MAKING A WIND TURBINE

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Working with renewable energy sources is dangerous. You are dealing with electricity, high roof tops or towers and numerous unknown conditions. Seek expert opinions and help where necessary. While carrying out your E4E project, we assume that you are aware of all the risks and possible damages associated with home improvements and renewable energy.

Wind Turbine Introduction

Home improvements and alterations often need local government permits and licenses or may be illegal in your area. Check with your town, city, state, province, county or country for applicable laws.

It is recommend that you call your local electrician (and other professionals) to assist in your renewable energy project. Failure to do so could cause injury or death and you are acting at your won risk.

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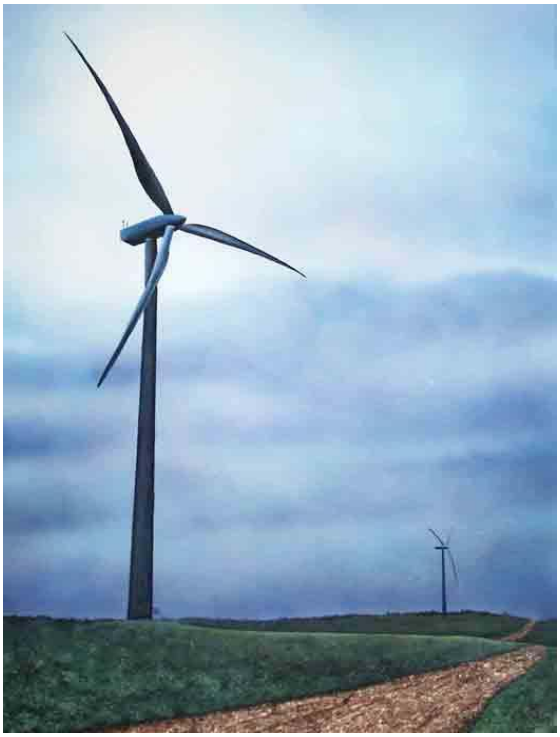
Wind Power:

The following five parts all work simultaneously, with the end result being kinetic energy converted to electric: a generator, blades, mounting, tower, and control panel.



Basic process:

Wind ➡ Current into the battery ➡ A load on the Generator ➡ Usable energy!

Generator:

This wind turbine transforms wind power into electricity, with the use of an A DC Motor that generates the power to spin the blades,

Options include:

- Electric lawn mower motors that have been recycled.
- All motors made by Ametek.
- Alternators with a permanent magnet (car alternators).

In order to find a DC motor you can check eBay, or look for inexpensive power tools. Drills, screwdrivers and other tools are a great way to find inexpensive DC motors although they do not generate much energy they are great for smaller projects. A great DC motor/generator is the Ametek 30VDC as pictured below. I purchased this DC motor for about $50 from ebay.

I will admit however, since then a lot of people have realized the potential of these motors and the price has gone up. If you can't find a cheap one you may want to look at car alternators or something cheaper.

http://www.earth4energy.com/recommends/ebay-ametekwindgenerators.php

What DC motor should you use?

What you want to look for is a surplus permanent magnet DC motor and pay attention to the RPM, shaft size, amps and voltage. You need to look for a DC motor with a LOW RPM rating. The reason for this is because when we use a DC motor as a generator it must spin much faster than the rated RPM to produce the rated voltage. Your goal is to obtain a DC motor with HIGH voltage (over 12v), HIGH current and LOW RPM rating.

An ideal motor would be one rated under 400 RPM at 30 volts. When this is used as a wind generator you could expect 12v at a low RPM.

If you do not have strong winds then you need a motor with a very low RPM rating. You may need to attach the blades to a larger hub and run a belt to the DC motor. This will allow the blades to spin slower and the DC motor will spin much faster. Obviously though,

strong winds are the key to high generator output.

So how do DC motors work as a power generator?

Usually a DC motor will use power, but when we spin the motor in the opposite direction it will actually generate power. It's quite simple really.

The power will go back out the same wires where the power usually comes in from. It's very simple, which is why DC motors are perfect for our DIY wind generator.

