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DIY 1000 watt wind turbine

by **sspence** on June 2, 2006

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Intro: DIY 1000 watt wind turbine

We built a 1000 watt wind turbine to help charge the battery bank that powers our offgrid home. It's a permanent magnet alternator, generating 3 phase ac, rectified to dc, and fed to a charge controller. The magnets spin with the wind, the coils are fixed, so no brushes or slip rings necessary.

Step 1: Build the magnet disks

We had 12" steel disks hydro cut. We cut a template for mounting the magnets. Then we mounted 12 grade n50 magnets around the outside edge. We then built a form, and poured the resin with hardner.

Step 2: Build the coil disk

We wound the nine individual coils, soldered them in a 3 phase wye configuration, and encased them in resin. We used 35 turns of 2 parallel strands of 14 gauge enameled (magnet) wire for 12 volts. Use 70 turns of single strand for 24 volts. # 3 phase diagram shown here shows 3 stator coils. each of those coils is actually 3 coils in series. coils 1,4, and 7 are series together, 2,5, and 8 are series together, and 3,6, and 9 are series together.

more details, see the following page 15 for the series star, 1-y diagram.

http://www3.telus.net/faheydumas/Wind_Turbine/Forum/AXIAL_FLUX_HowItWorks.pdf
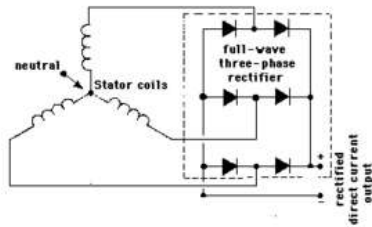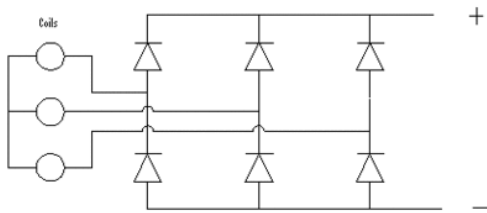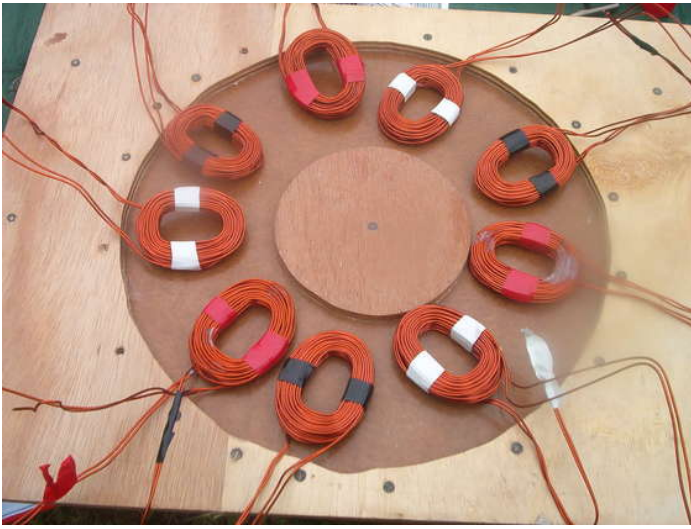
Step 3: Build the bearing assembly
Two Harley Davidson wheel bearings are inserted into the pipe, with a smaller pipe locked between them to keep them in place.

Step 4: Construct the blades

The blades are 2" x 6" pine, cut at 10 degrees on a table saw, and sanded into a rough airfoil. Not perfect, but close enough.

More can be found at

http://tech.groups.yahoo.com/group/axialflux/

http://www.green-trust.org

http://youtube.com/watch?v=o9EEHFKEckM

Step 5: Bolt it all together

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schel says:
Mar 11, 2011. 1:25 PM   **REPLY**

All I gotta say is AWESOME!! well done!

the applications of this design are wide open!
2 of these -sans the blades...could easily gen a bunch -o-power on say,...a stationary bike...or heck a small lawnmower engine could spin a row of these ...make for Da' BomB camping gen

Thanks for sharin' yer info bro!

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hemang charaniya says:
Mar 2, 2011. 6:03 PM   **REPLY**

can you help me how can i built 10 mw wind power plant. you have any idea. plese help me i need you help.

