

# Guide to Buying a Wind Energy Resources

## Wind Turbine



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## Wind Energy Resources Guide to Buying a Wind Turbine:

The Wind Energy Resources (WER) range of small scale wind turbines are an efficient and cost effective way of providing electricity for domestic or commercial use. The WER range consists of 5kW, 10kW, 30kW, 50kW and 100kW wind turbines to suit a variety of projects and their energy demands. This guide will take you through the planning and buying process of our range of small scale wind turbines. At WER we understand that the purchase of a turbine is a long term investment and believe the cost of energy produced by our turbines is the lowest of any small turbine. During the feasibility stage you will need to address certain questions:

- Project Feasibility
  - Is my site suitable for this turbine?
  - Which size wind turbine is right for me?
  - What planning considerations will I need to take into account for my site?
  - How much energy will it generate per year?
  - How much will it cost?

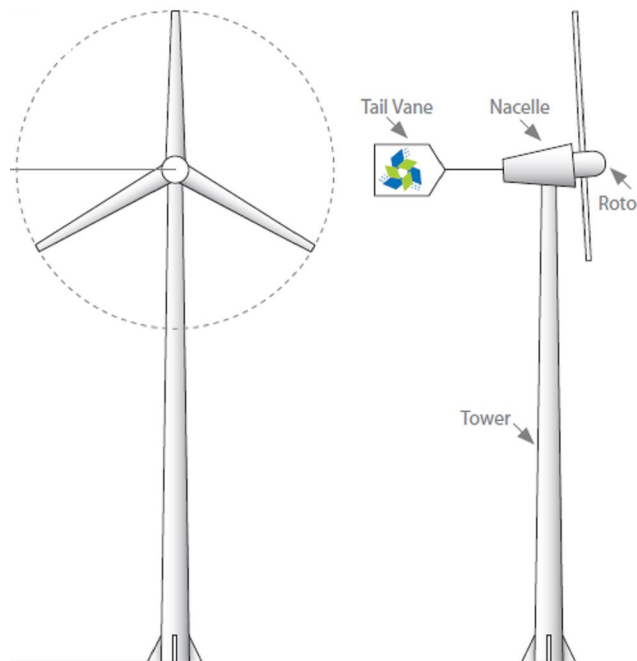
Once you have completed the feasibility stage; assessed and determined that your proposed installation site is suitable for a WER wind turbine, the remaining section of the guide will take you through the final steps towards purchasing a wind turbine:

- Conducting a site survey
- Ordering your wind turbine – Quotes and delivery from WER
- Installation & commissioning
- Generating revenue from your turbine

## WER Wind Turbine Components

As an owner of a wind turbine you will need to be familiar with the system and how it works. This is not only to be able to generate as much energy from it as possible, but also for operation and maintenance purposes which may occur later on in its operational life. There are many components that make up a wind turbine system:

- Turbine - Comprises of the blades and nacelle. The nacelle houses the gearbox, electrical control systems, mechanical brake, electromagnetic brake and the generator. The turbine converts the energy from the wind into electricity using 3 aerodynamic blades. The blades drive the generator round which generates the electricity. Generally, a good measure of a wind turbines capacity is not how tall the tower is, but the size of the blade diameter and swept area. (Right - a diagram of a typical WER wind turbine).



- Inverter – As the voltage from the generator is different to that of the grid, the power from the generator needs to be converted to DC. The inverter then changes the output ensuring it is suitable for the local grid system. The inverter also provides safety features with automatic grid disconnection features when there is a grid connection failure. Always contact your utility supplier first when purchasing a grid connected wind turbine, they will be able to provide you with information on the procedures to connect your turbine to the grid.
- Tower - The turbine is mounted onto a tower to avoid low lying local obstructions. Generally the larger the capacity of the turbine, the larger the tower will be to incorporate the larger blades. WER offer free standing monopole towers for our small scale wind turbines.
- Tower Foundations – The foundations are what anchor the tower into the ground and will need to be very sturdy as to keep the turbine from collapsing or shifting in heavy winds. Before carrying out any foundation work a soil sample must be taken to determine foundation requirements. Foundation work should be carried out before installing the turbine to allow the concrete to settle and dry.