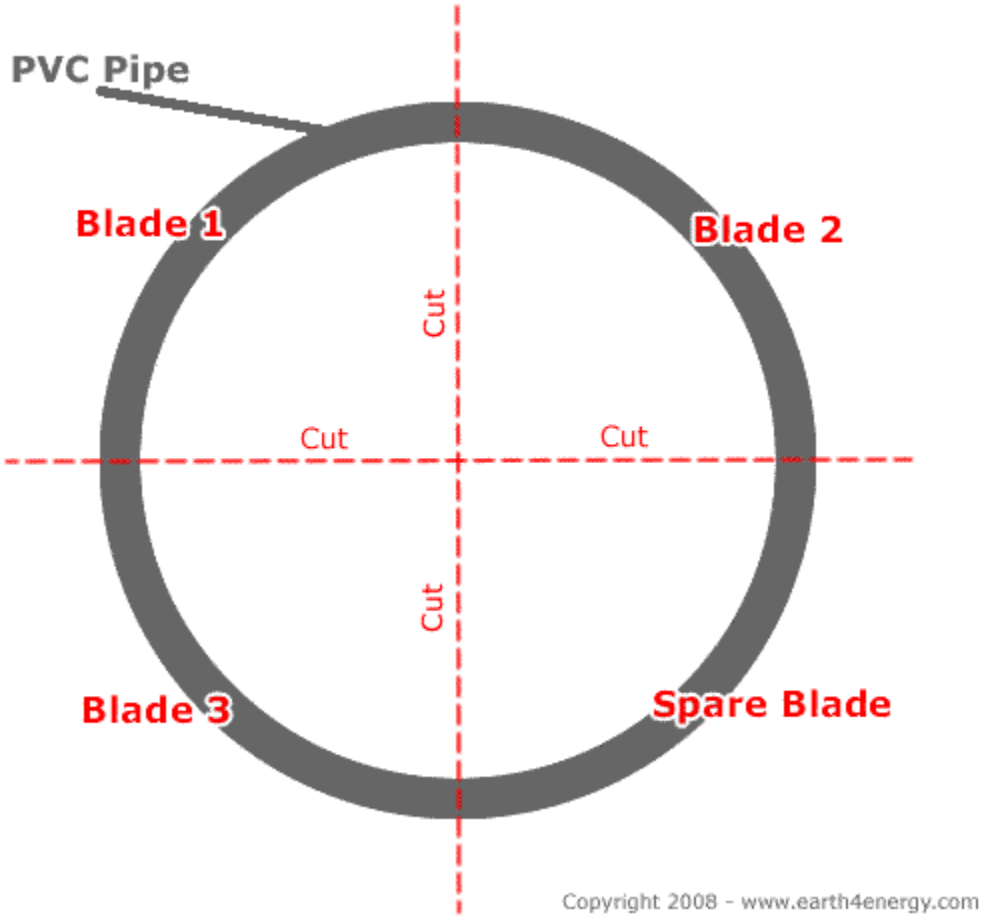
Blades:

The blades literally take wind and turn it into usable energy. We used the materials and measurements below, choosing to cut our own blades.

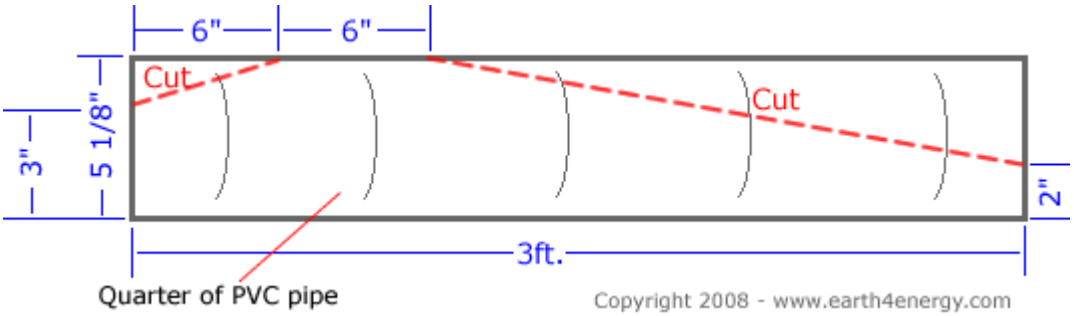
Using recycled fan blades is an option, if you don't want to cut your own blades. For more information on

building PVC blades from an old pipe please watch our instruction video from the members page.

- Acquire a 6-inch wide, 24-inch long PVC pipe.
- Quarter the piece of pipe around its circumference, cutting it lengthwise into four pieces (diagram on the next page).



