

## ENERGY FROM WIND ~ *Concept to Product*

The Windside generator is a vertical wind turbine based on nautical engineering, the generator is rotated by two spiral-formed vanes. First testing was carried out in Southern Finland both on land and sea locations as well as in the wind tunnel in the laboratory. During this nineteen year research and development work, Windside has tested battery charging systems of different size classes, and the development work of its own wind turbines for specific applications, continues product efficiently.

The structure of Windside wind turbine models are different. These differences have been denoted with the letters at the end of the model name, i.e. A, B, C. These codes indicate, for which purpose and for what weather conditions the model in question has been designed. Turbines with A withstand stormy winds of 60 m/s, models B - 40 m/s and with C – 30 m/s, producing energy up-to these maximum windspeeds.

All WS-Turbines have been made to withstand storms, frost, ice, heat and humidity.



**WS-4A (~20A)**

For professional use in demanding conditions



**WS-0,30A (~9A)**

For professional use in demanding conditions



**WS-2B (~20A)**

special construction for stormy winds



**WS-2A (~20A)**

for professional use in demanding conditions

WS-Turbines start energy production at very low wind speeds. The larger the device is, the earlier it will start battery charging. The starting speed for WS-0,15 is 4 m/s, for WS-0,30 model 3 m/s and for models over this size - 2 m/s. Energy production will continue even with lower wind speeds, the larger models at a wind speed of 1 m/s.

The largest vane sizes of Windside wind turbines that have been in serial production have had the diameter of 1 meter and the height of 4 meters. However, according to the studies of the Finnish Technical University, the wind turbine vane size can be increased by scaling all the dimensions where original geometrical ratios remain unchanged. Thus the Windside wind turbine can be even as high as 200 meters, with the diameter of 70 meters, which would correspond to a plant of several MW.

ENERGY FROM WIND ~ concept to product

## ENERGY FROM WIND ~ *in any location*

Windside Wind Turbines have been developed for demanding professional use. The devices work as autonomous units also in extreme conditions, withstanding sand and snow storms, hot, humid and freezing conditions from oceans to mountains. Due to WS-Turbine's simple design, the understanding of its operation principle and the installing procedure is easy even in the most primitive circumstances. The turbines can be used as an energy source in e.g. water lifting, house and street lighting, ventilation, boats, light houses and remote navigation aids, telecommunication towers, measuring systems, surveillance and signal equipment.



**WS-0,30A** with automatic lubrication system in a buoy in the Pacific Ocean



Assembling work of two **WS-0,30A** onto a buoy

WS-Turbines start the charging with very low wind speeds. The bigger the device is, the earlier it will start the battery charging. The starting speed for WS-0,15 is 4 m/s, for WS-0,30 model 3 m/s and for the bigger ones 2 m/s. The charging will continue even with lower wind speeds, with the bigger models even at the wind speed of 1 m/s.

The biggest vanes of the Windside wind turbines that have been in serial production have had the diameter of 1 meter and the height of 4 meters. According to the studies of the Technical University, the wind turbine can be upscaled by scaling all the measurings in a way that the geometry will stay unchanged. Thus the Windside wind turbine can be even as high as 200 meters, with the diameter of 70 meters, which would correspond to a plant of several MW.

ENERGY FROM WIND ~ *in any location*

## ENERGY FROM WIND ~ for any requirement

Explanations for model markings:

-number 0,30 = swept area of 0,30 m<sup>2</sup>


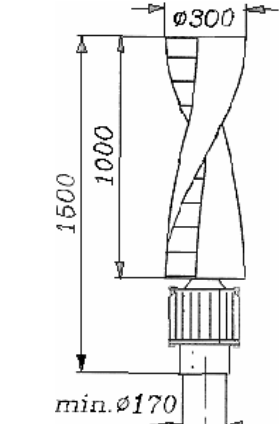
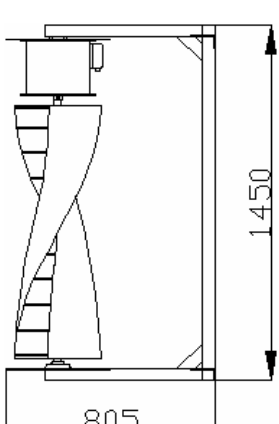
-alphabet (A) = wind endurance class:

A=60 m/s

B=40 m/s

C=30 m/s

For example WS-0,30A, withstands storm wind of 60 m/s:

Characteristics:	WS-0,30C	WS-0,30A
		
Rated power	9A/12V	9A/12V
Mast recommendation	wood/metal	metal
Cut-in wind speed	2,8 m/s	3,0 m/s
Rated wind speed	15 m/s	18 m/s
Cut-out wind speed	none	none
Swept area	0,30 m <sup>2</sup>	0,30 m <sup>2</sup>
Vane weight	2 kg	2 kg
Total weight of turbine	36 kg	70 kg
Rotor speed control	not required, electronic	not required, electronic
Overspeed control	none required	none required
Generator model	Windside	Windside
Generator construction	permanent magnet	permanent magnet
Generator types	1-400 V/12,24,48 V	1-400 V/12,24,48 V
Gear box	without gear	without gear
Main brake system	electronic	electronic
Charging controller	Windside WGU-22	Windside WGU-22
Measured sound emission	0 dB	0 dB

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Explanations for model markings:

-number 0,30 = swept area of 0,30 m<sup>2</sup>


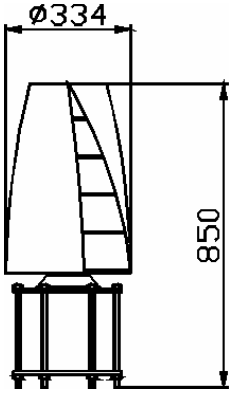
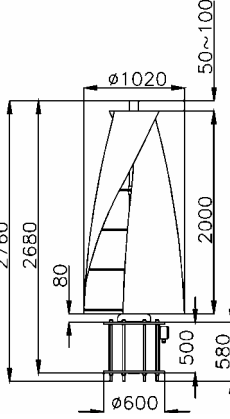
-alphabet (A) = wind endurance class:

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C=30 m/s

For example WS-0,30A, withstands storm wind of 60 m/s:

Characteristics:	WS-0.15B/C	WS-2B
		
Rated power	9A/12V	20A/12V
Mast recommendation	wood/metal	wood/metal
Cut-in wind speed	2.0 m/s	2.0 m/s
Rated wind speed	20 m/s	20 m/s
Cut-out wind speed	none	none
Swept area	0.15 m <sup>2</sup>	2.0 m <sup>2</sup>
Vane weight	1 kg	20 kg
Total weight of turbine	30 kg	400 kg
Rotor speed control	not required, electronic	not required, electronic
Over-speed control	none required	none required
Generator model	Windside	Windside
Generator construction	permanent magnet	permanent magnet
Generator types	1-400 V/12,24,48 V	1-400 V/12,24,48 V
Gear box	without gear	without gear
Main brake system	electronic	electronic
Charging controller	WGU-22	WGU-25/WGC-10
Measured sound emission	0 dB	0 dB

ENERGY FROM WIND ~ for any requirement

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Explanations for model markings:


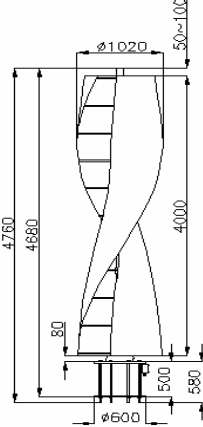
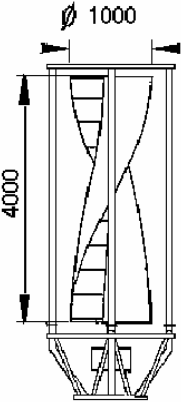
-number 0,30 = swept area of 0,30 m<sup>2</sup>

-alphabet (A) = wind endurance class:

A=60 m/s

B=40 m/s

C=30 m/s

Characteristics:	WS-4C	WS-4A
		
Rated power	20A/12 V	20A/12 V
Mast recommendation	wood/metal	metal
Cut-in wind speed	1,5 m/s	1,9 m/s
Rated wind speed	15 m/s	18 m/s
Cut-out wind speed	none	none
Swept area	4 m <sup>2</sup>	4 m <sup>2</sup>
Vane weight	2 kg	2 kg
Total weight of turbine	700 kg	1000 kg
Rotor speed control	not required, electronic	not required, electronic
Overspeed control	none required	none required
Generator model	Windside	Windside
Generator construction	permanent magnet	permanent magnet
Generator types	1-400 V/12,24,48 V	1-400 V/12,24,48 V
Gear box	without gear	without gear
Main brake system	electronic	electronic
Charging controller	WGU-25/WGC-10	WGU-25/WGC-10
Measured sound emission	0 dB	0 dB

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## ENERGY FROM WIND ~ power for life

Maximum continuous output (watts) at various wind velocities

Minimum Wind Velocity	4	3	2	2	2	2	2
Wind Velocity m/s	Model WS-0.15	Model WS-0.30	Model WS-2	Model WS-4	Model WS-12	Model WS-30	Model WS-75
3	-	2	10	20	65	150	375
4	2	4	20	40	130	300	750
5	3	7	35	70	228	527	1312
6	5	10	50	100	325	750	1875
7	7	15	75	150	488	1125	2812
8	10	21	105	210	683	1575	3937
9	15	30	150	300	975	2250	5625
10	20	40	200	400	1300	3000	7500
11	22	55	275	550	1788	4125	10312
12	35	70	350	700	2275	5250	13125
13	45	90	450	900	2925	6750	16875
14	60	120	600	1200	3900	9000	22500

Expected annual production is  $-100W/m^2 = 860 kWh/m^2/year$

Estimated annual production of different models:

Model	Average Wind Speed	3 m/s	5 m/s	7.5 m/s	10 m/s	
Model WS-0.15	1	8	25	60	129	kWh/year
Model WS-0.30	2	17	60	120	258	kWh/year
Model WS-2	3	86	301	800	1720	kWh/year
Model WS-4	5	172	602	1700	3440	kWh/year
Model WS-12	6	560	1956	5525	11180	kWh/year
Model WS-30	7	1290	4532	12000	25800	kWh/year
Model WS-75	10	3225	11283	32000	64500	kWh/year



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ENERGY FROM WIND ~ power for life

## ENERGY FROM WIND ~ *power from the environment*



WS-0.3C (background) and WS-0.15 turbines mounted on masts to extend above local obstructions and attain maximum exposure to wind speeds. These turbines are mounted in extremely low temperature environments producing power in temperatures as low as – 40°C for a winter refuge in Lapland .

ENERGY FROM WIND ~ power from the environment

## ENERGY FROM WIND ~ power for demanding applications



**WS-2AK-EX** Class 1 Division 2 Wind turbine suitable for installation in Gas Hazard environments

ENERGY FROM WIND ~ power for demanding applications



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