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Wind Power Systems



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Introduction - Wind Power Systems

Taking advantage of wind power is an effective way to reduce energy expenses while reducing your negative impact on the environment. You can do this by installing wind turbines for your home that will generate electricity. You may find this process to be surprisingly easy and inexpensive. Before you get started, however, you must understand how wind turbines work.

All home wind turbines have seven main components in common: a generator, blades, mounting, a tower, a charge controller, batteries, and an inverter. These seven parts work together to convert kinetic energy into electrical energy which can be used in your home.

- 1) Generator
- 2) Blades
- 3) Mounting
- 4) Tower
- 5) Charge Controller
- 6) Battery
- 7) Inverter



Each of these individual components are discussed in further detail below.

Generator:

A generator is the component which actually creates power from the spinning of blades by the wind. Generators will often come in the form of DC Motors. These motors can be purchase from a wide variety of sources. If possible, we recommend that you purchase a used DC Motor in order to save money. Online resources such as EBay offer used DC Motors for as little as \$26 USD.

When shopping around for a DC Motor, try to find one that has:

- High DC Voltage
- High Current
- Low RPM Rating

Additionally, motors that will be effective include permanent magnet alternators, recycled electric lawn mower motors, and Ametek permanent magnet motors.

Various Ametek Motors:



You may prefer purchasing pre-fabricated blades rather than crafting your own. In this case, there are several online resources which offer wind turbine blades which are ready for installation. The blades pictured below were purchased from Amazon.com and cost around \$240 USD.

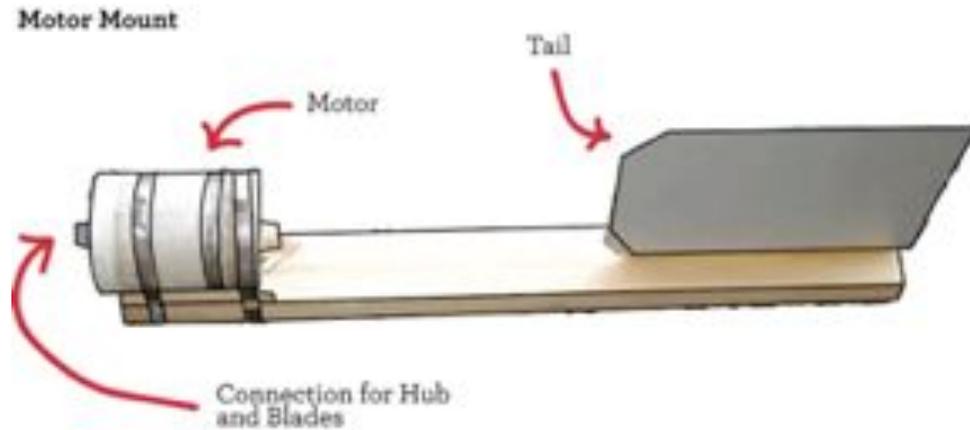


Whether you choose to build your own blades or purchase them from a third party, you will have to attach them to a hub (pictured below) so they can be easily secured to the generator.



Mounting:

Once you've acquired a motor and blades, you must attach them to a mounting frame so that they can begin working to produce wind power together. This mounting includes a tail that will allow for stabilization in the wind. A simple mounting diagram can be seen below:



To protect the wind turbine, blades, and mounting from harsh weather and UV damage, it's crucial that all parts be protected with paint.

Tower:

Once the mounting has been completed, it needs to sit on top of a tower that will give it access to wind flows. The tower should elevate the wind turbine to at least 10 feet off the ground. Higher is generally better and you want to be situated higher than any other obstacle nearby such as another house or large tree that may obstruct the wind.



The tower should be constructed out of a metal pipe at least 1 1/4" in diameter. This pipe should be anchored to the ground with metal wiring. An alternative option may involve recycling a basketball hoop base or a similar item that provides built-in height and stability.

Charge Controller:

The charge controller is a vital part in your wind turbine system. It determines when batteries are full and stops the wind turbine from dumping excess power into the battery. This helps prevent the battery from overcharging which can lead to a shorter life-span.

Charge controllers will also allow you to monitor the voltage of the batteries in your system so you can see if they are operating at maximum efficiency.

Charge controllers can be purchased at local hardware stores for around \$25 USD. An example of a charge controller is pictured below.



Batteries:

Batteries collect and save the energy created by your wind turbine system. Batteries act as the reservoir of energy which provides additional energy to your home. When constructing your wind power system, you must be sure to include the correct type of battery.

Wind power systems require deep-cycle lead acid batteries. These are the types of batteries which are also used to power electric golf carts, portable lighting, and audio systems. It is important to note that a car battery is NOT suitable for your wind power system.

These batteries can be expensive, so we recommend that you purchase used deep cycle batteries in order to reduce project costs. You can do this by purchasing batteries online or by collecting and refurbishing old batteries discarded by local companies.



Inverter:

There are two basic kinds of electrical current: Direct Current (DC) and Alternating Current (AC). The type of current that is generated by wind power systems is direct current. However, nearly all homes require alternating current. As a result, an inverter must be incorporated into your system.

