Group Research

http://inhabitat.com/eolic-a-foldable-portable-wind-turbine/

Enter the Eolic, a portable turbine that can be mounted on its telescopic pole in just three steps.

The carbon fiber and aluminum turbine is the brainchild of designers Marcos Madia, Sergio Ohashi and Juan Manuel Pantano. It's still in the concept stages, but we imagine that the Eolic could be useful in developing countries or in disaster situations where on-the-grid power isn't available.

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http://inhabitat.com/hymini-tiny-wind-power-charger/

We've seen an array of solar-powered battery chargers, but the HyMini takes wind power to a whole new portable level. This cute little personal wind turbine can be hooked up to various devices to charge your phones, cameras, and other

small electronics when you are on the go: walking around, driving or even riding your bike.

Driving Forces for Energy:
(1)concern over remaining fossil fuel reserves, import dependence and security of supply, (2)concern about environmental pollution, and (3) government support and financial incentives

http://www.absenergyresearch.com/energy-market-research-reports/renewable-energy-market-research-reports

Wind Power can be extremely attractive to customers in the energy resource fields
http://www.stsresearchgroup.com/examples-energy.php#energy2
Renewable energy can supply a significant proportion of the United States' energy needs, creating many public benefits for the nation and for states and regions, including environmental improvement, increased fuel diversity and national security, and regional economic development benefits.
http://www.ucsusa.org/clean_energy/technology_and_impacts/impacts/public-benefits-of-renewable.html
The primary customers for wind turbines are independent power producers (IPPs) and
utilities, with some community wind farms also purchasing turbines
With an expected life of 20 to 25 years, wind turbine reliability is an
important concern for customers. Wind turbine maintenance is expensive, both in terms
of the cost of repairs and lost generating time, so customers want to buy turbines that will
require minimal maintenance
turbine prices have increased to as much as $1,240/kW in 2007 ($1,240,000/MW) due to
rising prices for commodities (e.g., copper and steel), tight supply of key components,
and a weak U.S. dollar.
http://www.usitc.gov/publications/332/ITS-2.pdf
The investment you would need to make is one time, and after the basic infrastructure is ready, you would not need to spend any more money (for home)
http://www.buzzle.com/articles/windmill-power-for-your-home.html

Wind energy has been used for pumping water and milling grain for hundreds of years. More recently, wind energy has also been used for electricity generation. Developing countries can take advantage of wind power on a small scale, both for irrigation (wind pumps) and for generation of electricity (wind generators).

Small wind turbine systems, with a capacity ranging from 50 W to 10 kW and rotor diameter ranging from about 0.5 m to 7 m, are primarily used in battery charging.

The batteries can then be used for energy supply for houses, hospitals, farms, telecommunication, navigation, etc. Wind energy systems can also operate in parallel with diesel sets or solar PV systems.

http://practicalaction.org/energy/small_scale_wind_power?utm_source=S000&utm_medium=PPC&utm_campaign=C10105&gclid=CI7Kmor3q64CFSU0QgodAxEVRw
Most of the commercial-scale turbines installed today are 2 MW in size and cost roughly $3.5 Million installed. Wind turbines have significant economies of scale. Smaller farm or residential scale turbines cost less overall, but are more expensive per kilowatt of energy producing capacity. Wind turbines under 100 kilowatts cost roughly $3,000 to $5,000 per kilowatt of capacity. That means a 10 kilowatt machine (the size needed to power an average home) might cost $35,000-$50,000.
http://www.windustry.org/how-much-do-wind-turbines-cost

Variable - Wind alone is not going to solve our energy problems. Conservation and efficiency matters could have a greater impact on the electrical demands of the nation, however trends don't appear to be heading in that direction.

Sound - At currently envisioned setbacks at the property line, sound levels are capped at the level of 50 db, comparable with conversation levels.

