificato di fine lavori, a firma del Geom. Di Santi Fabrizio acquisita agli atti di questo Ente il 13/09/2011 al prot. n. 8243;
- la relazione prot. n. 2333 del 27/03/2012 dell'Area di Vigilanza, "... *inerente l'accertamento dell'avvenuta istallazione delle torri anemometriche alle c.da Serra Gagliardi c/o azienda Falanga Pasquale e Canio e c.da Mattina Grande c/o terreno di proprietà Cardacino Francesco*";

SI RENDE NOTO

che la Skywind S.r.l. con S.C.I.A. n. 07/2011, ha comunicato la esecuzione dei lavori di installazione di due torri anemometriche sui terreni distinti in catasto al fg. 75 p.lla 471 e al fg. 73 p.lla 483, così come confermato e dal direttore dei lavori con la nota in premessa specificata.

Distinti Saluti.

IL RESPONSABILE DELL'UFFICIO TECNICO
Ing. Maria Vita ROSSINI

OTECH ENGINEERING INC.

ANEMOMETER CALIBRATION REPORT

Test Date: 31 January 2011 **Revision No: 0**

630 Peña Drive, Suite 800
Davis, CA 95618-7726
Office: (530) 757-2264
http://www.otechwind.com

Customer Information

NRG Systems, Inc.
110 Riggs Road
Hinesburg, VT 05461
USA

Instrument Under Test (IUT)

Model No: NRG #40 Sine
Serial No: 179500167554
Output: Sine Wave
IUT Power: 0 VDC
Heater Power: 0 VDC
Mount Diameter: 12.7 mm
Test Procedure: OTECH-CP-001

Wind Tunnel Test Facility

Otech Tunnel ID: WT2B
Type : Eiffel (open circuit, suction)
Test Section Size : 0.61 m x 0.61 m x 1.22 m
Manufacturer : Engineering Laboratory Design, Inc.

Data Acquisition

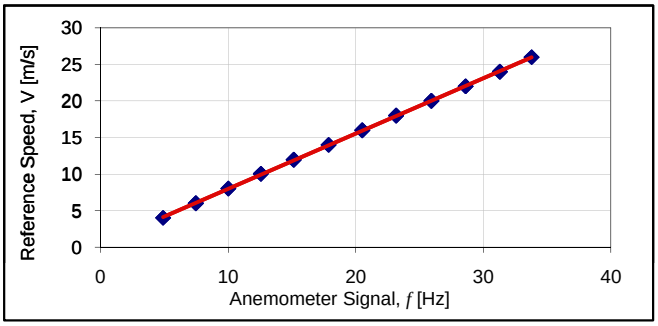
Hardware : National Instruments CDAQ-9172 USB 2.0 chassis with NI 9205 32-chan 16-bit AI module
Software : National Instruments LabVIEW 2010
Signal Reduction Method for IUT: FFT Analysis

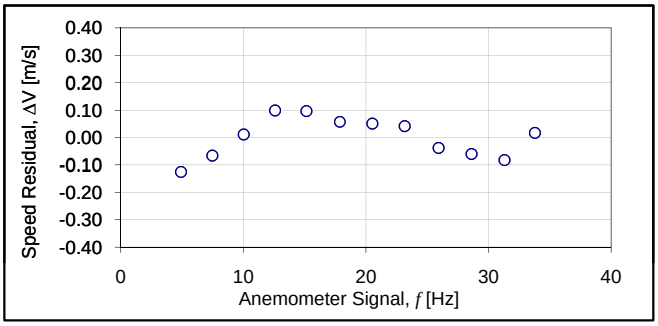
Measuring Equipment

Reference Speed : Four United Sensor Type PA Pitot-static tubes sensed by an MKS Barotron Type 220D Differential Pressure Transducer (NIST traceable)
Amb. Pressure : Setra Model 270 Barometer (NIST traceable)
Amb. Temperature : OMEGA HX94 SS Probe (NIST traceable)
Relative Humidity : OMEGA HX94 SS Probe (NIST traceable)

Test Conditions

Reference Speed Position Correction = 1
Reference Speed Blockage Correction = 1
Mean Ambient Pressure = 102,284 Pa
Mean Ambient Temperature = 22.9 deg C
Mean Relative Humidity = 42.6% RH
Mean Density = 1.1988 kg/cubic meter





