# ECOROTE

GREEN WIND ENERGY

## MODERN

WIND TURBINES
AND HYBRID
SYSTEMS







Hipar sp. z o.o.

www.hipar.pl

Hipar sp. z o.o.

## SCIENTIFIC POTENTIAL + TECHNOLOGY PARK = SUCCESS

**HIPAR Sp. z o.o.** was created in 2004. The registered office of the Company is in Wola Rafałowska. At the beginning the main object of the Company operations was machining of steel and cast iron elements. Since 2006 the main products of the Company have been pulleys to Volkswagen motors. At that time the Company became a supplier of the pulleys for the production lines of new motors.

Since 2015 **Hipar Sp. z o.o.** has also manufactured equipment for independent operation of power plants outside of the power grid. Among other things, the Company offers innovative vertical axis wind turbines (VAWT) and photovoltaic trackers enabling the generation of 45% more energy from the PV panels compared to the stationary system.

**Hipar** as a production-trade enterprise provides an individual approach to each customer, adapting all its offered products to customer needs and environmental conditions i.e.: the geographical location, insolation, landform, level of the average wind speed which makes it an unmatched company in comparison to other companies.



**13** years on the market





**100%**
Polish products

## THE ADVANTAGES OF OUR WIND TURBINES

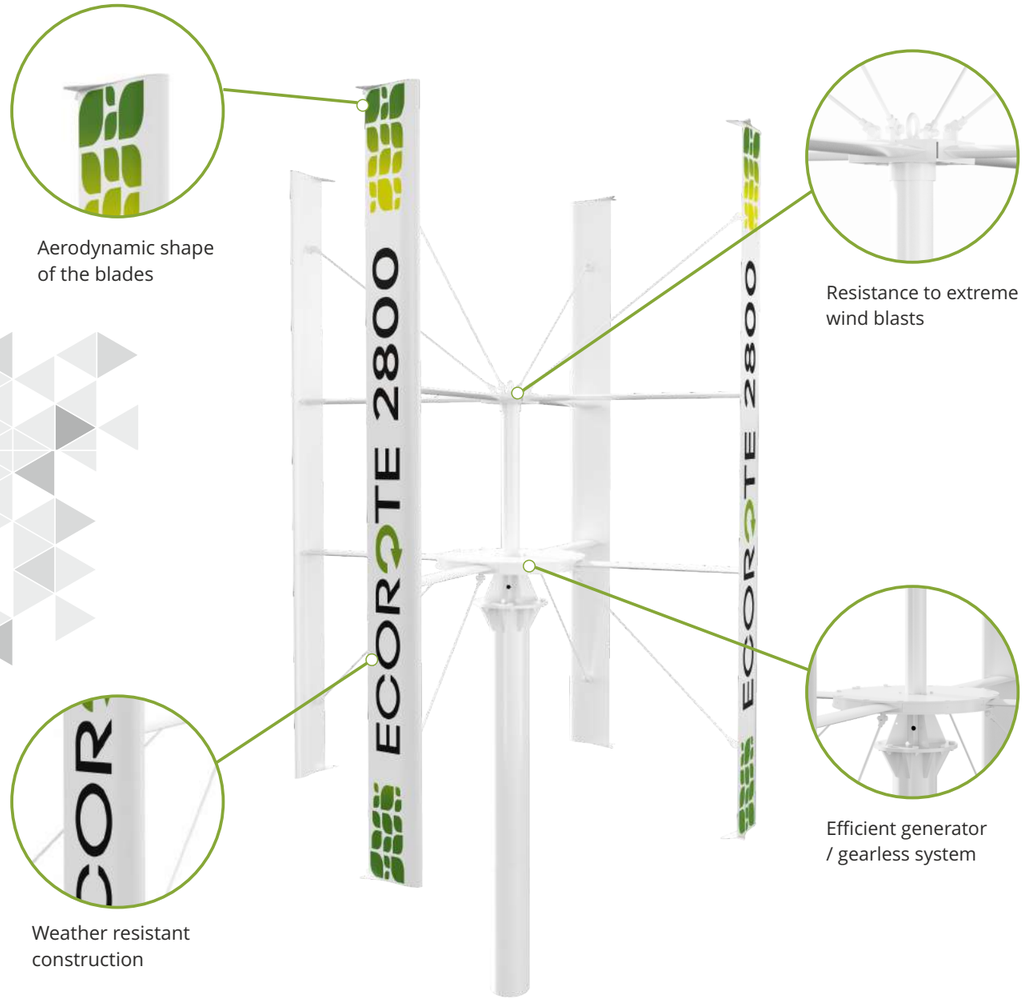
ECOROTE Wind Turbines Line It is our flagship product. We produce turbines with power ratings from 300W to 9800W.

ECOROTE turbines have been developed by our team of designers and constructors in close cooperation with the Rzeszow University of Technology's flagship research institution specializing in Aviation.