Shadows/Strobe - Conditions have to be right for shadow flicker to occur. The sun has to be in a certain position relative to the turbine and the wind direction. Due to the changing orbital path of the sun, these conditions occur twice a year and last for only a few days, and then only for the 10 to 15 minutes it takes for the shadow to pass away from a building.

FAA Lighting - Mandated by federal law to all tall structures such as communication or water towers.

http://www.communitywindenergy.us/?page_id=8
The cons of renewable enrgy as opposed to non-renewable are based on price. We spent 200 years learning how to extract coal and oil cheaply, but the technology for extracting energy from sunlight is new and nowhere near as advanced. Therefore it currently costs a bit more to produce energy from renewables. However the coal and oil fields will run dry in the next 50 years so the balance of cost will swing the other way very soon.
http://environment.newarchaeology.com/renewables.php

Wind turbines can be damaged in thunderstorms, because of their tall, thin shape. The website of the National Lightning Safety Institute indicates that most damage to wind turbines is caused by lightning.

The blades of wind turbines can hit birds who attempt to fly between them, especially if the turbines are placed in migratory flight patterns. Keep in mind that

birds are also affected by the disadvantages of other power generation methods, especially pollution.

Wind turbines create noise from the turning of the blades. Some people do find it very annoying and stressful while others do not mind. The noise is more likely to be a problem in otherwise quiet rural areas.

Wind turbines cause interference to nearby television reception. This can be frustrating for people whom have problem getting a clear image on the TV.

For wind powered turbines to reach optimum efficiency, the wind resource needs to be at over ten mph for long periods of time. Areas with low wind speed are not suitable for maximum gain.

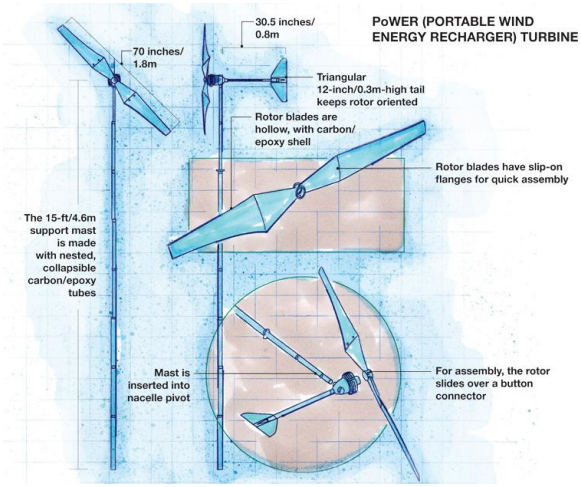
http://windturbine.me/prosandcons.html

http://wowozine.com/?p=4666

'Revolver' is a portable wind turbine that you can carry with you wherever you go. Just fold it open on a camping trip, on a rooftop in the city or at a remote party and you'll have sufficient juice to power up your cell phone, portable, a lamp, ... (all separately, not together) The 'Revolver' turbine is the result of a design challenge of design agency 'Frog' that asked its worldwide employees to design a solution for the usage of wind energy through existing infrastructure. The 'Revolver' wind turbine in operation can generate 35 watts of power, enough to keep you off-the-grid but still powered. Wanna get one ? You still have to wait a little because it's currently in the concept phase. Keep checking the website for more news.

www.frogdesign.com

http://www.compositesworld.com/articles/portable-wind-turbine-powers-the-warrior



- Composite wind turbine has a total weight, including support pole, of about 10 lb/4.5 kg, making it easily transportable by one person on foot.
- Turbine components break down into easily assembled pieces that are short enough to fit inside an existing military backpack.
- The unit can be deployed by a single person, yet produces enough power to recharge batteries or run a critical small appliance.

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http://windspireenergy.com/wp-content/uploads/Pages-from-10-WIND-0216-WindspireSpecSheet-standard1.pdf
http://www.windspireenergy.com/windspire/

How does it work?

Windspires operate with three sets of tall, narrow airfoils that catch the wind while spinning around a vertical axis

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http://www.helixwind.com/en/S322.php

Helix Wind turbines are completely safe for wildlife because they spin at much lower speeds than horizontal turbines and appear as a solid mass rather than a sharp blurring blade that a bird or bat cannot see or detect.

