The Ultimate Guide To Creating A Wind Turbine

DISCLAIMER

These guides and videos have been designed to help others to help create alternative energy by showing how to create a wind turbine. Every effort has been made to make this report as complete and accurate as possible. There may be the possibility of mistakes in content and type. This report contains information on wind turbines only up to the publishing date. Some tips and techniques may change within time. This report should be used as a guide to making wind turbines and does not guarantee these methods.

The purpose of this these guides and videos is to educate. We are not responsible for any errors or omissions. The author and publisher shall have neither liability nor responsibility to anybody or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by this report.

The Project Consists Of:

Building The Wind Turbine
Building The Tower
Combining Both The Turbine and Tower
Installing

Introduction:

There are several guides on building wind turbines on the internet, but the problem is that these turbines are usually pretty big in size. The following instructions show how to create a wind turbine. You will also find links at the last page of this guide to show you exactly how to create your own vertical wind turbine too.

We've added simple modifications to the original guide for a bigger treadmill motor which takes bigger blades, weighs more, requires a more durable fastening for the turbine blades and also uses a bearing to attach to the tower.

Yes it is possible to create your own wind-powered generator from left over scrap material. The majority of the tools that are needed can be found at any local hardware store or at a junkyard. We strongly suggest going to your local junkyard to find the material needed.

Tip: Be sure to check out freecycle.org to check for parts that you can use.

You can pick up the motor for a wind turbine on EBay for extremely cheap. You can also pick up PVC pipe to create the blades from just about anywhere. You can also create the tail from an old roller paint pan too.

Note: Safety should always come first. Wind generators can be extremely dangerous, especially in extreme weather conditions.

The wind turbine shown in this guide is based off of the Chispito Wind Generator. There are several photos that we will show as we continue moving forward in this guide.

Supplies Needed:

A 260 VDC, 5 A continuous duty Treadmill Motor with a 6 inch threaded hub is the best thing you get for smaller wind turbines. You can get these motors from any motor surplus stores and can also find them cheap on EBay. You can actually get about 7 amps in a 30 MPH wind. This is exactly what you need to get your turbine project moving into the right direction.

260 VDC

If you're looking to build a vertical axis wind turbine (VAWT) you will want to pick up a 90 VDC 20A treadmill motor. This motor requires an upgrade to most of the original Chispito instructions due to bigger size and weight. It also produces a lower output voltage too.

You can also use a permanent magnet DC motor that returns at least 1 V for every 25 RPM and is able to handle up to 10 amps. You can find something such as the Ametek 30, which has been said to be the best motor that money can buy. Because it is the best motor, it usually means it's also the most expensive too.

Note: If you go with another motor, there will be specific changes to the supply list, such as you will have to find a hub, a circular saw blade with a 5/8" shaft adaptor.

Tools Needed:

Drill
Drill Bits (7/32”, ¼”, 5/16”)
Pipe Wrench
Flat Head Screwdriver
Wire Strippers
Jigsaw With A Metal Blade
Crescent Wrench
Wire Strippers
Vise or A Clamp
Tape Measure
Compass and Protractor
Sharpie Marker
¼” #20 Thread Tapping Set

The Materials To Build The Turbine

The Mount:

36” of 1” Square Tubing (Larger motors should use 6 FT of L Tubing
2: Floor Flange- Or a rotating dolly wheel with a hole in the middle
2” x 4” Nipple
3 x ¾” Self tapping screws
For the larger 20 AMP motor it’s suggested to use a caster wheel that has a hole in the middle to attach the motor to the tower. This will help the motor turn without difficulty and doesn’t wear out the tower.

Note: If you know how to weld, you can weld a 4” section of 2” pipe into your square tubing as opposed to using the flange, sheet metal screws or nipple.