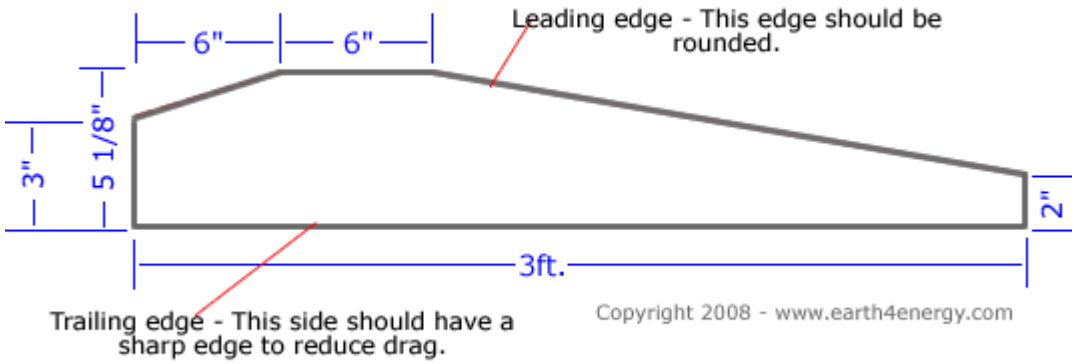
- Cut one blade, using it as a template for the others (standard measurements provided).



The wide part of the blade is what will help the windmill start spinning. The blade comes down to a narrow 2" tip, as this will allow the windmill to spin at high speeds.

After the shape is cut, you need to do some sanding/ grinding. Make the leading edge rounded and smooth. This will allow the wind to flow over the top of it easier. You need to angel the trailing edge until it is sharp. This will reduce the drag from the blades as it spins around. To angle the edge you can use an angel grinder then a sander to remove any rough parts.

The below diagram shows what parts of the blade need to be shaped and grinded.



Now we need to drill a couple of holes. Bolts will go through the holes and attach the blade to the hub. The below diagram shows the placement of the holes when our hub design is used. If you plan to use your own hub from scrap metal than simply mark out the holes to suit your hub.

Note: It's a good idea to have the hub ready before drilling the holes in the blades. This way you can confirm the holes on the hub match the holes on the blade.

After you have finished one blade simply, use the same above steps for the next two blades. You can use the extra piece of pipe and make a spare blade if you like too.

When your blades are all shaped, you should give them a sanding. This will help the paint stick to the pipe. The paint will help protect the blades from sun and rain. See the below image for painted blades ready for mounting:

Now that the blades are made its time to work on the hub.

We have determined that three blades is the optimum number – according to our extensive research. In addition to confirming our research, it is common practice for most commercially made turbines also use three blades. Even numbers of blades often suffer vibration issues. Single-bladed turbines must have a large counterweight opposite the blade to keep them balanced. By adding more blades, the return on your investment is diminishing. We found that the expense

and complexity go up quickly, with an improvement of performance only marginal. Adding more blades tends to increase torque, which also comes at the expense of speed.

You will rarely see a wind turbine with more than five blades, because generators like to run fast. Where torque is important issue, you may see turbines with many blades, i.e. pumping water on ranches. However, they don't make good electrical generators, unless their output is geared way up to create the speed.

Aluminum Disks for Blade Hub:

Attach your blades to a hub so they can then be easily secured to a mounting. You can pickup pieces of scrap alloy hubs like this from metal scrap yards. If you have been through all of the free options and still have not found a suitable hub you can always purchase one online. Below is a hub from GreenergyStar that costs

$39.

Mounting:

Attach the motor and blades to a shared mounting, so they can begin working simultaneously to produce wind power, then useable electricity.

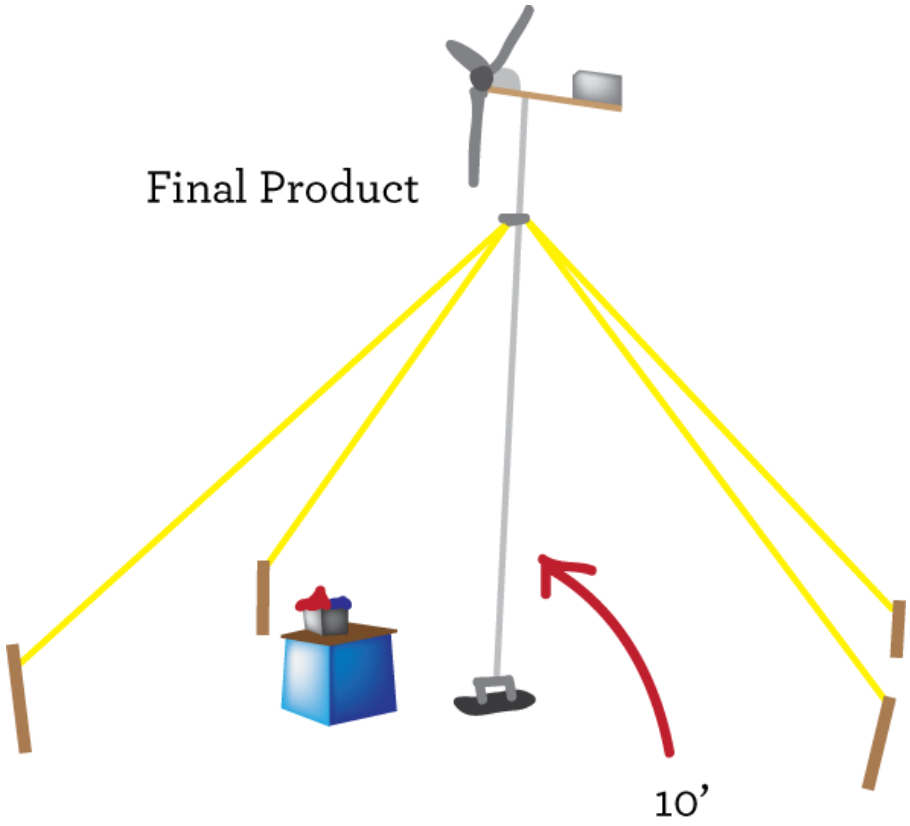
Use stainless steel hose clamps to secure the motor to a piece of wood that is about 3 foot long. You can then secure the tail to the other end by cutting a slice out of the wood and sliding the tail in. Then secure it with silicone.