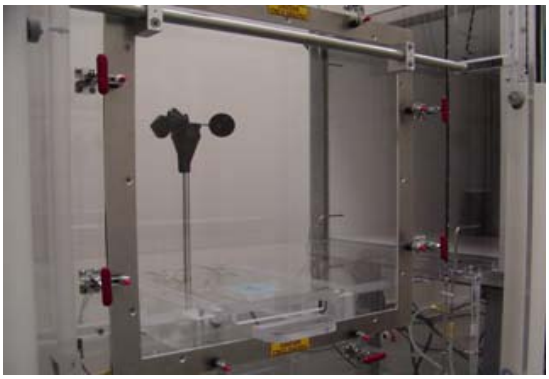
Transfer Function Test Results:

V [m/s] = 0.757 f [Hz] + 0.41

Regression Parameters

r = 0.99995
std. err. estimate =0.0768 m/s
slope =0.757 m/s per Hz
std. err. slope =0.00243 m/s per Hz
offset =0.41 m/s
std. err. offset =0.05179 m/s

Reference Speed [m/s]	Anemometer Output [Hz]	Residual [m/s]	Ref. Speed Uncertainty
3.992	4.900	-0.125	0.490%
7.998	10.012	0.011	0.559%
11.961	15.134	0.097	0.482%
15.984	20.508	0.051	0.473%
19.994	25.922	-0.038	0.499%
24.011	31.287	-0.082	0.470%
25.992	33.773	0.016	0.472%
22.001	28.603	-0.060	0.476%
17.980	23.157	0.042	0.470%
13.987	17.861	0.057	0.474%
10.020	12.568	0.098	0.472%
5.994	7.467	-0.066	0.479%



***Note*: Generic photo of test set-up**

Approved by: Adam Havner, Lab Manager

OTECH ENGINEERING INC.

ANEMOMETER CALIBRATION REPORT

Test Date: 23 May 2011 **Revision No: 0**

630 Peña Drive, Suite 800
Davis, CA 95618-7726
Office: (530) 757-2264
http://www.otechwind.com

Customer Information

NRG Systems, Inc.
110 Riggs Road
Hinesburg, VT 05461
USA

Instrument Under Test (IUT)

Model No: NRG #40 Sine
Serial No: 179500174535
Output: Sine Wave
IUT Power: 0 VDC
Heater Power: 0 VDC
Mount Diameter: 12.7 mm
Test Procedure: OTECH-CP-001

Wind Tunnel Test Facility

Otech Tunnel ID: WT1C
Type : Eiffel (open circuit, suction)
Test Section Size : 0.61 m x 0.61 m x 1.22 m
Manufacturer : Engineering Laboratory Design, Inc.

Data Acquisition

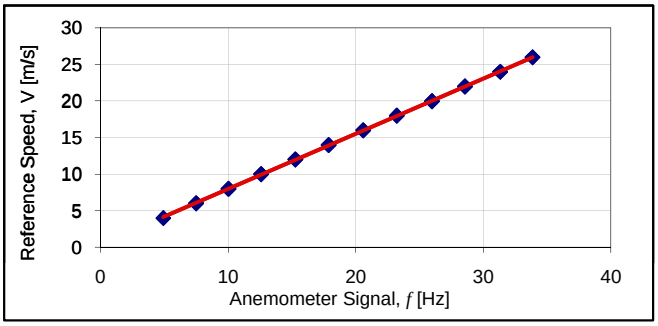
Hardware : National Instruments CDAQ-9172 USB 2.0 chassis with NI 9205 32-chan 16-bit AI module
Software : National Instruments LabVIEW 2010
Signal Reduction Method for IUT: FFT Analysis

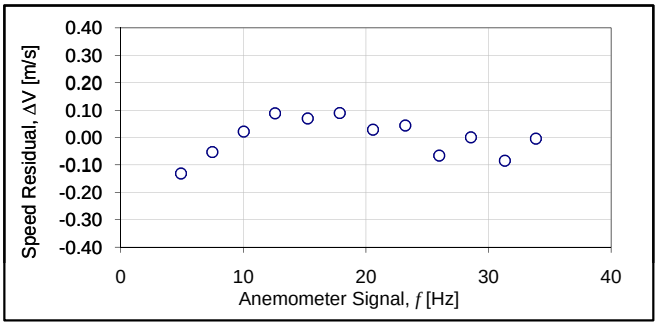
Measuring Equipment

Reference Speed : Four United Sensor Type PA Pitot-static tubes sensed by an MKS Barotron Type 220D Differential Pressure Transducer (NIST traceable)
Amb. Pressure : Setra Model 270 Barometer (NIST traceable)
Amb. Temperature : OMEGA HX94 SS Probe (NIST traceable)
Relative Humidity : OMEGA HX94 SS Probe (NIST traceable)