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http://www.tangarie.com/products/gale_vertical_axis_wind_turbine.php

- Produces up to 50% more electricity on an annual basis versus conventional turbines with the same swept area
- Generates electricity in winds as low as 4 mph (1.5 m/s) and continues to generate power in wind speeds up to 130 mph (60m/s) depending on the model
- Withstands extreme weather such as frost, ice, sand, humidity and wind conditions greater than 130 mph (60 m/s)

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http://www.renewableenergyfocus.com/view/319/recycling-wind/

Some thought has gone into developing new ways of producing wind turbine blades to make the disposal and recycling process easier. Court at NaREC explains: “There are … thoughts about trying to use thermoplastic matrix composites in wind turbine blades, the idea being that thermoplastics are easier to recycle, as evidenced in the automotive sector. Whether the mechanical and physical performance of the thermoplastic based materials is sufficient for a multi-megawatt wind turbine blade has yet to be proven. For micro-wind turbines, e.g. up to around 5 kW, it is possible to, and some do, use some form of moulded thermoplastic, reinforced or otherwise – in which case recycling is much more of a possibility.”

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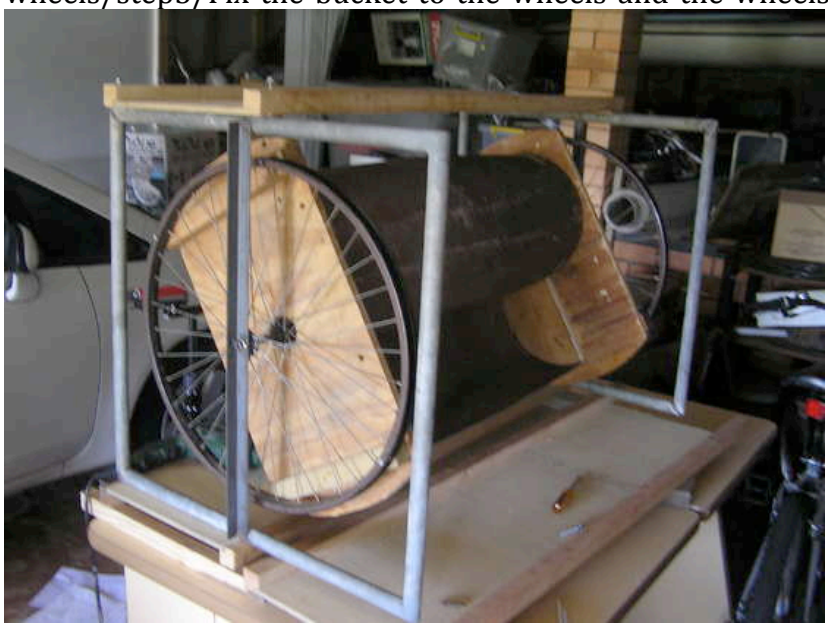
http://paginas.fe.up.pt/~feliz/e_paper15_BicycleWindTurbine.pdf

On the contrary, convergent turbines seem to concentrate the flow instead of dispersing it, therefore avoiding some of the effects that contribute to reducing the efficiency of the system. Any attentive observation of the structure of a bicycle wheel will bring light to our spirits: in effect, the steel wires connecting the metalic ring to the central axis of rotation are mounted in a way that resemble the convergent turbine design.