- Operation independent on the wind direction
- Resistance to strong wind
- Simple mechanical construction enabling failure-free operation
- Durability
- No overhauls required
- Possibility to operate in On-Grid /Off-Grid/Hybrid systems
- Simple installation at hotels, shops, blocks of flats, production halls and other buildings
- High manufacturing quality
- Aesthetic appearance
- High strength
- Possible operation at temperatures ranging from -40°C to +70°C
- Resistance to any weather conditions
- Water heating
- Polish engineering and manufacturing
- Silent operation
- Low starting speed – approx. 1 m/s
- Service-free operation
- Absence of friction devices
- High quality of the applied materials
- No detrimental impact on the environment

# THE ADVANTAGES
# OF TURBINE CONSTRUCTION

A wind turbine allows for processing 71% (0.42 of Betz number) of wind energy into electricity.  98% of materials of which our products are made come from Polish manufacturers. Disc generator that converts the kinetic energy of wind into electricity has been developed so as not to have friction elements, by which it excludes maintenance. The blades of the turbine, thanks to the use of extruded aluminum profile of seamless monolith construction, are characterized by resistance to thermal expansion caused by heat. In addition, a white, sunlight reflecting paint, of C5+M resistance class is applied on the turbines. In addition, steel elements are galvanized and aluminum elements are anodized in order to ensure their effective corrosion protection.




Aerodynamic shape
of the blades

Resistance to extreme
wind blasts

Efficient generator
/ gearless system

Weather resistant
construction

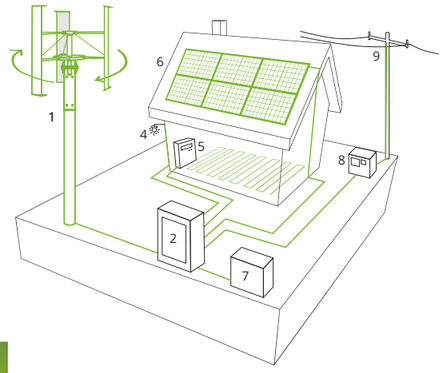




# TURBINE
# PARAMETERS

| Turbine name | ECOROTE 300 | ECOROTE 1500 | ECOROTE 2800 | ECOROTE 9800 |
|---|---|---|---|---|
| Turbine power | 300W | 1500W | 2800W | 9800W |
| Impeller diameter | 1 | 2,2 | 2,2 | 4 |
| Turbine height | 1,2 | 1,5 | 3 | 5,5 |
| Starting speed | 3 m/s | 1,5m/s | 1,25m/s | 1,2m/s |
| Rated speed | 10m/s | 12m/s | | |
| Total weight | 48 kg | 155 kg | 175 kg | 550 kg |
| Wings and arms | Aluminium structure with resistance tested in extreme conditions | | | |
| Brake | Electromagnetic | Electromagnetic and electromechanical additionally | | |
| Operation system | On-Grid/Off-Grid/Hybrid | | | |
| Controller | Microprocessor | | | |
| Inverter output voltage | 24/48/96V DC or 230V AC | 1x230V AC or 3x230V AC 50Hz | 3x230V AC 50Hz | |
| Inverter output voltage | 1 | 1 or 3 | 3 | |
| Generator output voltage | AC | | | |
| Noise level acc. to PN-EN 61400-11 | < 46 dB at 8 m/s in the distance of 60 m | | | |
| Operating temperature | -40°C to +70°C | | | |
| Corrosion protection | Anodizing, galvanizing, powder coating C5+M | | | |
| Mast types | Concrete posts, metal posts, lattice work, and roof platforms<br>Possible structure manufacturing to individual order | | | |
| Mast sizes | 2 m to 25 m | | | |
| Compliance with standards | CE,IEC 61400-2, 61400-11 | | | |