Test Conditions

Reference Speed Position Correction = 1
Reference Speed Blockage Correction = 1
Mean Ambient Pressure = 101,070 Pa
Mean Ambient Temperature = 24.6 deg C
Mean Relative Humidity = 39.9% RH
Mean Density = 1.1775 kg/cubic meter





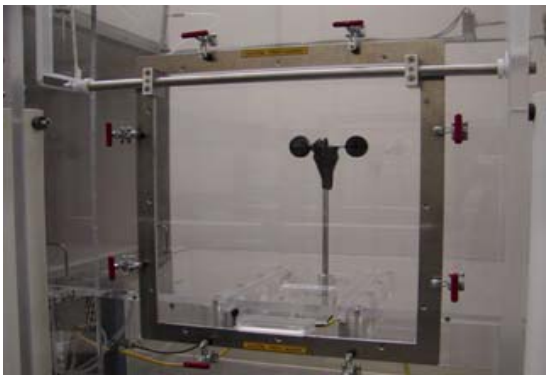
Transfer Function Test Results:

V [m/s] = 0.755 f [Hz] + 0.40

Regression Parameters

r = 0.99995
std. err. estimate =0.0743 m/s
slope =0.755 m/s per Hz
std. err. slope =0.00235 m/s per Hz
offset =0.40 m/s
std. err. offset =0.05016 m/s

Reference Speed [m/s]	Anemometer Output [Hz]	Residual [m/s]	Ref. Speed Uncertainty
3.981	4.908	-0.131	0.513%
7.990	10.014	0.021	0.497%
11.993	15.250	0.069	0.485%
15.971	20.570	0.028	0.467%
19.954	25.968	-0.066	0.480%
23.972	31.311	-0.085	0.477%
25.966	33.844	-0.004	0.478%
21.966	28.543	0.000	0.474%
17.970	23.195	0.044	0.473%
13.977	17.850	0.089	0.473%
9.991	12.575	0.088	0.480%
5.993	7.469	-0.053	0.495%



***Note*: Generic photo of test set-up**

Approved by: Adam Havner, Lab Manager

DEUTSCHER KALIBRIERDIENST DKD

Kalibrierlaboratorium / Calibration laboratory
Akkreditiert durch die / *accredited by the*
Akkreditierungsstelle des Deutschen Kalibrierdienstes

Deutsche WindGuard
Wind Tunnel Services GmbH
Varel

Deutscher Akkreditierungs Rat DAR
DKD-K- 36801

09/3127
DKD-K-36801
05/2009

Kalibrierschein
Calibration Certificate

Kalibrierzeichen
Calibration label

Gegenstand *Object*	Cup Anemometer
Hersteller *Manufacturer*	Windspeed LTD Denbighshire LL18 2AB
Typ *Type*	A 100 LK
Fabrikat/Serien-Nr. *Serial number*	Body: 1263 Cup: G/6U
Auftraggeber *Customer*	WPD AG D 28211 Bremen
Auftragsnummer *Order No.*	VT09345
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	3
Datum der Kalibrierung *Date of calibration*	27.05.2009

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Der DKD ist Unterzeichner der multi- lateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.
This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
The DKD is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.

Stempel *Seal*	Datum *Date*	Leiter des Kalibrierlaboratoriums *Head of the calibration laboratory*	Bearbeiter *Person in charge*
Deutscher Kalibrierdienst DKD-K-36801	27.05.2009	Dipl. Phys. D. Westermann	Dipl.-Ing. (FH) M. Meyer zu Himmern

Deutsche WindGuard Wind Tunnel Services GmbH
Oldenburger Str. 65
26316 Varel ; Tel. ++49 (0)4451 9515 0

09/3127
DKD-K-36801
05/2009

Kalibriergegenstand
Object Anemometer

Kalibrierverfahren
Calibration procedure
IEC 61400 12 1 - Wind Turbine Power Performance Testing 12 2005
MEASNET - Cup Anemometer Calibration Procedure – 09 1997
ISO 3966 – Measurement of fluid in closed conduits - 1977

Ort der Kalibrierung
Place of calibration Windtunnel of Deutsche WindGuard, Varel

Messbedingungen
Test Conditions

wind tunnel area [1]	10000 cm²
anemometer frontal area [2]	200 cm²
diameter of mounting pipe [3]	27 mm
blockage ratio [4]	0.020 [-]
blockage correction [5]	1.000 [-]
average WindGuard reference [6]	196.9 1/s (Vector A100)
present WindGuard reference [7]	196.9 1/s