Inverters transform direct current into alternating current, thereby allowing the power generated by your wind turbine system to be effectively used in your home.



How Everything Works:

Now that you have a basic understanding of all the components of a wind power system, you can begin to see how the overall system works as a whole.

First, the wind turbine generates DC voltage which is sent to the charge controller. Depending on the condition of the batteries, the charge controller either sends the DC voltage directly to the batteries to bring them up to peak charge or, if they already charged, the charge controller diverts the power into a secondary load.

Next, batteries store all of the DC voltage until they are called upon to deliver this stored energy. Once called upon, the inverter changes DC (direct current) volts into AC (alternating current) volts.

Finally, the free energy that was generated is put to work in your home.



Location

A wind turbine is a worthwhile installation in most locations, but it's important to make sure that you have enough space so as not to bother your neighbors. This is especially important in densely populated areas. As a result, you will likely need to mount your turbine in a strategic place.

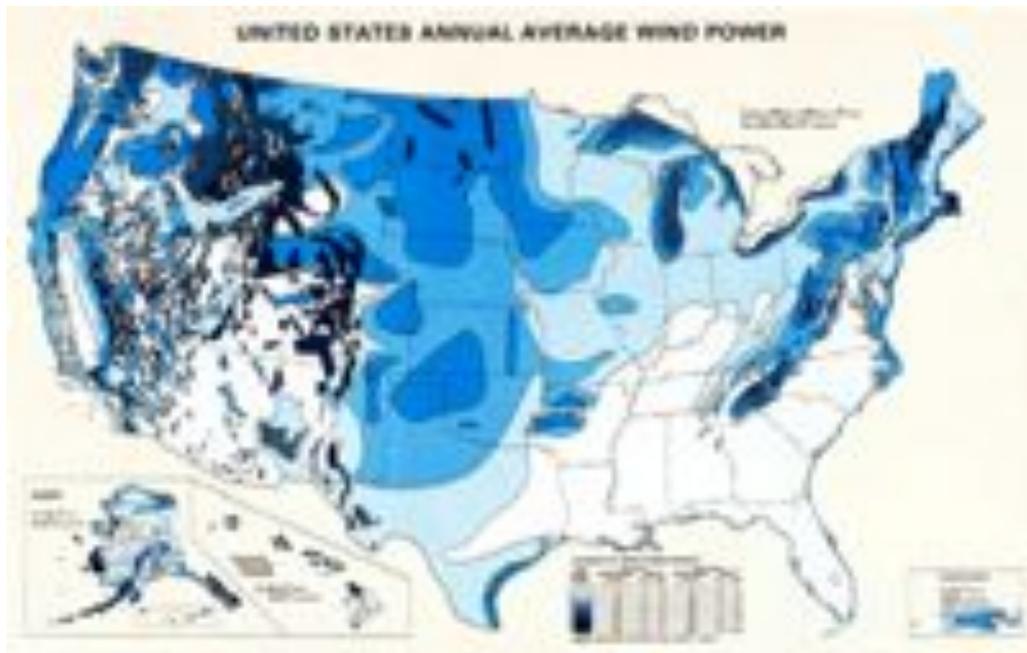
Your wind turbine should be clear of all buildings, trees, or other types of structures that can obstruct wind flow. All of these things will negatively affect the amount of wind reaching the turbine, therefore reducing the amount of energy your system is able to generate.

If possible, assemble your wind turbine in a clear and open space. If you do not have such a space, make a tower that extends high enough in the air to clear all obstructions that may be in the way. Note that as your tower becomes taller, it will require a stronger more secure anchoring system. You may also consider installing your wind turbine on top of your roof in order to achieve greater height. Be sure to check your local area for any permits that may be required prior to installing your turbine.



Measuring Wind

Before you install a wind turbine, it's important to determine how much wind you get on a regular basis in your area. A wind turbine can be a great source of power in places with a steady flow of wind. The map below shows the areas of the United States which generate the most powerful winds. The darker shaded areas generate the highest winds while light areas produce the lowest. For an effective wind power system, you should live in an area with moderate amounts of wind.



Additional resources for determining wind flows in your area can be found below:

http://www.bergey.com/wind_maps.htm

http://www.windpoweringamerica.gov/wind_maps.asp

<http://www.nrel.gov/gis/wind.html>

<http://www.windpowermaps.org/default.asp>

<http://worldwind.arc.nasa.gov/>

DIY Affordability:

Building your own wind turbine is much cheaper than buying the pre-made variety. It can also be fun and provide a sense of accomplishment. For this reason, we strongly encourage building as much of the system yourself as possible.

Constructing your own wind turbine out of affordable materials will also help lower your energy bill by taking pressure off of household loads. If you choose, recycling various materials to build your wind turbine can save you a great deal of money while further helping the environment.

We hope that this guide will help you understand the process of building an at home wind power system and encourage you to explore other Do-It-Yourself projects that can save you money.