# **USE OF** TURBINES

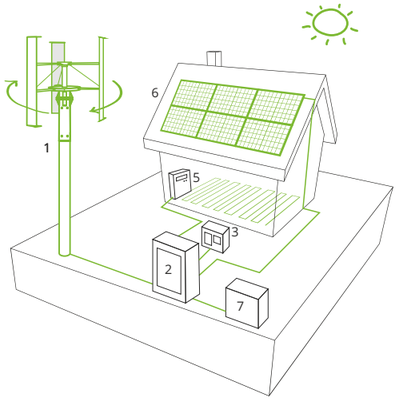


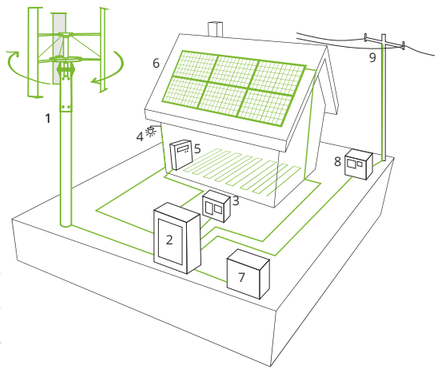

### 1. On-grid system/ On-grid hybrid system

a solution usually applied when a building is connected to power engineering network. It is one of the simplest systems consisting of a wind turbine of any capacity, grid inverter of the output voltage of 1 x 230 V AC or 3 x 230 V A, two-directional meter to measure the power generated and consumed, security measures in the form of circuit breakers and surge arresters, turbine stopping resistor and connection to the power grid. On-Grid systems may also be developed for photovoltaic modules, thus creating Hybrid systems. Moreover, batteries saving surplus power may be installed. In case of frequent power failures from the grid, the system may be additionally provided with a diesel generator.
An On-Grid system enables the use of directly generated power and resale of the power in case of energy surpluses or accumulation in the power grid.

### 2. Off-grid system / Off-grid hybrid system

a perfect solution for buildings which are not connected to the power grid, e.g. recreational houses, or in case the house residents wish to be completely independent of the energy suppliers. The system is identical as the On-Grid one but the battery is a must in order to store the surplus of the energy generated. The system does not have to be connected to the power grid, so there is no need for a two-directional meter. The system may be extended for photovoltaic panels and diesel generator, identically as in the case of an On-Grid system.
Both solutions have their advantages and disadvantages. An On-Grid system is supplied by the power from the grid, so at the moment of power failure in the grid the electric equipment in the house does not operate (except for the case when a diesel generator is additionally installed). An Off-Grid system is connected to batteries, so there is no fear of power failure. The latter system is more expensive and there is no possibility to resale the generated power to the gird.




### 3. On/off-grid system / On/off-grid hybrid system

a solution combining the advantages of On-Grid and Off-Grid systems. An On/Off-Grid system removes the problem of power failure, usually as a result of weather anomaly, power grid repair, etc. The system first of all accumulates surplus energy in batteries and uses the accumulated energy when the wind turbine combined with the additional photovoltaic panels are not generating enough energy, or uses the batteries in case of complete grid failure. The battery of specific capacity takes missing energy from the power grid through the system controlling inverter as soon as the battery has been completely discharged. The system may also output energy to the gird when the batteries are fully loaded and the energy generated by the wind turbine and the photovoltaic panels is sufficient for the building supply.

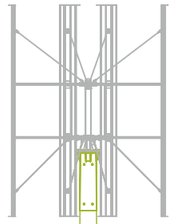
Legend

1. Ecorote wind turbine 2. Inverter/hybrid controller 3. Batteries 4. 230V receivers 5. Water heater / hot water / heating
6. Photovoltaic panels (in a hybrid system) 7.Generator (optional) 8. Switch /AC counter 9. Network



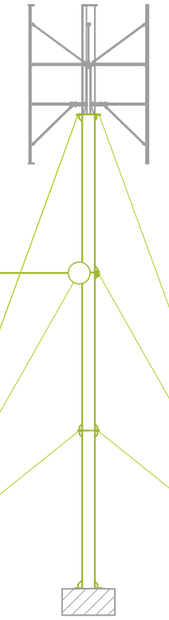


# TYPES OF MASTS



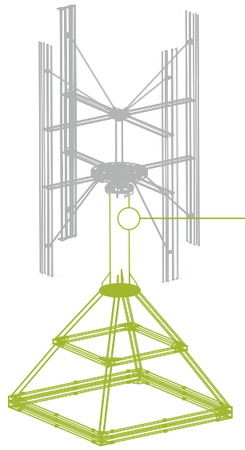
## PRE-STRESSED MAST

are made by concrete pouring into a rotating conical mould, which ensures high technical parameters and smooth surface. The masts are characterised with long-lasting operation and durability. They are cheaper than other masts of similar heights. An attachment with platform for turbine installation is needed for a pre-stressed mast.



## STEEL MAST WITH CABLE STAYS

are made of combined thin-wall tubes. Lightweight construction and the possibility of the mast disassembly into short sections ensure comfortable transport. The stays fixed to concrete anchors balance the stress that may be present. The turbine is mounted directly on the mast, without any additional attachments.



## FLAT-ROOF MAST

have the form of latticework of large span between the legs, which ensures stability and durability of the structure. It is possible to design a mast which does not reach higher than three metres above the roof. Four structure elements ensure simple transport, installation and dismantling. On flat roofs two vibration damping connectors are additionally applied in order to minimise the vibrations transferred to the building.