The Motor:

260 VDC, 5 A continuous duty Treadmill Motor with a 6 inch threaded hub or an Ametek 30
30 - 50 Amp Blocking Diode (one-way)
2 x 5/16” x 3/4” Motor Bolts
3" X 11" PVC Pipe - or larger depending on the size of the treadmill motor

The Tail:

1 sqft (approx) lightweight material (metal) - used roller paint tray will work
2 X 3/4" Self-tapping Screws

The following instructions and diagrams are from:
http://www.greenterrafirma.com/DIY_Wind_Turbine.html

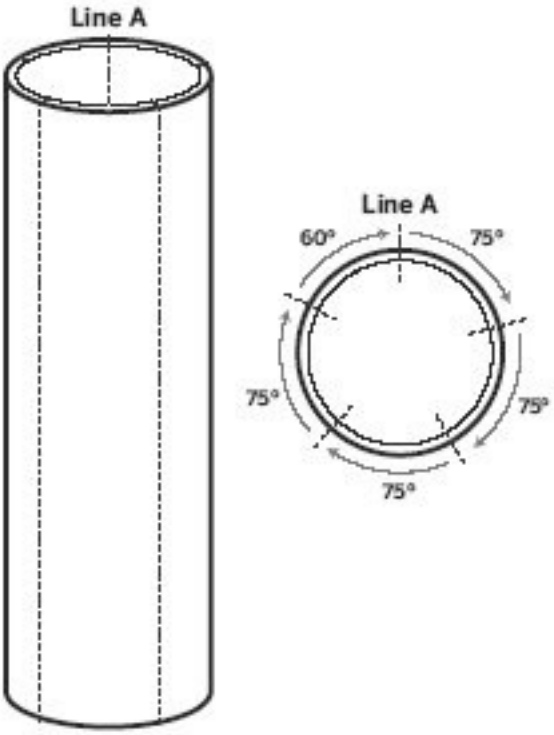
ASSEMBLY

Cutting Blades - makes 8 blades (or 2+ blade sets) and a thin waste strip.

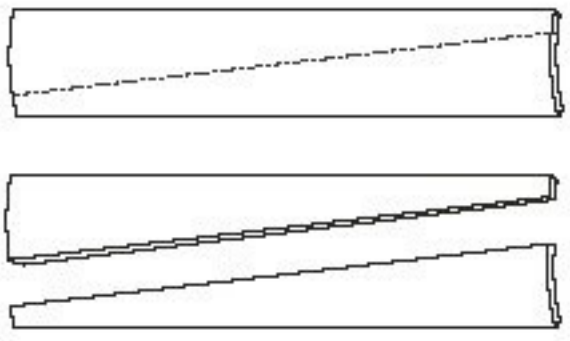
I have created a separate page with more pictures and expanded on this process a bit. After you've done this once, it makes sense. These instructions could use a little help for the first time wind turbine blade maker.

Place the 24" Length of PVC pipe and square tubing (or other straight edge) side by side on a flat surface. Push the pipe tight against the tubing and mark the line where they touch. This is Line A.
Make a mark near each end of Line A, 23" apart.

Tape 3 sheets of A4 paper together, so that they form a long, completely straight



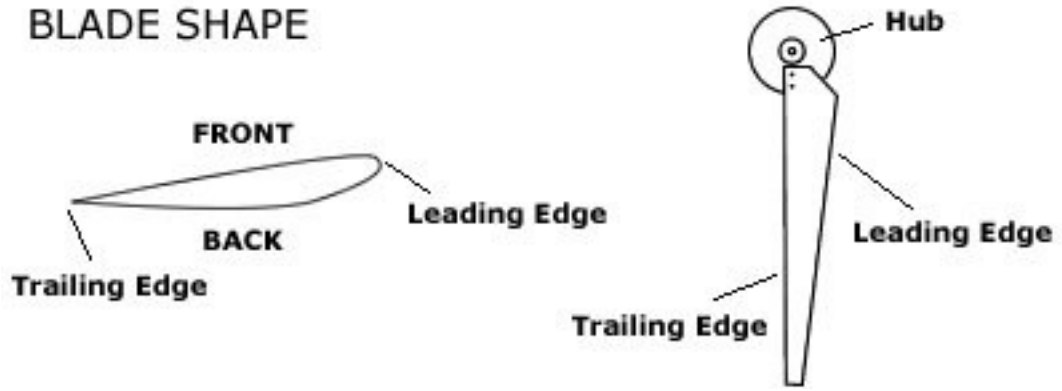
piece of paper. Wrap this around the section of pipe at each of the two the marks you just made, one then the other. Make sure the short side of the paper is straight along Line A and the paper is straight against itself where it overlaps. Mark a line along the edge of the paper at each end. Call one Line B and the other Line C.
Start where Line A intersects Line B. Going left around Line B; make a mark at every 145 mm. The last section should be about 115 mm.
Start where Line A intersects Line C. Going right around Line C, make a mark at every 145 mm. The last section should be about 115 mm.
Mark each line using a straight edge.
Cut along these lines, using the jigsaw, so that you have 4 strips of 145 mm and one strip about 115 mm.