http://usa.windspot.es/home-wind-turbines/products/87/get-to-know-windspot

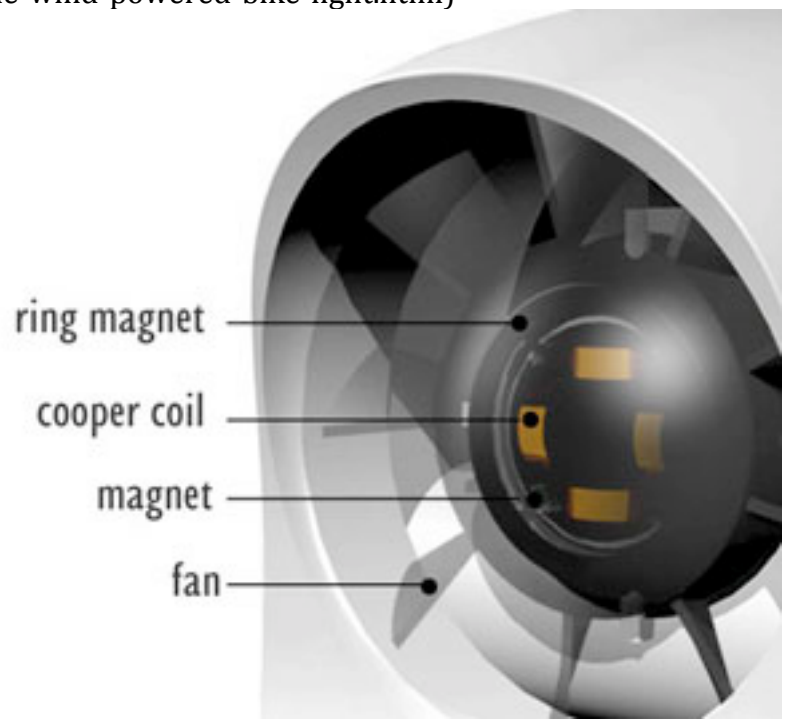
The **Windspot variable pitch system**, unlike other wind turbines, is robust, effective and requires minimal maintenance. It is also silent, due to the painstaking aerodynamic design of its blades and the fact that it operates at low rpm.

1. http://www.instructables.com/id/Wind-turbine-with-bicycle-wheels/step5/Fix-the-bucket-to-the-wheels-and-the-wheels-to-the/



2. http://www.zteck.com/passive/homemade_wind_turbine.htm

3. Wind powered bike light (http://www.treehugger.com/bikes/a-double-whammy-the-wind-powered-bike-light.html)



4. (Effective wheel designs) http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0CF8QFjAD&url=http%3A%2F%2Fpaginas.fe.up.pt%2F~feliz%2Fe_paper15_

5. http://www.treehugger.com/renewable-energy/diy-vertical-axis-wind-turbine-video.html

7. http://www.ecofriend.com/entry/5-diy-vertical-axis-wind-turbine-designs-generate-clean-energy/

8. http://ecorenovator.org/diy-vertical-axis-wind-turbine/

9. http://www.youtube.com/watch?v=ITXqFe_aG1I

10. http://www.youtube.com/watch?v=lyMasRuvG8Y

1.) Vertical Turbine

http://www.greenoptimistic.com/2009/01/28/very-efficient-vertical-wind-turbine-once-thought-impossible-to-build/

He designed a **windmill** consisting of 8 turbines, each having 4 structural steel wind scoops. The **vertical turbine** has 32 scoops in total and the wind can blow from any direction making the blades spin. By now the prototype is working flawlessly and even the slightest breeze of wind can make its blades spin. The turbine has a 12 feet diameter and is 36 feet tall.

As nobody made a large scale vertical turbine before , Fuller thinks his will be the one: "I've been able to demonstrate that for every 10 feet of baffle, there's a 300 percent

increase of output with the rotor. So my thought is that a 40 foot baffle will increase output by 1200 percent. If the 40 foot baffle system is successful, that means that 1 turbine and baffle system (about $200,000), would have the same amount of power as 12 turbines without baffles (about $150,000), so there's financial efficiency. That's a big change" .