## Productivity analysis of **ECOROTE 2800** turbine for selected regions

| Country | City | Average wind speed in a year [m/s] | Annual energy production [kWh] | Co2 emissions savings [kg CO2] |
|---|---|---|---|---|
| Argentina | Buenos Aires | 5,5 | 3225 | 2612 |
| Australia | Melbourne | 8,9 | 21006 | 17015 |
| | Sydney | 8,1 | 14896 | 12066 |
| Austria | Vienna | 5,9 | 4276 | 3464 |
| Belarus | Minsk | 5,5 | 3224 | 2611 |
| Belgium | Brussels | 5,8 | 3992 | 3234 |
| Brazil | Rio De Janeiro | 6 | 4575 | 3706 |
| Bulgaria | Sofia | 3,8 | 721 | 584 |
| | Varna | 5,4 | 2994 | 2425 |
| Canada | Ottawa | 7,7 | 12287 | 9952 |
| China | Beijing | 5,5 | 3224 | 2611 |
| | Shanghai | 6,7 | 7115 | 5763 |
| Croatia | Dubrovnik | 6,8 | 7547 | 6113 |
| | Zagreb | 4,5 | 1434 | 1162 |
| Czech Republic | Prague | 5,4 | 2994 | 2425 |
| Denmark | Copenhagen | 6,4 | 5926 | 4800 |
| Estonia | Tallinn | 7,1 | 8955 | 7254 |
| Finland | Helsinki | 7,2 | 9462 | 7664 |
| France | Bordeaux | 5,9 | 4276 | 3464 |
| | Marseille | 7,8 | 12910 | 10457 |
| | Paris | 5,7 | 3722 | 3015 |
| Germany | Berlin | 5 | 2195 | 1778 |
| | Hamburg | 6,3 | 5564 | 4507 |
| | Hannover | 5,1 | 2378 | 1926 |
| Greece | Athens | 6,2 | 5218 | 4227 |
| Hungary | Budapest | 6,6 | 3224 | 2611 |
| Iceland | Reykjavik | 8,8 | 20181 | 16347 |
| India | Mumbai | 3,8 | 721 | 584 |
| Ireland | Dublin | 7,8 | 12910 | 10457 |
| | Waterford | 8,3 | 16316 | 13216 |
| Israel | Tel Aviv | 5,7 | 3722 | 3015 |
| Italy | Catania | 4,6 | 1567 | 1269 |
| | Milan | 3,3 | 405 | 328 |
| | Roma | 4,1 | 983 | 796 |
| Japan | Tokyo | 5,9 | 4276 | 3464 |
| Kazakhstan | Aktau | 7,3 | 9988 | 8090 |
| | Almaty | 6,4 | 5926 | 5926 |
| | Astana | 6,9 | 7998 | 6478 |
| | Atyrau | 7,6 | 11683 | 9463 |
| Latvia | Riga | 7,1 | 8955 | 7254 |
| Lithuania | Klaipeda | 6,6 | 6701 | 5428 |
| | Vilnius | 5,7 | 3722 | 3015 |
| Mexico | Mexico | 5,2 | 2572 | 2083 |
| Morocco | Marrakech | 5,8 | 3992 | 3234 |
| Netherlands | Amsterdam | 6,6 | 6701 | 5428 |
| Nigeria | Abuja | 4,1 | 983 | 796 |
| | Lagos | 5,5 | 3224 | 2611 |
| Norway | Bergen | 8,4 | 17053 | 13813 |
| | Oslo | 7,2 | 9462 | 7664 |
| Poland | Gdansk | 6,8 | 7547 | 6113 |
| | Cracow | 5,2 | 2572 | 2083 |
| | Warsaw | 5,4 | 2994 | 2425 |
| Portugal | Lisbon | 7,1 | 8955 | 7254 |
| Qatar | Doha | 5,8 | 3992 | 3234 |
| Russia | Novosibirsk | 5,9 | 4276 | 3464 |
| | Moscow | 5,9 | 4276 | 3464 |
| | St. Petersburg | 6,9 | 7998 | 6478 |
| | Vladivostok | 6,5 | 6305 | 5107 |
| South Africa | Capetown | 7,4 | 10533 | 8532 |
| Spain | Barcelona | 5,4 | 2994 | 2425 |
| | Madrit | 4,8 | 1862 | 1508 |
| | Malaga | 6,4 | 5926 | 4800 |
| Sweden | Goteborg | 7,1 | 8955 | 7254 |
| | Sztokholm | 6,7 | 7115 | 5763 |
| Turkey | Istanbul | 6,6 | 6701 | 5428 |
| UAE | Abu Dhabi | 4 | 889 | 720 |
| Ukraine | Kiev | 5,3 | 2777 | 2249 |
| | Odessa | 6,3 | 5564 | 4507 |
| United Kingdom | Glasgow | 6,7 | 7115 | 5763 |
| | Liverpool | 7,6 | 11683 | 9463 |
| | London | 5,3 | 2777 | 2249 |
| USA | Kanzas | 6,6 | 6701 | 5428 |
| | New York | 6,3 | 5564 | 4507 |

