



WES⁵ Tulipo

TECHNICAL SPECIFICATIONS

The WES⁵ *Tulipo* is especially developed for the urban environment. The output of the 5.2 kW asynchronous generator has been limited to 2.5 kW at a nominal wind speed of only 9 m/s. This turbine with a tip-height of 15 meter has an extremely low noise emission, causes hardly any resonance and can be put on top of office or residential buildings.

GENERAL SPECIFICATIONS

Supplier / producer	WES BV
Life expectancy	15 years
Service	maintenance once in two years
Generator	5.2 kW
Power Output	2.5 kW at 140 rpm 9 - 20 m./s (limited to 140 rpm)
Cut in wind speed	3 m/s (grid connection necessary)
Cut out wind speed	20 m/s
Nominal wind speed	9 m/s at 140 rpm and 2,5kW power
Maximum wind speed	59,5 m/s (IEC 61400-1 class 2).
Yawing	active yawing by means of a yaw motor
Power regulation	fixed pitch stall
Hub height	12.25 m.
Number of blades	3
Rotor diameter	5 m.
Type of conversion system	asynchronous generator/variable speed IGBT converter

MATERIAL SPECIFICATIONS

Tower	steel, hub height 12.30 m, diameter 273 mm
Total weight	approx. 850 kg
Foundation	standard concrete block-system with anchor
Nose, cover	glass reinforced epoxy
Blades	glass reinforced epoxy
Corrosion protection	Total construction is galvanised
Protection	Tower and covers and blades are coated Ral 6019 IP 55

ELECTRICAL SPECIFICATIONS

Power	2,5 kW
Voltage	400V/50Hz 3 phase or 400V/60Hz 3 phase
Connection	grid connected
Converter	PWM inverter (back-to-back inverter)

GENERATOR

Type	a-synchronous
Brake	Spring powered electromagnetic brake of 80 Nm on fast shaft
Harmonics	NEN 11000-3-2- (< 16A)

EMC

EN 55081-1 en EN 55082-2 (CE)

APPLIED STANDARDS

Wind turbine	IEC 61400-2 (wind class 2)
Certification	IEC 61400-22 by UL
Lightning security	NEN 1014
Protection	IEC 529

SAFETY

Safety	(IEC 61400-2) normal safety through central control
Autonomous safety circuit	rpm > 150, stop (brake and emergency yawing)
Safety actions	“Failsafe” brake on fast shaft of generator independent yawing of 90 degrees
Emergency battery	24Vdc/24 Ah for yawing and safety circuit

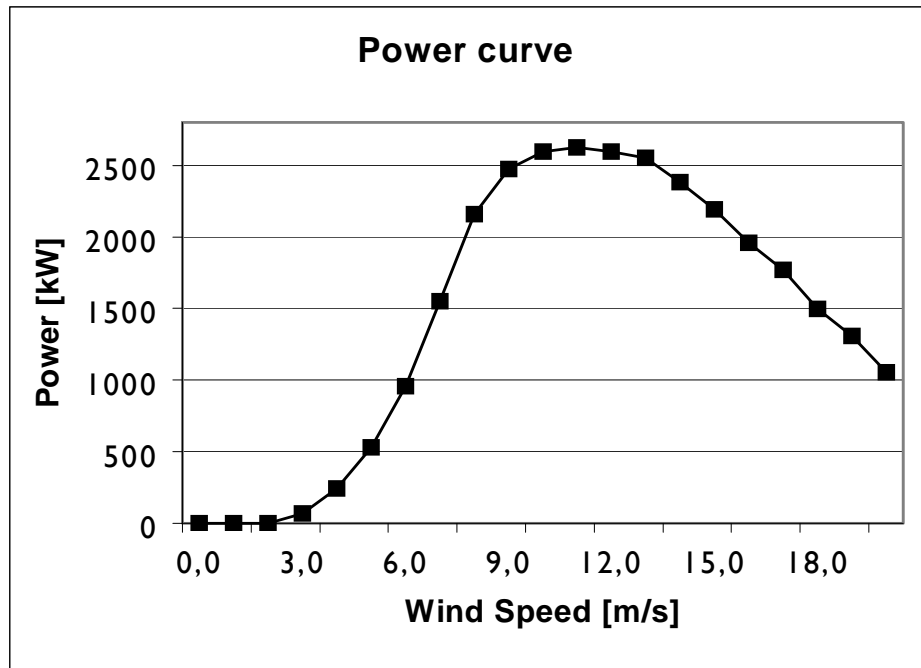
ENVIRONMENTAL CONDITIONS

Environment temperature	-20 °C tot + 40 °C
Operational temperature	2 °C - + 40 °C
Air humidity	95 %
Noise levels	35 dB(A) on 20 m. distance at 140 rpm (9 m./s) 72 dB(A) at nacelle