2.) Mini Wind Turbine

http://www.gotwind.org/diy/12-inch-mini-turbine.htm

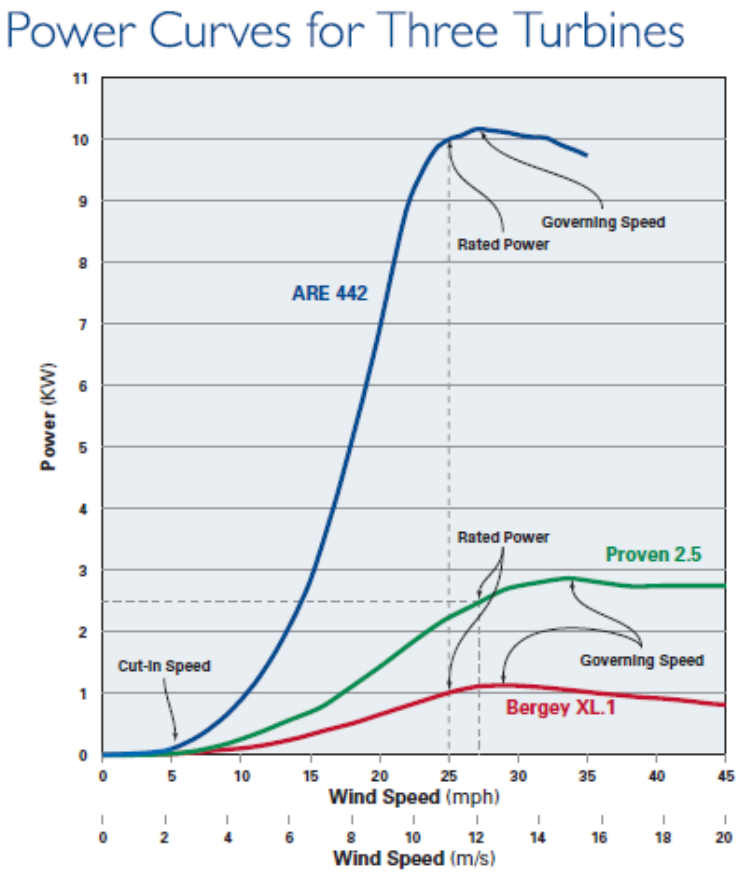
This was a very successful project, I used an off the shelf 3 bladed propeller, beautifully balanced and extremely strong, made from glass filled nylon, they are designed as 'pusher' props and can spin at up to an amazing 13 000 rpm when driven by a radio control plane engine. I suspect just 2000 rpm will be my max as a wind generator.

Having the blades pre made allowed me to focus my attention on matching the alternator to the blades characteristics, having seen Ed Lenz's work over on Windstuff now using radial air core alternators, I decided to work along similar lines. The benefit being, no iron in the design therefore no cogging effect that would kill a tiny wind turbine (mechanical resistance making it barely start up).

I sourced a very powerful N42 Neodymium cylinder magnet here that differs from most magnets in that it is diametrically magnetised i.e. the 2 poles are on the edge of the cylinder and not the face, as with most. This would give me a 2 pole single phase alternator.

Using adobe illustrator I drew to scale my alternator idea, and this helped me to realise the design and the layout.

Wind Power Curves



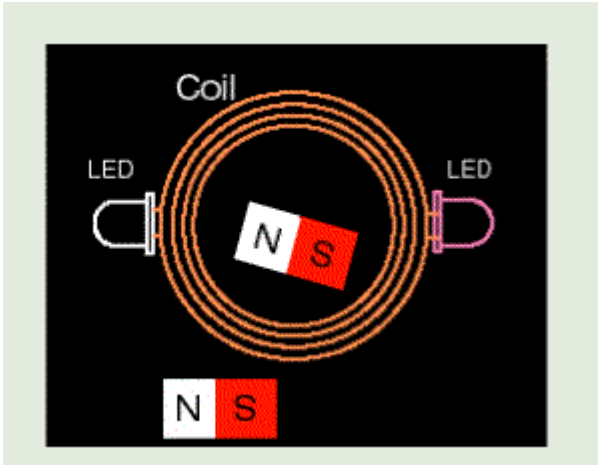
http://homepower.com/view/?file=HP127_pg92_Woofenden

What's the Curve?