## WER Small Scale Wind Turbine Range

WER's range of small scale wind turbines includes: 5kW, 10kW, 30kW, 50kW and 100kW models. Below is a brief technical description of each model and the tower height that would be needed. (See WER's brochure for further information).

### 5kW – Tower height 9m

### 10kW – Tower height 12m

Model	FD5-5/10	FD7.5-10/10
Rotor Diameter (m)	5	7.5
Blade Material	Wood-Epoxy	Wood-Epoxy
Number of Blades	3	3
Working Wind Speed (m/s)	3 - 25	3 - 25
Cut-in Wind Speed (m/s)	<3	<3
Rated Wind Speed (m/s)	10	10
Survival Wind Speed (m/s)	50	50
Rated Output Power (kW)	5	10
Maximum Output Power (kW)	5.8	12.4
Rated Output Voltage (V)	DC 230	DC 460
Generator Type	3 Phase Permanent Magnet Generator	3 Phase Permanent Magnet Generator
Weight (kg)	167	600
Speed Regulation	Yaw Regulating, Electromagnetic Brake and Passive Stall Control	Yaw Regulating, Electromagnetic Brake and Passive Stall Control
Noise (dBA) with 6 m/s wind speed and background	<55	58
Distance of measure (m)	8	10

### 30kW – Tower height 16m

### 50kW – Tower height 25m

Model	FD10-30/12	FD13-50/12
Rotor Diameter (m)	10	13
Blade Material	Wood-Epoxy	Wood-Epoxy
Number of Blades	3	3
Working Wind Speed (m/s)	3 - 25	3 - 25
Cut-in Wind Speed (m/s)	<3	<3
Rated Wind Speed (m/s)	12	12
Survival Wind Speed (m/s)	50	50
Rated Output Power (kW)	30	50
Maximum Output Power (kW)	35	55
Rated Output Voltage (V)	DC 460	DC 460
Generator Type	3 Phase Permanent Magnet Generator	3 Phase Permanent Magnet Generator
Weight (kg)	2000	2900
Speed Regulation	Mechanical Brake, Electromagnetic Brake and Yaw Regulating	Mechanical Brake, Electromagnetic Brake and Yaw Regulating
Noise (dBA) with 6 m/s wind speed and background	62	65
Distance of measure (m)	14	19

**100kW – Tower height 30m**

Model	FD20-100/12
Rotor Diameter (m)	20
Blade Material	Wood-Epoxy
Number of Blades	3
Working Wind Speed (m/s)	3 - 25
Cut-in Wind Speed (m/s)	<3
Rated Wind Speed (m/s)	12
Survival Wind Speed (m/s)	50
Rated Output Power (kW)	100
Maximum Output Power (kW)	118
Rated Output Voltage (V)	DC 460
Generator Type	3 Phase Permanent Magnet Generator
Weight (kg)	6500
Speed Regulation	Mechanical Brake, Electromagnetic Brake, Yaw Regulating, Blade Pitch Control

WER's 5kW and 10kW wind turbines are ideal for domestic use and with their competitive prices are an even more attractive investment. Both models could provide more than enough energy for the average households annual needs.

WER's 30kW, 50kW and 100kW range of wind turbines have high annual energy yields. This makes them an ideal purchase for a farm owner, a community project or for commercial and industrial use.

When you are in the process of selecting a wind turbine the main things to consider are: the tower height, blade diameter, cut-in wind speed, rated capacity / expected annual output, noise emissions and safety features. These are what to look out for in a wind turbine.