Measured actual power:

The curve data are valid for standard atmospheric conditions of 15° C air temperature, 1013 mbar air pressure and 1.225 kg/m³ air density, clean rotor blades and horizontal undisturbed air flow.

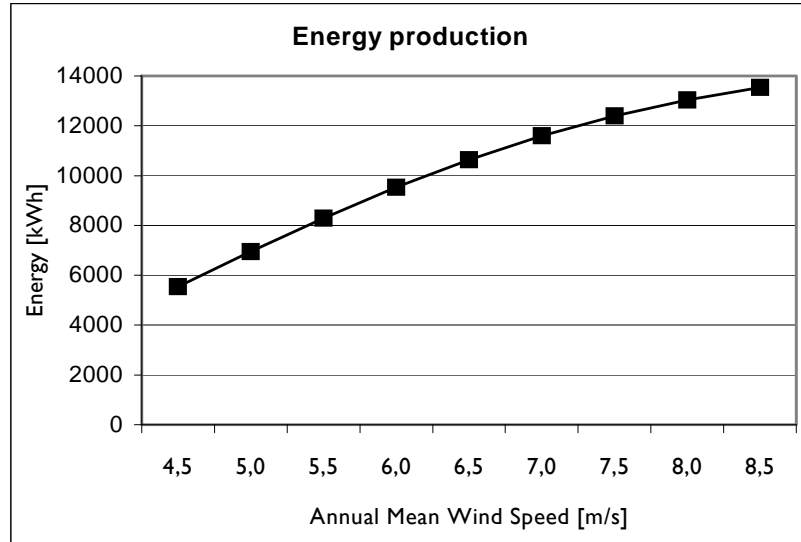
Wind speed [m/s]	Power [W]
0,0	0
1,0	0
2,0	0
3,0	68
4,0	243
5,0	530
6,0	958
7,0	1553
8,0	2159
9,0	2474
10,0	2595
11,0	2625
12,0	2598
13,0	2552
14,0	2382
15,0	2192
16,0	1960
17,0	1768
18,0	1495
19,0	1310
20,0	1055,0



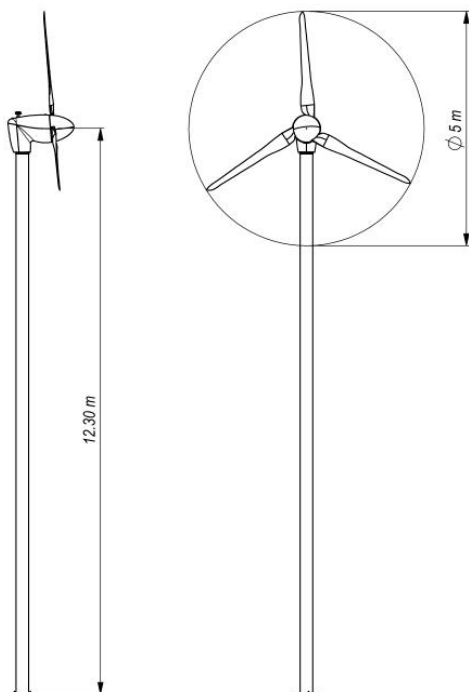
Measured production

The annual energy production data for different annual mean wind speeds at hub height are calculated from the above power curve data assuming a Raleigh wind speed distribution, 100% availability and no reductions due array losses, grid losses, or other external factors effecting the production.

Wind speed [m/s]	Energy [kWh]
4,5	5541
5,0	6947
5,5	8294
6,0	9534
6,5	10638
7,0	11593
7,5	12391
8,0	13036
8,5	13534



Front and side view of the WES⁵ Tulipo



Scale: 1:100