Any alternator or generator produces electricity at varying levels, depending on its rotational speed (rpm). When we plot the output against the speed, we get a curve. If the original motive force is wind, we can plot the generator output against wind speed, which gives us what is typically called a "power curve" for the wind generator (see the "Power Curves" graph). It shows wind speed in miles per hour (mph) or meters per second (m/s), and power in kilowatts (KW).

It's important to remember that power in its technical sense means "watts." This is an instantaneous measure of the rate of electricity generation (or transfer or use), and *not* a measure of energy (watt-hours), a quantity.

3.) Vertical Superbright L.E.D generator.



http://gotwind.org/diy/led_windgen.htm

We place a small magnet in a container, such as a film can, with a wire wrapped around it. Another magnet, outside the container passes by the film can causing the magnet inside to tumble. When the magnet in the container flips, it induces a current in the coil to power the lights.

Because the internal magnet is not fixed inside the coil, the lights will flash regardless of the speed or direction of the external magnet.

The AC current could be rectified and smoothed if required.

4.) Bottle dynamo generator

http://gotwind.org/diy/bottle_generator.htm

This design utilises the more readily available bottle style generator (particularly in the U.S), it is still being manufactured by various companies.

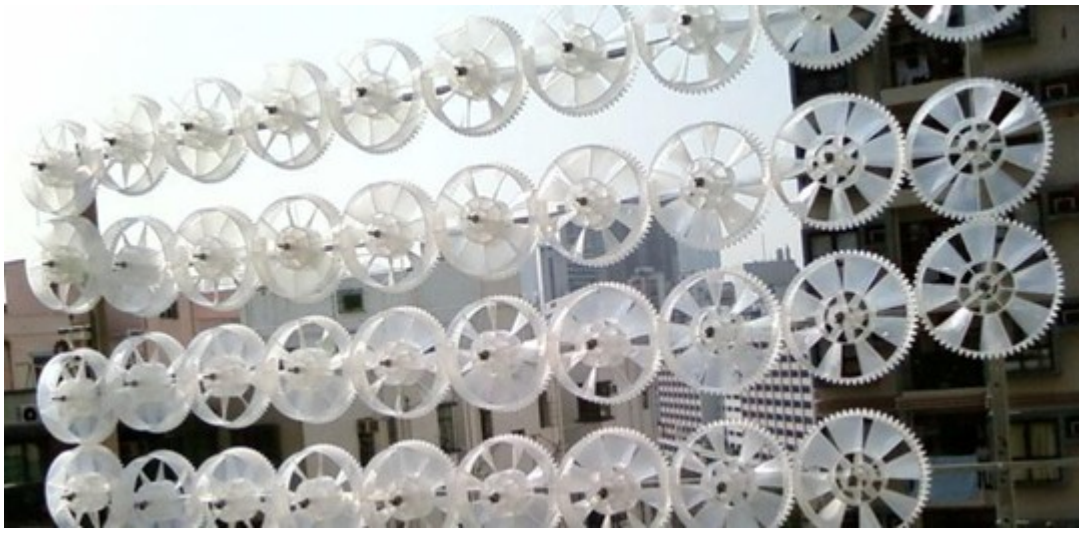
This unit has the same power output as the dynohub generator 6V - 3W, however it has to rotate at a much higher speed to reach its rated output.

I used a 320mm Diameter car radiator fan as the turbine, these are ideal as they are very strong and reasonably light. They also

reach a high rpm in windy locations. The fans can be found at car breakers yards for a couple of pounds each.

A nose cone can be created by buying a cheap plastic funnel and cutting the spout off and bunging up the hole.