It is crucial that all wooden parts be covered in UV protected latex paint, which will protect the entire project from harsh weather when used properly. You don't want to be dealing with rotting wood every couple of years, so please make sure this is done.

You can also use an alloy bar to secure the motor and tail piece too. This will look more professional.

Tower:

Use "guy lines" to hold the tower up. Please see the below picture for a better understanding.



Finding a Tower:

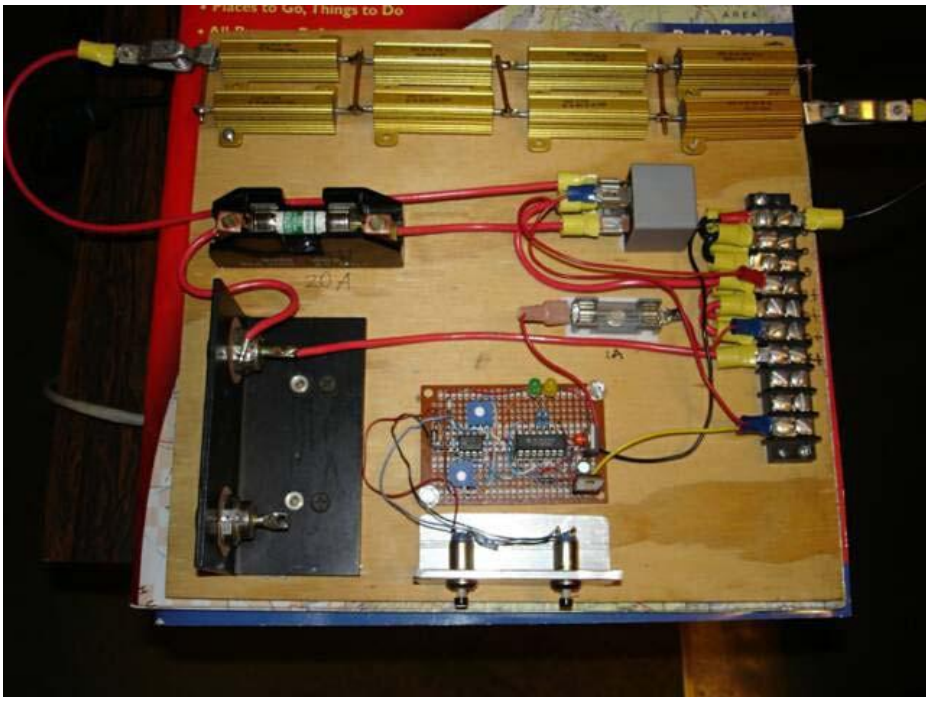
Old satellite TV towers work well, as well as standard steel pipe, 2-3” thick. Anything that is sturdy, roughly 8-12 feet tall, and can easily be anchored in the ground with concrete, can make a great tower. Alternatively, if you know how to weld you can build your own tower. Below is a picture of a cheap satellite tower

sourced online. It's the perfect tower for a backyard windmill.

Recycling a basketball hoop base, which provides built-in height and stability, is another alternative the tower option has.

Charge Controller:

Wind Turbine Introduction



To determine when the wind turbine should stop dumping power into the battery, a charge controller must be attached. This necessity prevents the battery from over-charging, and wearing out too soon.

How Everything Works:

The DC motor will feed energy to your charge controller which will pass this onto the battery. Note: If using a 12 volt battery you will only begin to charge the battery once the wind turbine is producing 13 volts or more.