Take each strip and place them with the inside of the pipe facing down.

Make a mark at one end of each strip 115 mm from the left edge.
Make a mark at the other end of each strip 30 mm from the left edge.
Mark and cut these lines, using the jigsaw.

Note: we also made a set of blades 38 inches long using the same measurement - only the length was changed - 24 inches to 38 inches.



Sanding the Blades You should sand the blades to achieve the desired airfoil. This will increase the efficiency of the blades, as well as making them quieter.

The angled (leading) edge wants to be rounded, while the straight (tailing) edge wants to be pointed.

Any sharp corners should be slightly rounded to cut down on noise.

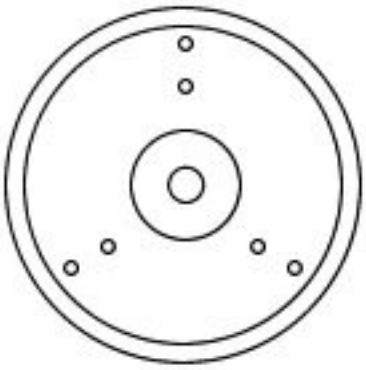
Making The Tail The exact dimensions of the tail are not important. You need about one square foot of lightweight material, preferably metal. You can make the tail any shape you want, so long as the end result is stiff rather than floppy, we used an old aluminum paint tray (flattened). Our 6 foot long rail has holes already in it, so we will simply bolted the tail in place near the end of the rail - see instructions below about "balancing" the complete setup.

Drilling Holes in Blades - using the ¼" drill bit

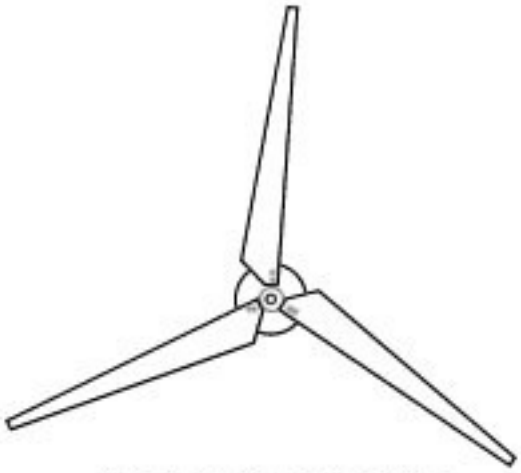
Mark two holes at the wide end and along the straight edge of each of the three blades. The first hole should be 3/8 " from the straight edge and ½ " from the bottom. The second hole should be 3/8 " from the straight edge and 1 ¼" from the bottom.
Drill these 6 holes - 2 per blade (3 blades in total)

Drilling Holes in Hub - using the 7/32" drill bit and ¼" tap

NOTE: You may want to modify these instructions. Try replacing the hub with an old, used 7 1/4 inch skill saw blade. The larger surface area will give you more space to screw or bolt the blades to. We also used 1/4 inch bolts rather than drilling and tapping holes. I've also see old aluminum frying pans used for this purpose. They are light and solid



HUB LAYOUT

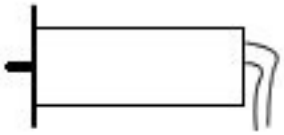


BLADE LAYOUT

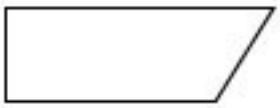
If the Treadmill motor comes with the hub attached, take it off, hold the end of the shaft (which comes through the hub) firmly with pliers, and turn the hub clockwise. This hub unscrews clockwise, which is why the blades turn counter-clockwise.
Make a template of the hub on a piece of paper, using a compass and protractor.
Mark 3 holes, each of which is 2 3/8" from the center of the circle and equidistant from each other.
Place this template over the hub and punch a starter hole through the paper and onto the hub at each hole.
Drill these holes with the 7/32" drill bit.
Tap the holes with the ¼" x 20 tap.
Bolt the blades onto the hub using the ¼" bolts. At this point, the outer holes have not been drilled.
Measure the distance between the straight edge of the tips of each blade. Adjust them so that they are all equidistant. Mark and punch each hole on the hub through the empty hole in each blade.
Label the blades and hub so that you can match which blade goes where at a later stage.
Remove the blades and then drill and tap these outer three holes.