5.) Micro Wind Turbine



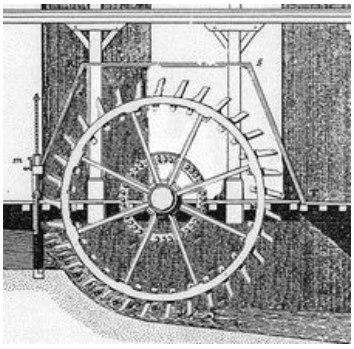
http://inhabitat.com/micro-wind-turbines-small-size-big-impact/

Conventional wind turbine technology has been a bit out of reach for most residential consumers living in urban areas—until now. Researchers at Hong Kong University and Lucien Gambarota of Motorwave Ltd. have developed Motorwind, a micro-wind turbine technology small enough for private use in both rural and urban environments. Unlike large-scale wind turbines, Motorwave's micro-wind turbines are light, compact (25 cm rotor diameter), and can generate power with wind speeds as low as 2 meters/second.
The gear-like turbines can be linked to fit just about anywhere and a row of eight turbines costs just $150 for now (prices may decrease once the turbines are mass produced). A portion of the revenue raised from the sale of Motorwind turbines (available for purchase here) will be donated to Hong Kong University to continue researching renewable energy technology.

According to tests, turbines arranged within a surface area of one square meter and a wind speed of 5 m/sec generate 131 kWh/yr. We'll be watching when the Hong Kong Sea School installs 360 micro-turbins (20 square meters) next month. A second installation of another 880 micro-turbines will be realized if the first installation is a success. Plans are also on the way for the World Wildlife Fund's Hoi Ha Marine Reserve to install micro-turbines some time in the near future.

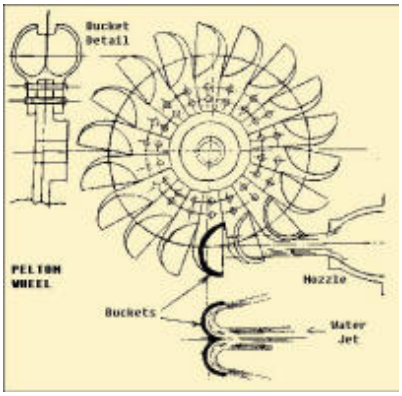
http://www.absak.com/library/hydro-power

Not everyone is lucky enough to have a source of running water near their homes. But for those with river-side homes or live-on boats, small water generators (micro-hydro turbines) are the most reliable source of renewable energy available. One relatively small water turbine will produce power non-stop, as long as running water is available, no matter what the weather.

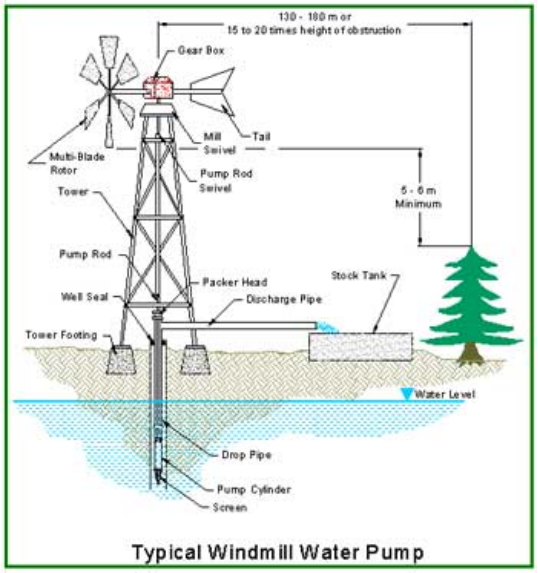


http://www.ehow.com/how_5256700_build-homemade-water-turbine-generator.html

Water turbine generators can be built at home with minimal materials. Moving water is the prime driving force to turn the turbine and generate electricity. Using bicycle parts and an older automotive generator, several water turbines can be employed to gain any desired level of voltage and strength. The average backyard engineer can build a water turbine in about a day.



Water Wheel Engineering by Ron Shannon provides the basics on water wheels and water turbines.
http://permaculturewest.org.au/ipc6/ch08/shannon/index.html



Water supplies such as wells and dugouts can often be developed on the open range. However, the availability of power supplies on the open range is often limited, so some alternate form of energy is required to convey water from the source to a point of consumption. Wind energy is an abundant source of renewable energy that can be exploited for pumping water in remote locations, and windmills are one of the oldest methods of harnessing the energy of the wind to pump water.