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sspence says:
Mar 3, 2011. 3:16 AM   **REPLY**

mw, as in milliwatt? or MW, as in megawatt? No, I only build units in the 500 to 1000 watt range.

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aistech says:
Feb 27, 2011. 9:51 AM   **REPLY**

hello im new to wind power could i build a 3 phase generator like the ones all over the net rectifiy it to dc power then put it through an inverter to tie into my house power to lower my usage

thanks

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sspence says:
Feb 27, 2011. 10:21 AM   **REPLY**

Yes. You will need a battery bank, and a battery/grid tie inverter, like the Outback.

Gmba says:
Feb 24, 2011. 6:10 AM   **REPLY**

I understand that the electricty generation discs are the same in most wind turbine i know of another method since using this one. Would there be a price for using this method if used in a comercialy available turbine? Who would the cost be payable to, you who I have learnt this information off or is there an owner of the generation discs?

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sspence says:
Feb 24, 2011. 3:39 PM   **REPLY**

This technology is open source, you are free to use it. However, donations are cheerfully accepted at http://www.green-trust.org

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dwkipling says:

will the pipes rust?

Feb 12, 2011. 3:27 PM **REPLY**

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sspence says:

yes, unless painted or clear coated.

Feb 13, 2011. 9:44 AM **REPLY**

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coolrider83301 says:

makita makes saw blades that are 12 inches in diameter with a 1 inch arbor. This could be used for the plates that hold the magnets. This might save the builder time and money especially if the blades can be found used.

Feb 9, 2011. 5:13 PM **REPLY**

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truesprocket says:

well done, theres a few things I don't quite get about the coils & theres connection but you've explained it fairly well, you'll need more schooling to be able to explain it to every body, lol . I have a 40 pound 12volt DC motor can I use it for a gen motor, it looks like a small golfcart motor, should I spin the shaft I see if I get power from the leads?

Dec 3, 2010. 5:51 AM **REPLY**

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jj.inc says:

If it is permanent magnet yes, if not your probably out of luck. If it has any pull on metal that should give you an idea, or just see if it sparks when you spin it.

Feb 4, 2011. 8:10 PM **REPLY**

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adrumsolo4u says:

I've been researching generator efficiency, and apparently if you decrease the number of coils at lower speeds, power output is increased. Do you think a setup like yours but with the ability to shut off 3 of the coils using relays (one for each phase) would be better?

I'm not trying to knock your design or anything, I just want to build the most efficient wind turbine possible (on a budget).

Nov 19, 2010. 5:56 PM **REPLY**

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sspence says:

That does not make sense, shutting off the coils reduces voltage. you'll never get the battery to charge.

Nov 20, 2010. 4:06 AM **REPLY**

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mathieulj says:

If you think about it this way it kinda makes sense with a turbine that has many PARALLEL (not series) coils. More coils == more load == less speed. If you don't have much wind, your turbine might grind to a halt, but if you then only use half your (PARALLEL) coils, it will turn faster giving you higher voltage (at lower amps) that might allow you to charge a battery when you otherwise wouldn't have enough wind to do so.

Dec 3, 2010. 9:12 AM **REPLY**

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sspence says:

there are 3 sets of coils, one for each phase. there are 3 series coils in each phase, for 9 coils total. Turbine voltage has to be higher than battery voltage in order to charge.

Dec 3, 2010. 2:59 PM **REPLY**

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mathieulj says:

What i meant was, for example if you had your 9 coils wired into 3 parallel sets (one coil/phase and 3 Y connections with each their own bridge). Then disconnecting the bridge from a Y set would lighten the load for a given input speed allowing the turbine to run at full speed in lighter winds.

Dec 3, 2010. 6:51 PM **REPLY**

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sspence says:

Why would you want to run "full speed" in light winds with no output? one coil per phase would give so low a voltage the batteries won't charge. voltage has to be higher than battery voltage to get any charge.

Dec 4, 2010. 6:33 AM **REPLY**

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mathieulj says:

What i am saying is... if you designed your coils to be wired in parallel and wired them as such (ex. more wire turns/coil == more voltage/coil and less current/coil at about the same power output). Then the 3 sets could independently charge the battery and you could optimize your generator for available wind-speed.