## An example amount of energy produced of the **ECOROTE 2800** turbine

(mounted at 15m height, taking with terrain roughness class of 1 and a Weibull factor of k=2.6)





# PV TRACKERS

(follow-up systems)



## Created for maximum use of solar energy

PV trackers (follow-up systems) are devices that increase the efficiency of a photovoltaic system by up to approx. 45% per year, by reducing the losses resulting from the sunlight angle. The movement of the panels prevents the deposition of dust and other contaminants that can cause the effect of local overheating of the panels. The follow-up system increases productivity of inverters that control the process of electricity generating from sunlight. The inverters work best at a high load, which is obtained only by using the follow-up systems. Through the use of wind and snow/ice sensors in the control automation, we protect the tracker against adverse weather conditions.

### PERFECTLY PRODUCED

The structure is entirely made of steel and aluminum, it is driven by two German K + G cylinders and coronary transmission designed for reliable operation in extreme weather conditions.

**Hipar's** offer includes trackers from

**3000W** to **8000W**

# Advantages of the PV trackers produced by us include, e.g.:

Very high utilization of sunlight, characterized by the possibility of the tracker perpendicular adjusting towards the sun at any time of the day

Increasing the efficiency of the panels by approx. **45%** per annum

Flexible range of motion for each geographical location:

- The tilt angle of the panels: from 1 deg. to 90 deg.
- The angle of rotation of panels: from 0 deg. to 350 deg.

Resistance to weather conditions

Work safety

Noiseless operation of the device

Reliability



Increasing the efficiency of inverters

Protection of panel against dust, dirt.

Visual attractiveness compared to stationary systems

Reduction of area required for the installation of PV systems compared to stationary systems,

Possibility of installation of the system without building permits thanks to use of the foundation placed on the face of the ground.





Products manufactured by our company collect more and more interest among

ORLEN

McDonald's

PLAY

As well as Investors private

# BEST QUALITY
## of products

Wind Turbines and Trackers produced by our company are of the utmost quality. This is confirmed by the strength and agility results carried out byz:

POLITECHNIKA RZESZOWSKA im. IGNACEGO ŁUKASIEWICZA

FIRES The Experts on Fire Safety

N° C-WS/008/1/09

PAN POLSKA AKADEMIA NAUK

Polish Academy of Sciences, which placed our turbine in the Polish Antarctic Station at the South Pole (wind speed reaches up to 71 m / s)

Our turbines and trackers have been evaluated as products with unparalleled performance and parameters by independent research units. With a specialized technical and design personnel and over 20 years of experience in the mechanical industry our company, in addition to production of turbines and tracker, deals with the automotive industry used by companies such as Volvo, Volkswagen, Mercedes , BMW, Festo, Caterpillar and many others.