Note: the metal slow moving vehicle sign is not solid enough to stand-up in high winds. We screwed on a wooden ring to the back of the sign to give it the required strength. This blocked too much wind so we ended up replacing it with a 6-inch wooden hub, reinforced with a metal plate on the back. Even later, we ended up replacing this hub with a 6" metal hub for added strength.

Make a Protective Cover for the Motor



MOTOR SIDE VIEW



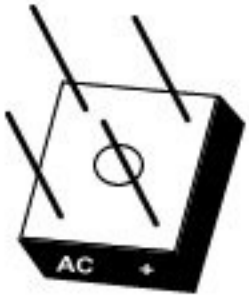
SLEEVE SIDE VIEW

SLEEVE FRONT VIEW

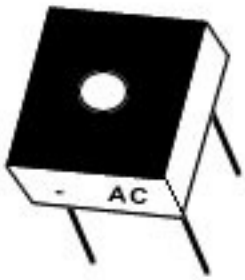
Draw two straight lines, about ¾" apart, along the length of the 8 " x 16" PVC Pipe. Cut along these lines.
Make a 45º cut at the end of the pipe.
Slide the cover over the motor and secure in place.

TURBINE ASSEMBLY

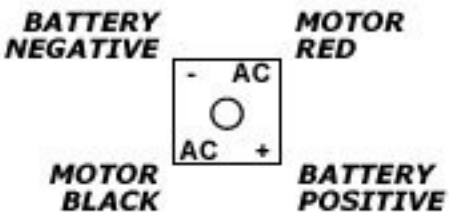
Remove the rubber wheel from the Caster. Drill through the caster and bolt to your tower assembly (top pipe of your tower)



DIODE TOP VIEW



DIODE BOTTOM VIEW



DIODE WIRING

Place the diode on the "L" tubing, about 2" behind the motor, and screw it into position using a self-tapping metal screw.
Connect the black wire coming out of the motor to the positive incoming terminal of the diode (Labeled AC on the positive side).
Connect the red wire coming out of the motor to the negative incoming terminal of the diode (Labeled AC on the negative side).
Place each blade on the hub so that all the holes line up. Using the ¼" bolts and washers, bolt the blades to the hub. For the inner three holes, use two washers per bolt, one on each side of the blade. For the outer three holes, just use one washer next to the head of the bolt. Tighten. This points the blades away from your tower.
Hold the end of the shaft of the motor (which comes through the hub) firmly with pliers, and turn the hub counterclockwise until it tightens and stops. Our motor didn't come with a hub, thus we attached our "pulley-hub" to the shaft.
Attach the caster dolly to the motor and "L" rail. Balance this whole setup by moving the 1 square foot tail section along the 6' long rail. Once you find the spot where everything is balance, bolt the tail to the rail at that spot.

For our larger (heavier) motor, we used a rotating caster with a hollow kingpin, bolted to the top of the tower. The dolly/caster needs to have a hole in the middle that you will run the power wires down, through the tower. The dolly is bolted directly to the DC motor, which made the complete mounting system much easier.

For a longer life span of your wind generator, you should paint the blades, motor sleeve, mount and tail.

On the larger 20A treadmill motor, we attached a dolly bearing directly to the bottom of the motor and then onto the top of the tower. Get a dolly wheel with a hole in the middle, which you thread the power wires through.

We also used the same PVC Blade Pattern to cut 3-foot blades. Just make the length 3 feet rather than 2 feet. The measurements at both ends stay the same - 145 cm wide sections that are next cut into 2 blades. This gives the same curve to the blades.