A generator will give an output voltage roughly proportional to it's rotational speed. In light winds (low speeds), the output voltage will fall below the needed charge voltage. If you then disconnect one of your parallel coils, the impedance will drop and, for a given speed, the output voltage will be the same at 2/3 current.

Difference is, now your generator is able to reach higher speeds with a given load (very light wind for example). So instead of being

Dec 4, 2010. 11:44 AM **REPLY**

dead in the water at low wind speeds (example; 2V short of being able to charge your battery) , you still get some current out into your battery pack.

bayomkii says:
Jan 26, 2011. 12:02 AM **REPLY**

yes you are right i have researched this on other designs too, it is the best approach to maximize your output for different ranges of wind speed on the same machine (otherwise your machine is either high efficiency low winds and low efficiency high winds or low efficiency low winds and high efficiency high winds) this approach allows your machine to take advantage of a wider range of wind speeds but it is only applicable where you have parallel coils

adrumsolo4u says:
Nov 21, 2010. 12:41 AM **REPLY**

yeahh, i just read it somewhere, it didn't make sense to me either, but some things just never make sense to me. I've also been considering going with a 6 phase setup to even further reduce vibration intensity at peak power.

So, you published this instructable in 2006, have you monitored its' annual kwh output?

sspence says:
Nov 21, 2010. 4:30 AM **REPLY**

I have not calculated the annual output. It usually rnges from 2 kWh - 5 kWh daily.

nnsg says:
Jan 18, 2011. 2:43 PM **REPLY**

What set up would you need to store the power

sspence says:
Jan 18, 2011. 3:17 PM **REPLY**

a 3 phase rectifier and batteries

greedpower says:
Jan 14, 2011. 8:54 AM **REPLY**

Could you please tell me why you would not recommend using or making PVC blades? Thanks.

sspence says:
Jan 14, 2011. 3:28 PM **REPLY**

They don't hold up. PVC degrades in sunlight and a 8' blade would flex too much and snap.

markriley55 says:
Jan 11, 2011. 10:51 AM **REPLY**

I have downloaded your design a while back. Very good design and detailed directions. I have access to free magnetron magnets from microwaves. I was wondering if it would be possible to use these round magnets about the same size as yours but with about a 3/4 inch hole in the middle. I know I would have to modify the design and wind round coils instead of square coils, but what's your opinion on power output compaired with the square mags and coils? Thanks for your time.

sspence says:
Jan 11, 2011. 3:37 PM **REPLY**

Depends on how strong those magnets are. I do not know. It would still work though.

markriley55 says:
Jan 11, 2011. 3:54 PM **REPLY**

Ok, I may get an N50 and do some comparisons, thanks for the reply

mikesnyd says:
Nov 23, 2010. 9:13 PM **REPLY**

12 N50 magnets. I am just guessing that they the dimentions are 2" X 1" X 1".
what is going to be affected if i was to use slightly thinner magnets? I just coughed and kicked myself in the foot when i realized how much these magnets really are.
I want to make a jig like the one you used for winding the wire. What is the inside shape i should use? an ellipse or rectangle? And what size? Thanks and what a really great build you have here.

kernelpower says:
Dec 1, 2010. 5:29 AM **REPLY**

I have just purchased 24 magnets off ebay N48 2"*1"*1/2" FOR ABOUT £7 EACH ROUGHLY 10 BUCKS, its the mopst expensive single part but well worth getting decent strong ones.

sspence says:
Nov 24, 2010. 3:13 AM **REPLY**

Dimensions are correct. The thinner ones are not likely to be N50's. You can smaller, like N35, but output will be less. I would go with a jig size slightly larger than the magnet. Rectangle would be fine.

scrappykoala says:
how do you get the two magnet rotors in to place? There has to amazing force pulling on both of them so how do you do it?

Nov 18, 2010. 11:23 PM **REPLY**

sspence says:
Slide the first one on, with the adjustment posts. slide on the stator. then slide the second rotor on. it stops when it hits the adjustment nuts.

Nov 19, 2010. 3:28 AM **REPLY**

zia0007 says:
Hi sspence, Would having a laminated iron core around the copper coils improve the power output?

Nov 4, 2010. 6:51 PM **REPLY**

sspence says:
No, it would not. It would introduce cogging, and destroy low speed performance.