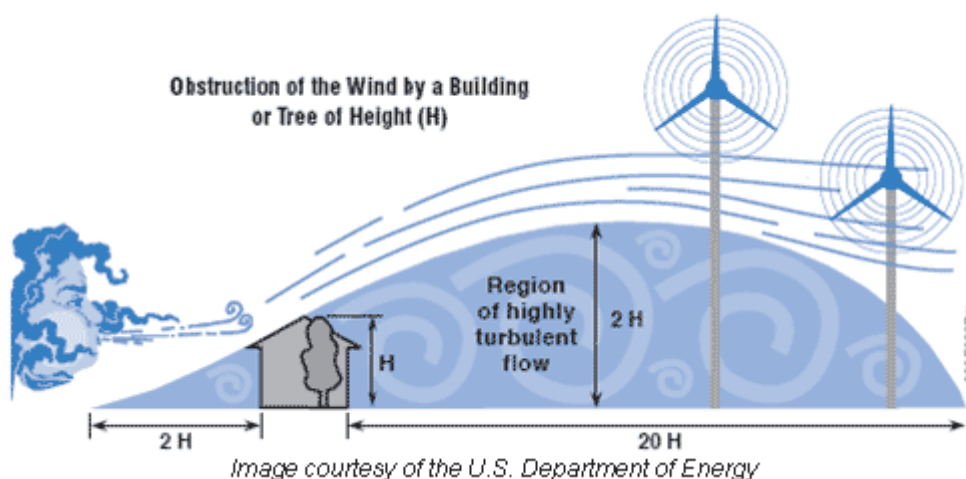
The main considerations for the purchaser should be: What is my annual energy consumption? How much of this do I want the turbine to contribute to? Will the wind turbine I selected be able to meet this energy demand? Once you have selected the wind turbine which you feel will meet your energy demands you will need to assess whether your chosen installation site is suitable for it.

## Assessing Your Site

Site surveys should be conducted before installing your turbine, to assess the suitability of the proposed site. The following considerations should be made:

### Neighboring Obstructions

Installing a wind turbine in a built up area can cause problems with wind speeds, direction and turbulence. Wind turbines do not like turbulence! Excessive turbulence can cause fatigue damage and shortens a wind turbines life-span. The diagram illustrates the effect a building can have on the wind. The turbine should be located 20 X the height of the building or obstruction away (at the very least 10 X) or alternatively be on a sufficiently high tower to be above the turbulent region.



### Turbine Location

- The longer the distance the turbine is from the property or grid connection, the longer and more expensive the cable will be to connect it. This also increases the power loss which will inevitably occur in the cables if the electricity has to travel long distances between the turbine and power connection.
- Consideration of noise from the turbine should also be factored in when planning to install a wind turbine. Installing a turbine near a neighbor's house could lead to objections from the local community and subsequent planning implications.
- Access to the site will be needed for delivery and installation of the turbine. In some cases a crane may be needed to erect the tower. WER only supplies free standing wind turbines and does not supply turbines for mounting on domestic or commercial roofs.

## How Much Energy Will My WER Wind Turbine Generate?

### Site Wind Speeds

The energy output of any wind turbine is dependent on the wind speeds available at the site. WER's range of wind turbines cut-in wind speed is approximately 3 m/s; therefore it is imperative that you acquire accurate wind speed measurements for your installation site in order to obtain maximum benefits from your wind turbine. Use the wind speed that best represents the hub height of your proposed wind turbine (check with WER if you are unsure of this).

More often than not many individuals will use wind atlases or maps for wind speed measurements. Wind atlases show annual mean wind speeds for a specific area commonly using a color scheme to represent wind speeds. Most countries have wind atlases and these can be used to estimate average mean wind speeds at your site. However, these are not entirely accurate and should only ever be used as a rough guide. Visit <http://www.windatlas.dk/> to find your countries wind atlas.