Umgebungsbedingungen
Test conditions

air temperature	21.9 °C	± 1.0 K
air pressure	1020.9 hPa	± 1.0 hPa
relative air humidity	44.2 %	± 2.5 %

Dateiinformation
File info

Anmerkungen
Remarks calibrated with 405 Type Single Mount

-

Auswertesoftware
Software version 4.0

[1] Querschnittsfläche der Auslassdüse des Windkanals
[2] Vereinfachte Querschnittsfläche (Schattenwurf) des Prüflings inkl. Montagerohr
[3] Durchmesser des Montagerohrs
[4] Verhältnis von 2) zu 1)
[5] Korrekturfaktor durch die Verdrängung der Strömung durch den Prüfling
[6] Referenzwert des Referenzanemometers bei 10 m/s (Mittelwert)
[7] Aktueller Wert des Referenzanemometers

Dieser Kalibrierschein wurde elektronisch erzeugt
This calibration certificate has been generated electronically

Kalibrierergebnis:
Result:

Test Item (1/s)	Tunnel Speed (m/s)	Uncertainty (k=2) (m/s)
79.748	4.219	0.10
118.236	6.221	0.10
155.580	8.115	0.10
192.530	9.972	0.10
232.045	11.960	0.10
272.131	13.958	0.10
309.650	15.936	0.11
289.200	14.881	0.10
251.923	12.957	0.10
211.638	10.950	0.10
173.384	9.026	0.10
135.002	7.073	0.10
98.111	5.184	0.10

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor k=2 ergibt. Sie wurde gemäß DKD-3 ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95 % im zugeordneten Wertintervall.

Der Deutsche Kalibrierdienst ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Die weiteren Unterzeichner innerhalb und außerhalb Europas sind den Internetseiten von EA (www.european-accreditation.org) und ILAC (www.ilac.org) zu entnehmen.

The expanded uncertainty assigned to the mea-surement results is obtained by multiplying the standard uncertainty by the coverage factor k = 2. It has been determined in accordance with DKD-3. The value of the measurand lies within the assigned range of values with a probability of 95%.

The DKD is signatory to the multilateral agree-ments of the European co-operation for Accredita-tion (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

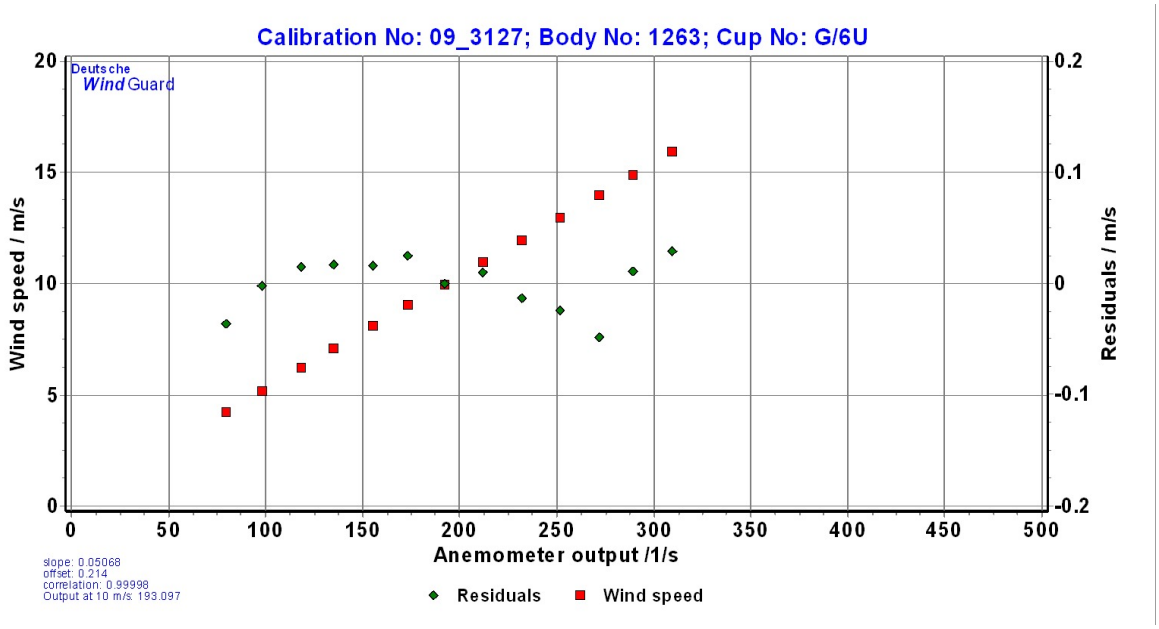
1 Detailed MEASNET[1] Calibration Results