# Hipar sp. z o.o.

**Producer**
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ECOROTE

## WINDTURBINE 1500



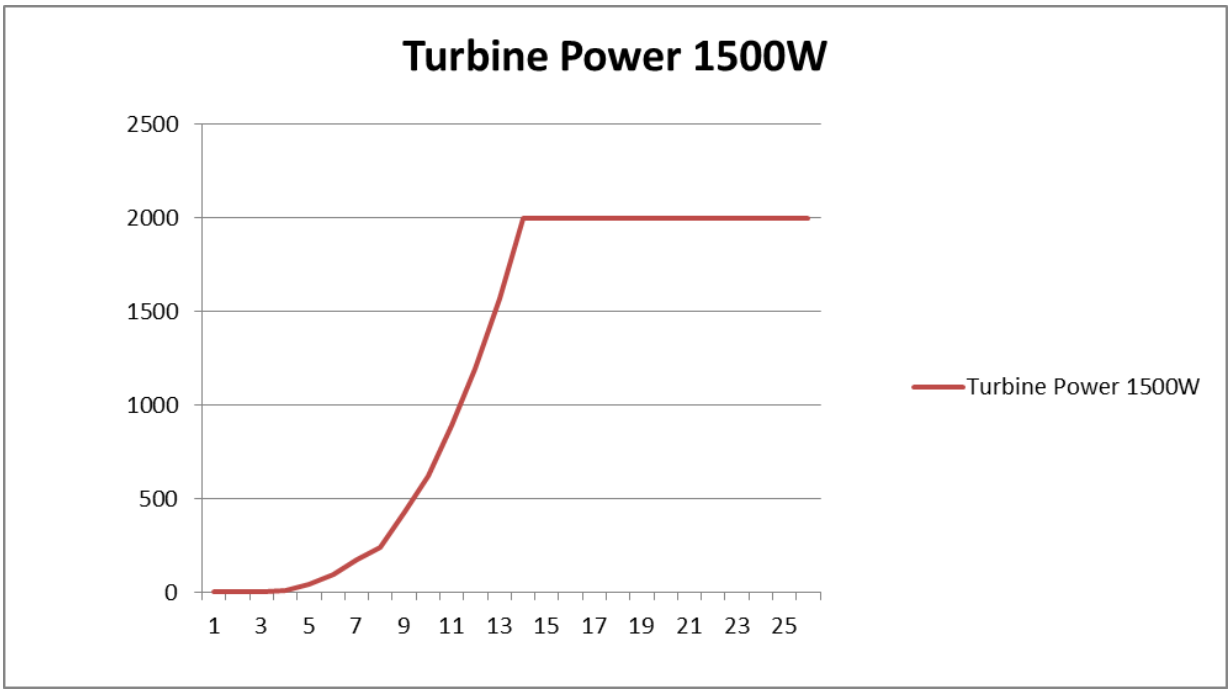
| | |
|---|---|
| Nennleistung | 1500 w |
| Rotordurchmesser | 2,2 m |
| Rotorhöhe | 1,5 m |
| Start ab | 1,5 m/s |
| max Leistung bei | 12 m/s |
| Gewicht | 155 kg |
| Blätter und Arme | aerodynamische, widerstandsfähige Aluminiumstruktur. Getestet unter extremsten Umweltbedingungen |
| Bremse | elektromagnetisch und elektromechanisch |
| Nutzung der Anlage | Einspeisung, Inselversorgung, Hybrid |
| Controller | Microprocessor |
| Generator Output | Wechselstrom |
| Geräusch Level | <46 dB bei 8m/s in nur 60m Entfernung (vergl. zu PN-EN 61400-11) |
| Betriebstemperatur: | -40C° bis 70 C° |
| Korrosionsschutz | eloxiert, Feuerverzinkt, Pulverbeschichtung |
| Nutzbare Masttypen | Stahlmasten, Betonmasten Gittermast, Dachgestell, Sonderkonstruktionen möglich |
| Mastgrößen | 2m - 25m; Standard 7m |
| Standards: | CE, IEC 61400-2, 61400-11, VDE-AR-N 4105, VDE 0126-1-1, ÖVE/ÖNORM E 8001-4-712:2009-12, Anh. A |
| Made in EU | |

Vertrieb Deutschland, Österreich, Schweiz

Vertikale Windkraftanlagen Hartmann

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info@vwah.de
WhatsApp: +49 172 83 78 011
Telefon: +49 375 360 84 10
**„Kaufen Sie noch Strom?“®**

| Cp | Wind speed | Turbine Power 1500W | RPM | AC voltage | AC current |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | -1 | 0,00 |
| 0 | 1 | 0 | 20 | 43 | 0,00 |
| 0 | 2 | 0 | 39 | 87 | 0,00 |
| 0,15 | 3 | 9 | 59 | 130 | 0,07 |
| 0,3 | 4 | 41 | 78 | 174 | 0,24 |
| 0,345 | 5 | 92 | 98 | 218 | 0,42 |
| 0,37 | 6 | 171 | 117 | 261 | 0,65 |
| 0,325 | 7 | 238 | 137 | 305 | 0,78 |
| 0,39 | 8 | 426 | 156 | 349 | 1,22 |
| 0,4 | 9 | 622 | 176 | 392 | 1,59 |
| 0,418 | 10 | 892 | 195 | 436 | 2,04 |
| 0,42 | 11 | 1193 | 215 | 480 | 2,49 |
| 0,425 | 12 | 1567 | 234 | 524 | 2,99 |
| 0,435 | 13 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 14 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 15 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 16 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 17 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 18 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 19 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 20 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 21 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 22 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 23 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 24 | 2000 | 250 | 559 | 2,86 |
| 0,435 | 25 | 2000 | 250 | 559 | 2,86 |




Referenzwerte Windkanal. Erträge können je nach Bedingungen am Standort abweichen.