Wind atlases only give an approximation of wind speeds at your location. The true wind speed will be influenced by the local topography and any nearby obstructions such as tall buildings and trees. For more accurate wind speeds WER suggest erecting a met mast at the installation site (erected at the same hub height of your turbine) for a set period of time to provide a more accurate result for the locations average wind speed.

WER would like to make clear that it is extremely difficult to accurately predict the actual annual average wind speed at a particular site and that this figure can also vary from year to year. Wind turbine energy yield is proportional to the cube of the wind speed; as a result differences in wind speed will have significant effects on energy yield. Wind speeds can also be affected by tall objects such as trees and tall buildings, which in turn can affect the energy yield from the wind turbine. WER therefore cannot accept responsibility for the average wind speed, and resultant annual energy generation estimates as they are subject to many factors beyond WER's control. Any WER provided estimates should only be used as a general guide to what you might expect at your site (see below for energy yield estimates).

## Energy Output for WER Small Scale Wind Turbines

With an accurate average wind speed for your installation site you can now begin to obtain guideline figures for your wind turbines annual output. The following table gives an approximate indication of the energy yields that the WER wind turbines can generate per annum from wind speeds of 4 – 10 m/s.

Model: FD5-5/10 – 5kW

Wind Speed (m/s)	Energy (kWh/yr)	Energy (MWh/yr)
4	4,253	4.25
5	8,558	8.56
6	13,048	13.05
7	17,267	17.27
8	20,619	20.62
9	22,019	22.02
10	23,760	23.76

Model: FD7.5-10/10 – 10kW

Wind Speed (m/s)	Energy (kWh/yr)	Energy (MWh/yr)
4	9,279	9.28
5	18,122	18.12
6	27,890	27.89
7	37,296	37.30
8	44,073	44.07
9	46,239	46.24
10	49,836	49.84

Model: FD10-30/12 – 30kW

Wind Speed (m/s)	Energy (kWh/yr)	Energy (MWh/yr)
4	17,011	17.01
5	34,231	34.23
6	57,411	57.41
7	82,879	82.88
8	103,096	103.10
9	123,304	123.30
10	136,924	136.92

Model: FD13-50/12 – 50kW

Wind Speed (m/s)	Energy (kWh/yr)	Energy (MWh/yr)
4	27,877	27.88
5	57,000	57.00
6	94,085	94.09
7	135,397	135.40
8	174,232	174.23
9	208,384	208.38
10	231,402	231.40

Model: FD20-100/12 – 100kW

Wind Speed (m/s)	Energy (kWh/yr)	Energy (MWh/yr)
4	57,734	57.73
5	124,843	124.84
6	208,769	208.77
7	287,315	287.31
8	362,897	362.90
9	434,500	434.50
10	483,261	483.26

## Planning – The Planning System

When installing a wind turbine planning permission may be required. All wind turbine planning applications are usually determined by local planning authorities. Therefore, WER recommend that you make contact with your local planning office and advise them of your intention to put up a turbine. They will be able to provide information on the procedures and likely costs, constraints and timeline for such an application.

Planning permission can be more difficult in areas such as green belt areas, military airfields / airbases, rural areas where the local community like to keep areas free from development e.g. national parks and other designated areas, and heavily populated areas where noise emissions may cause problems. If you are seriously considering purchasing a wind turbine, researching and seeking planning permission should be one of the first things you do as it can delay or even prevent the project from happening.

For more detailed information on planning for Small Wind Turbines visit these web sites:

<http://www.bwea.com/small/planning.html>

<http://www.awea.org/>

<http://www.ewea.org/>

## Funding and Grant Routes

There are many different types of grants and funding available for small scale renewable energy projects. The type and amount available to you will all depend on the type of project it is. For wind turbines many schemes will only fund turbines up to a certain capacity rating. The majority of funds and grants are available for domestic, agricultural, not for profit organizations and community based projects. Grants are usually funded by utility companies, local councils / government initiatives, lottery funding etc.