Nov 5, 2010. 3:16 AM **REPLY**

zia0007 says:
So the only problem is the cogging effect. Lets assume then that we had a design with laminated iron and one without. If both could rotate at say 300 RPM. Would the iron laminated core design produce more electrical energy output. All things being equal and ignoring the input energy required to rotate it?

Nov 8, 2010. 9:51 AM **REPLY**

sspence says:
most likely, but in wind apps we can't ignore the input energy, as it is variable and intermittent.

Nov 8, 2010. 10:24 AM **REPLY**

zia0007 says:
Ok Spence I see. I like your magnet disc design. I want to apply this on an external source other than wind hence the question. Anyway I thought of an improvement. Use round magnets and place them around the circumference touching each other. So we induce more current in the coil within any given time.

Nov 8, 2010. 2:16 PM **REPLY**

Gmba says:
Your explanation of the production method has been really helpful. I started by looking for how to build the generator discs for my invention of a wind turbine. This part has been explained well here. Would have learnt about how to make coils at an electrician training course, thankfully i managed to complete the designing before then.

Nov 5, 2010. 7:32 AM **REPLY**

griffin93 says:
Are the two magnet disks used, one on each side of the magnet disks, and are their polarities the same, like north on the outside for both.

Oct 24, 2010. 12:40 PM **REPLY**

sspence says:
two steel plates, one on each side of the coils, 12 magnets on each disk, facing the coils, alternating N S N S N S etc. N on one disk matches S on the other disk. N and S are on the flat sides facing the coils, not on the ends.

Oct 24, 2010. 1:10 PM **REPLY**

jj.inc says:
what wind speed do you reach 1000w, what resin do you use, and how do you deal with the 6 out coming wires (3 separate phase), do you have maybe 3 separate things running off of it.

Oct 18, 2010. 6:11 AM **REPLY**

sspence says:
28 mph is about 1000 watts. normal fiberglass resin is fine. there are only 3 wires coming out as the other 3 tie together (it's a wye), and the three that come out connect to a 3 phase rectifier, that makes dc for battery charging. This is explained in the instructable.

Oct 18, 2010. 7:07 AM **REPLY**

jj.inc says:
yea I realized all of these but the speed today

Oct 20, 2010. 4:31 PM **REPLY**

mveenstra33 says:
i dont know how to make the alternator.. how did you get the steel disks formed?
what did you do with the copper wire?

Oct 19, 2010. 10:42 AM **REPLY**

sspence says:
The steel disks were cut from plate steel with a hydrocutter. The copper wire was wound into coils, as described in the instructable.

Oct 19, 2010. 3:16 PM **REPLY**

menahunie says:

Oct 10, 2010. 3:25 PM **REPLY**

Interesting post; but is it just to show everyone what you did? or show them how to duplicate what you did?
I have to go with the latter since you left out allot of build information.
The cost from doing this "project" cost vs. power output is far more than what I did.
I went to a junkyard found a 260 amp alternator ($100)off an ambulance and mounted and attached a wind prop to it. I pulled the voltage regulator and used a Sevcon unit for control. I used #4 welding cable with soldiered terminals to take the alt. output directly from the rectifiers. For charging the batteries using a HF (high Freq. battery charger is best). There is more electronics for the out put to the house etc..
You can also use the motor from a treadmill; you see them all the time on someone's curb they are throwing out...
I included some math about windturbines:
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

In parting even the motor from a direct drive washing machine can and is used for a wind generator; the design is very similar to what you show everyone in your posting. All I am trying to comment about is allot of people may not have the time or ability to duplicated what you did.

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sspence says:

Oct 10, 2010. 4:10 PM **REPLY**

We documented what we did, and tried to show how to do it with enough detail that anyone can duplicate.

4 ft. blades in 10 mph winds can only output about 60 watts.

4 ft. blades in 20 mph winds can only output about 500 watts. No way can it do 1200 watts.

http://www.green-trust.org/windpowercalc/eindex.html

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ashbranmeg says:

May 5, 2010. 11:25 AM **REPLY**

Did you alter the polarity of your magnets? If not, wouldnt the output of your generator be DC with no need for a rectifier? If there is no alternating of the field, there will be no reversing of the flow? That means DC not AC?

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