ECOROTE

## WINDTURBINE 2800



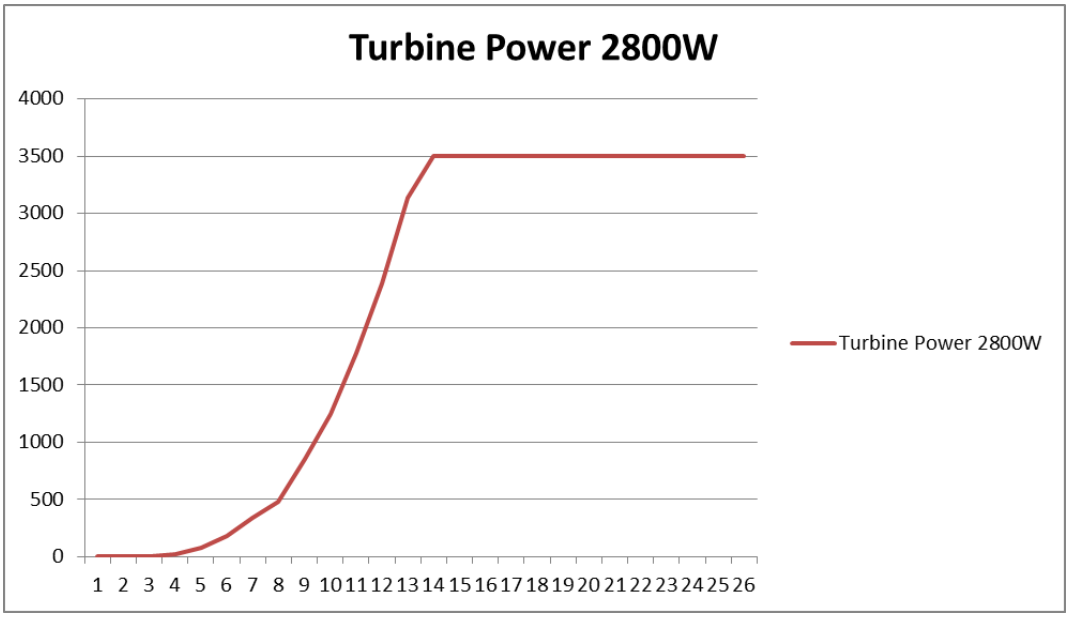
| | |
|---|---|
| Nennleistung | 2800 w |
| Rotordurchmesser | 2,2 m |
| Rotorhöhe | 3 m |
| Start ab | 1,25 m/s |
| max Leistung bei | 12 m/s |
| Gewicht | 175 kg |
| Blätter und Arme | aerodynamische, widerstandsfähige Aluminiumstruktur. Getestet unter extremsten Umweltbedingungen |
| Bremse | elektromagnetisch und elektromechanisch |
| Nutzung der Anlage | Einspeisung, Inselversorgung, Hybrid |
| Controller | Microprocessor |
| Generator Output | Wechselstrom |
| Geräusch Level | <46 dB bei 8m/s in nur 60m Entfernung (vergl. zu PN-EN 61400-11) |
| Betriebstemperatur: | -40C° bis 70 C° |
| Korrosionsschutz | eloxiert, Feuerverzinkt, Pulverbeschichtung |
| Nutzbare Masttypen | Stahlmasten, Betonmasten Gittermast, Dachgestell, Sonderkonstruktionen möglich |
| Mastgrößen | 2m - 25m; Standard 7m |
| Standards: | CE, IEC 61400-2, 61400-11, VDE-AR-N 4105, VDE 0126-1-1, ÖVE/ÖNORM E 8001-4-712:2009-12, Anh. A |
| Made in EU | |

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info@vwah.de
WhatsApp: +49 172 83 78 011
Telefon: +49 375 360 84 10
**„Kaufen Sie noch Strom?“®**

| Cp | Wind speed | Turbine Power 2800W | RPM | AC voltage | AC current |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | -1 | 0,00 |
| 0 | 1 | 0 | 20 | 43 | 0,00 |
| 0 | 2 | 0 | 39 | 87 | 0,00 |
| 0,15 | 3 | 17 | 59 | 130 | 0,13 |
| 0,3 | 4 | 82 | 78 | 174 | 0,47 |
| 0,345 | 5 | 184 | 98 | 218 | 0,85 |
| 0,37 | 6 | 341 | 117 | 261 | 1,30 |
| 0,325 | 7 | 476 | 137 | 305 | 1,56 |
| 0,39 | 8 | 852 | 156 | 349 | 2,44 |
| 0,4 | 9 | 1244 | 176 | 392 | 3,17 |
| 0,418 | 10 | 1784 | 195 | 436 | 4,09 |
| 0,42 | 11 | 2385 | 215 | 480 | 4,97 |
| 0,425 | 12 | 3134 | 234 | 524 | 5,98 |
| 0,435 | 13 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 14 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 15 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 16 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 17 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 18 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 19 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 20 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 21 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 22 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 23 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 24 | 3500 | 250 | 550 | 6,36 |
| 0,435 | 25 | 3500 | 250 | 550 | 6,36 |




Referenzwerte Windkanal. Erträge können je nach Bedingungen am Standort abweichen.