DKD calibration no.	09/3127
Body no.	1263
Cup no.	G/6U
Date	27.05.2009
Air temperature	21.9 °C
Air pressure	1020.9 hPa
Humidity	44.2 %

Linear regression analysis

Slope	0.05068 (m/s)/(1/s) ±0.00010 (m/s)/(1/s)
Offset	0.214 m/s ±0.020 m/s
St.err(Y)	0.026 m/s
Correlation coefficient	0.999980

Remarks no



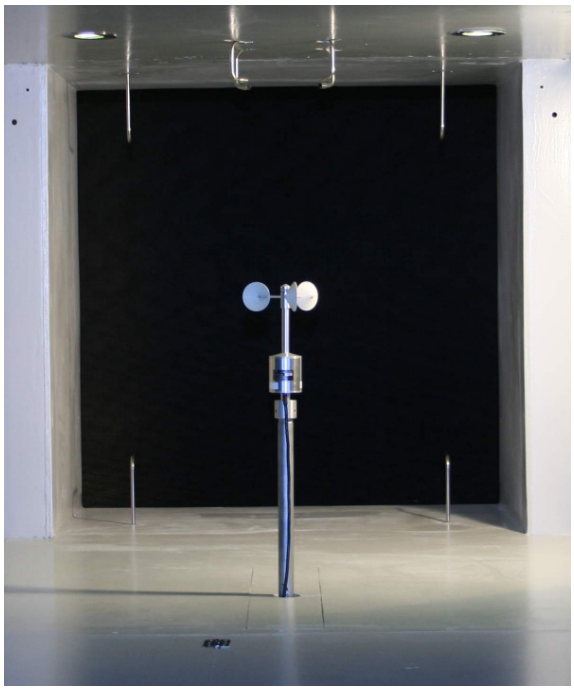
[1]) According to MEASNET Cup Anemometer Calibration Procedure 09/1997.
Deutsche WindGuard Wind Tunnel Services is accredited by MEASNET and by the Deutscher Kalibrierdienst – DKD (German Calibration Service). Registration: DKD – K – 36801

2 Instrumentation

Pos.	Sensor	Manufa.	Identification	Year	Calibration
1	Pitot static tube	Airflow	483/8 Nr. 000142	02	06/02
2	Pitot static tube	Airflow	483/8 Nr. 000143	02	06/02
3	Pitot static tube	Airflow	483/8 Nr. 000144	02	06/02
4	Pitot static tube	Airflow	483/8 Nr. 000145	02	06/02
5	Pressure transducer	Setra	C 239 Nr. 1688081	02	DWG12/07
6	Pressure transducer	Setra	C 239 Nr. 1688082	02	DWG12/07
7	Pressure transducer	Setra	C 239 Nr. 1688083	02	03/07
8	Pressure transducer	Setra	C 239 Nr. 1688084	02	03/05
9	El. Barometer	Vaisala	100 A Nr. X2010004	02	DWG12/07
10	El. Thermometer	Galltec	KPK 1/6-ME	02	DWG12/07
11	El. Humidity sensor	Galltec	KPK 1/6-ME	02	DWG12/07
12	Wind tunnel control	-	-	-	-
13	CAN-BUS / PC	esd	-	04	05/04
14	Anemometer		-		
15	Universal Isolator	Knick	P2700 - 58285/8198430	05	01/06

Table 1 Description of the data acquisition system

3 Photo of the calibration set-up



Calibration set-up of the anemometer calibration in the wind tunnel of Deutsche WindGuard, Varel.
The anemometer shown is of the same type as the calibrated one.
Remark: The proportion of the set-up are not true to scale due to imaging geometry.

4 Deviation to MEASNET procedure

The calibration procedure is in all aspects in accordance with the IEC 61400-12-1 Procedure

5 References

[1] J. Mander, D. Westermann, 12/2007 - Verfahrensanweisung DKD-Kalibrierung von Windgeschwindigkeitssensoren
[2] IEC 61400-12-1 12/2005 - Wind Turbine Power Performance Testing
[3] ISO 3966 1977 - Measurement of fluid flow in closed conduits
[4] MEASNET 09 1997 - Cup Anemometer Calibration Procedure