How much water can a wind-powered pump deliver?
The amount of water a wind-powered water pumping system can deliver depends on the speed and duration of the wind, the size and efficiency of the rotor, the efficiency of the pump being used, and how far the water has to be lifted. The power delivered by a windmill can be determined from the following equation:
$P = 0.0109(D^2)(V^3)h$
http://www.iklimnet.com/save/windwaterpump.html

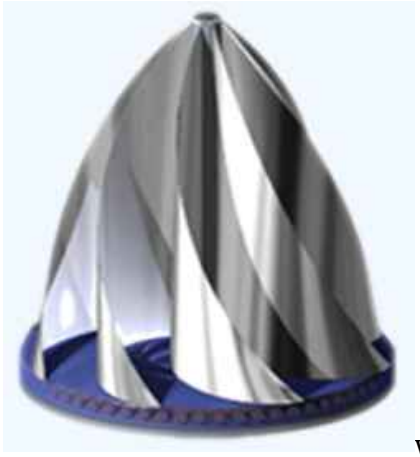
This is a video of a wind turbine mad from scratch that pumps water and powers Christmas lights at the same time.
http://www.instructables.com/id/WIND-POWERD-WATER-PUMPMINI-WIND-TURBINE/

To ensure wind turbines that are big in size work in a better manner, a new kind of air-flow technology may soon be introduced. Apart from other aspects, it will focus on efficiency of blades used in the wind turbines. The technology will help in increasing the efficiency of these turbines under various wind conditions. This is a significant development in the area of renewable energy after new wind-turbine power generation capacity got added to new coal-fired power generation in 2008
http://www.alternative-energy-news.info/efficiency-of-wind-turbine-blades/

The company is recognized as the developer of a U.S. Department of Energy-recognized “transformative” wind energy technology. It will maintain its aerodynamic research center in Wilbraham along with establishing a new corporate headquarters and product development center in the historic Waltham Watch Factory. The company also intends to assemble its first wind turbines in Massachusetts. If everything goes according to the plan, the company will establish a new benchmark for other wind energy technology companies to look up to and aspire to.
http://www.alternative-energy-news.info/flodesign-wind-turbine-business/


Worldwide interest in renewable energy options has given rise to a rash of new wind turbine designs. Some of the most recent models on the market are vertical axis wind turbines (VAWTs), which manufacturers claim are quiet, efficient, economical and perfect for residential energy production, especially in urban environments.

http://www.motherearthnews.com/Renewable-Energy/2008-02-01/Wind-Power-Horizontal-and-Vertical-Axis-Wind-Turbines.aspx#ixzz1mrzndAyO


we get excited about new technologies; sometimes we jump the gun, so it is great to find a product that is new, different and actually available. It's a "Magnetically-Levitated Axial Flux Alternator with Programmable Variable Coil Resistance, Vertical Axis Wind Turbine' , and it has just come on the market. Designed by Thomas Priest-Brown and Jim Rowan in Canada and manufactured in Texas, it"solves 11 different problems that previously limited the development of vertical-axis wind turbines for generation of electricity ." The center hub floats on a magnet, and the coils that generate the power are at the outer ring, with magnets at the tips of the blades flying over them at high speed.
http://www.treehugger.com/renewable-energy/mag-wind-vertical-axis-turbine-for-your-home.html

http://www.angelfire.com/ak5/energy21/savonius.htm
This is a homemade windmill pump that uses a vertical axis windmill to run the pump.

Equations that could help optimize efficiency:
Bringing in paper with a few a few more equations to see what factors and variables we are working with. Easier to write them out…

The governing equation for power extraction is given below:

P=F dot U

where: P is the power, F is the force vector, and U is the speed of the moving wind turbine part. F and U are vectors.

Betz's law is a theory about the maximum possible energy to be derived from a "hydraulic wind engine"