# ECOROTE

## WINDTURBINE 9800




| | |
|---|---|
| Nennleistung | 9800 w |
| Rotordurchmesser | 4,3 m |
| Rotorhöhe | 5,6 m |
| Start ab | 1,2 m/s |
| max Leistung bei | 12 m/s |
| Gewicht | 550 kg |
| Blätter und Arme | aerodynamische, widerstandsfähige Aluminiumstruktur. Getestet unter extremsten Umweltbedingungen |
| Bremse | elektromagnetisch und elektromechanisch |
| Nutzung der Anlage | Einspeisung, Inselversorgung, Hybrid |
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| Betriebstemperatur: | -40C° bis 70 C° |
| Korrosionsschutz | eloxiert, Feuerverzinkt, Pulverbeschichtung |
| Nutzbare Masttypen | Stahlmasten, Betonmasten Gittermast, Dachgestell, Sonderkonstruktionen möglich |
| Mastgrößen | 2m - 25m; Standard 10m |
| Standards: | CE, IEC 61400-2, 61400-11, VDE-AR-N 4105, VDE 0126-1-1, ÖVE/ÖNORM E 8001-4-712:2009-12, Anh. A |

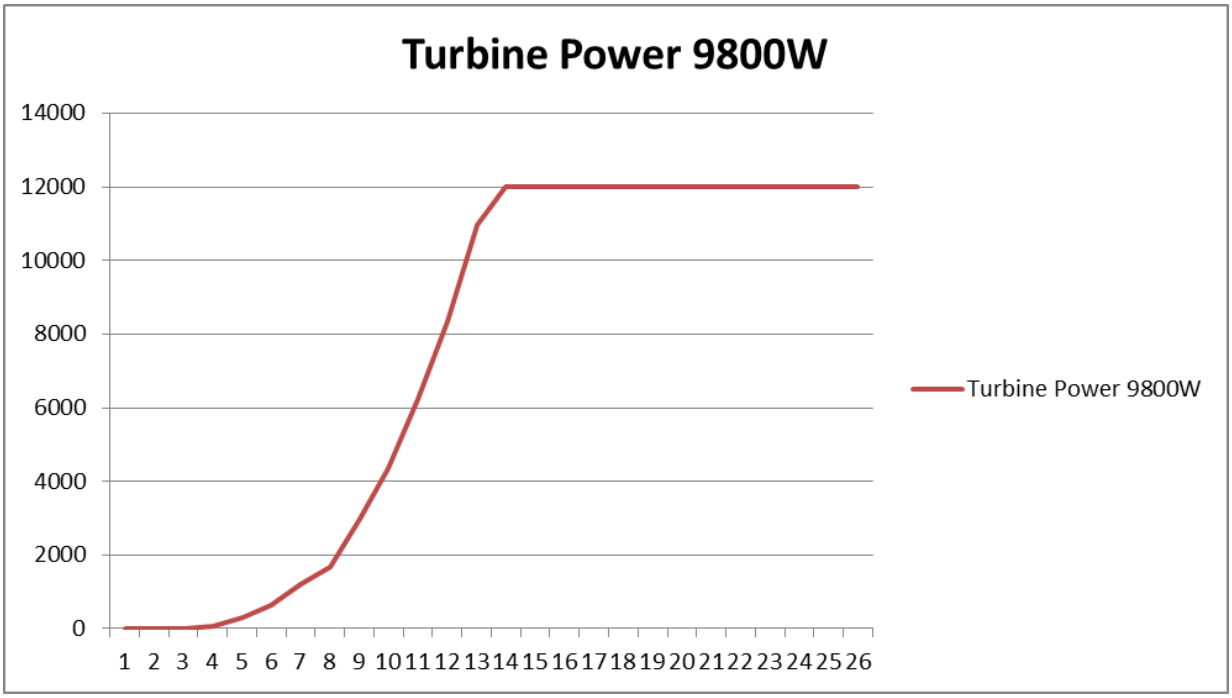
Made in EU

Vertrieb Deutschland, Österreich, Schweiz

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**„Kaufen Sie noch Strom?“®**

| Cp | Wind Speed | Turbine Power 9800W | RPM | AC voltage | AC current |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | -1 | 0,00 |
| 0 | 1 | 0 | 10 | 54 | 0,00 |
| 0 | 2 | 0 | 21 | 108 | 0,00 |
| 0,15 | 3 | 61 | 31 | 163 | 0,37 |
| 0,3 | 4 | 287 | 42 | 218 | 1,32 |
| 0,345 | 5 | 644 | 52 | 272 | 2,37 |
| 0,37 | 6 | 1194 | 63 | 327 | 3,65 |
| 0,325 | 7 | 1666 | 73 | 381 | 4,37 |
| 0,39 | 8 | 2983 | 83 | 436 | 6,84 |
| 0,4 | 9 | 4357 | 94 | 491 | 8,88 |
| 0,418 | 10 | 6245 | 104 | 545 | 11,45 |
| 0,42 | 11 | 8352 | 115 | 600 | 13,92 |
| 0,425 | 12 | 10972 | 125 | 654 | 16,77 |
| 0,435 | 13 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 14 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 15 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 16 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 17 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 18 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 19 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 20 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 21 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 22 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 23 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 24 | 12000 | 150 | 660 | 18,18 |
| 0,435 | 25 | 12000 | 150 | 660 | 18,18 |




Referenzwerte Windkanal. Erträge können je nach Bedingungen am Standort abweichen.