## Costs

WER wind turbines offer a highly efficient and low cost way of producing electricity. The total cost of a small wind turbine from WER will vary depending on the type of project, selected wind turbine, available grants, number of units ordered and package option selected.

### Wind Turbine Package Options:

- Standard: Nacelle, Blades & Controller with tower drawing.
- Standard + Monopole tower.
- Standard + Grid connected or off grid inverter packages.
- Foundation calculations (*full site information required*).
- Installation by one of our accredited contract partners.
- 24 hour technical support warranty and service packages.

Costs exclude V.A.T.

## Site Survey

A site survey is necessary to determine the suitability of the proposed installation site. The information collected during a site survey includes:

1. A wind assessment preferably using met mast results.
2. Identification of potential obstructions near to the installation site e.g. trees and buildings.
3. Permits – planning permission, environmental permits etc.
4. Topographic information for the site.
5. The energy demands of the turbine user and the theoretical contribution that the wind turbine will contribute to it.
6. Soil sample for foundation requirements.
7. Any site specific access issues that might impact the installation or maintenance of a small wind turbine.
8. Distance between the installation site and the nearest available grid connection.

## Quotation

WER will provide you with a quote upon request. The quote will provide a cost for the wind turbine and its components - the nacelle, blades, controller, tower and inverter for the model and number of units requested. A separate cost can be quoted for installation costs if requested. A site survey can be arranged once you have received your quote and you are happy to move forward with the purchase. Please see WER turbine package options.

## Delivery

Delivery of the wind generator (blades and nacelle), controller, tower and inverter will be made to the installation site. Delivery of the machine will depend on the number of units ordered and the capacity rating of the turbine ordered. WER will provide the delivery times in the quotation. The delivery time is subject to availability of materials and factory loading at time of order. The delivery time would commence on Formal Acknowledgement of Order and Receipt of Down payment and irrevocable letter of credit.

## Installation

This will be carried out by a professional and experienced installation company that WER has approved.

The key steps in the process are:

1. Foundation Preparation. This includes civil works e.g. laying the concrete foundations for the tower and if needed, digging a trench for the electrical connection to be made. It is recommended that you use a professional contractor to lay the foundations prior to installation of the turbine. WER will provide fully detailed instructions and drawings to enable you to arrange it yourself.
2. Tower. Due to the large size of WER's towers they will need to be delivered to the site and may be installed using a crane. Therefore easy access to the site will be needed.
3. Electrical. Your Wind turbine installer will provide and deal with all the electrical components during the installation period.
4. Turbine. The turbine will be delivered and assembled by the installer at the same time as the tower ready for erecting and commissioning.

## Generating Revenue from Your Wind Turbine

The majority of the energy generated by the turbine will be directly used by the owner. Any surplus energy which is generated, for example on extremely windy days, can be sold back to the grid at an agreed price from the local electricity provider. The price for this will depend on the provider and what rates they buy electricity back at. WER suggest that you research what incentives are available in your country of installation.

Selected countries offer incentives for electricity generated from renewables. Some countries adopt a Feed in Tariff (FIT) system. A FIT is a payment for energy that is paid to generators using a renewable energy source. This payment is likely to be per kWh of electricity generated and requires a meter to measure the amount of electricity generated.

## WER Wind Turbine Planning Procedure

Here are some of the key procedures to undertake when planning to install a small wind turbine.

1. Site survey – identifying obstructions, soil sample, access for installation & maintenance and average wind speeds.
2. Seeking planning permission.
3. Choosing the appropriate WER wind turbine model for your site and energy requirements.
4. Estimate the theoretical annual energy output from the installation site average wind speed.
5. Obtain the cost & a quotation from WER.
6. Identify possible funding / Grants for the project.
7. Installation & commissioning of the wind turbine.
8. Assessing possible revenue from selling exported power, ROCs and FITs.

For any queries or further information regarding purchasing a WER wind turbine do not hesitate to contact us.

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