The energy will then go from the battery to the inverter. The inverter will turn the DC energy from the wind turbine into AC energy which you can use to power everyday appliances.

Why do it?:

It is a great deal cheaper to build your own wind turbine, rather than buying a pre-made variety. You can also further help the environment by recycling different materials. This process saves you a lot of money in addition to environmental protection.

Your energy bill will also be lower, as you have effectively taken pressure off household loads, and by having constructed your own wind turbine out of affordable materials.

Location:

It is important to make sure that you have enough space so as not to bother your neighbors (especially in densely populated areas), but a wind turbine is a worthwhile installation in almost any location. It is very important to mount your generator and blades in

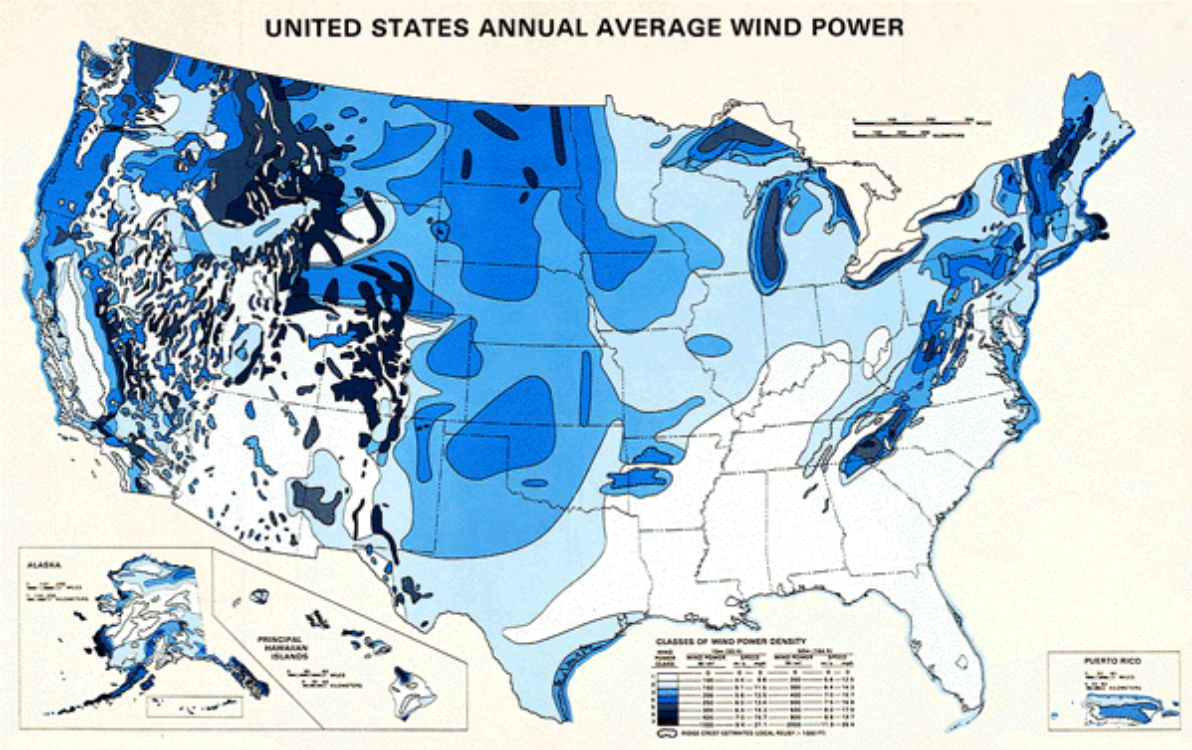
a strategic place, like a roof, if there are buildings, trees, or other types of structures that could obstruct airflow from your turbine.

Also, the most important part – You need wind! If you're in an area that doesn't get much wind you won't benefit from a wind turbine as it will not spin fast enough to produce the required voltage. If this is your case then look into solar energy.

Measuring Wind:

It's also important to determine how much wind you get on a regular basis in your area, before you install a wind turbine. In places with a steady stream of wind, a wind turbine can be a great source of power.

Wind Turbine Introduction



Click here for specific wind information in your area:

http://www.earth4energy.com/members/bonusbooks/windmap.pdf

This guide is intended to give you an understanding of wind energy and help you build a wind turbine. Remember, there is no set way to do this when trying to build a wind turbine for as cheap as possible. Be creative and test new ideas. One idea sent in by a member was to use a pulley system. This means having the blades on a separate (bigger) hub then run a belt to the DC motor shaft. This will allow the generator to produce 13 volts + at lower RPM.