Depending on the size of your motor, you may want to experiment with different lengths of blades. Our larger blades were not balanced as well as the shorter blades initially and thus turned slower. We cut them down in length from 36 inches to 32 inches and balanced them. To balance the blades, we placed the blades and hub, onto a long pointed nail. We than slid a washer along the blades to find the balance point. Then epoxy the washer in place (try to account for the weight of the epoxy as well).

How much power can we get from the wind?

Power **AVAILABLE** in the wind = .5 x air density x swept area x (wind velocity cubed)

Example: air density = 1.23 kg per cubic meter at sea level. Swept area = pi x r squared. Our 2 foot blades = 0.609m, 4 ft. = 1.219m. 10 mph = 4.4704 m/s, 20 mph = 8.9408 m/s.

How much power is in the wind: **2 ft. blade, 10 mph winds** = .5 x 1.23 x 3.14 x 0.609squared x 4.4704 cubed

= .5 x 1.23 x 1.159 x 89.338 = **63.7 watts**

With 4 foot blades and 10 mph winds = .5 x 1.23 x 4.666 x 89.338 = **256 watts**

With 4 foot blades and 20 mph winds = .5 x 1.23 x 4.666 x 714.708 = **2051 watts**

That's the MAXIMUM power in the wind. However, it's impossible to harvest ALL the power. The **Betz Limit** tells us that the maximum percentage of power we can harvest from the wind is 59.26%.

Thus our maximum power from these turbines would be:

2 ft. blades, 10 mph wind = **37.7 watts**

4 ft. blades, 10 mph wind = **152 watts**

4 ft. blades, 20 mph wind = **1,215 watts**

These values are the maximum power achievable. Your results will be less, depending on how well you shape the blades, how well balanced the blade assembly is, drag going over the hub, copper losses, etc. A very well built DIY HAWT would not likely get more than 50% of the above numbers.

Assembly

Base:

You'll need to dig a hole about 1 FT in diameter and about 2 feet deep.

You will now feed the 6" x 1 ¼" steel pipe nipple through the horizontal part of the 1 ½" steel pipe T

Be sure to screw the elbows onto each end of the nipple

Screw the 2 FT x 1 ¼" steel pipe nipples into the elbows

Be sure to set the hinge base into the hole so that the T is off the ground. The T should be level.

When the base is ready and level in the hole that was dug, you then want to pour concrete into the hole.

On The Pole

Be sure to drill a big hole about 1 FT from the bottom of the steel pipe for the wire to exit out.

Screw the pipe into the vertical part of the T

Be sure to create 4 loops of wire where each loop consists of several turns of wire

Place the 1 ½" U Bolt round the pipe, 3 FT from the top and thread it through the 4 loops. You'll then want to move the loops so they are all equally spaced out

Once you've finished that, be sure to tighten the U Bolt.

Secure a guy wire to each of the loops on the U Bolt

Leveling The Pole

Put 4 stakes about 12 feet from the base

Drive each stake into the ground. Make sure they are angled away from the base

Wire a turnbuckle to each stake using strands of wire

Raise the pole to a level position

Attach the guys to the turnbuckles

Make sure the pole is level and tighten the turnbuckles for a secure fit

Be sure to mark the front turnbuckle for future reference

Wiring:

Be sure to release the front guy and lower the pole to the ground

Feed the wires down into the pole and out of the hole in the bottom of the pipe

Be sure to wrap the bottom of the wires to provide a closed circuit

Slide the generator over the top of the pole and pull the wires up through to the generator

Wrap the red wire from the generator to the positive wire

Be sure to secure the connection and use heat shrink connectors or wire nuts.

Do this for both the positive wire and the negative

Raise the pole by pulling the front guy into place

Tighten the front guy to the mark that you made earlier

Unwrap the ends of the wires and connect them to the positive and negative terminals of your battery.

References

The same rules apply to building a wind turbine or a vertical wind turbine. For detailed instructions on how to build your own vertical wind turbine you will find videos and a guide by clicking on the links below.

Vertical Axis Wind Turbine With Videos:
http://www.applied-sciences.net/library/zoetrope.php

Instructional Guide On Building Vertical Wind Turbine
http://www.applied-sciences.net/library/data/zoetrope-wind-turbine.pdf

DIY Guide To Making A Wind Turbine
http://www.greenterrafirma.com/DIY_Wind_Turbine.html