ENERGY SELF SUFFICIENCY NEWSLETTER

January 2006

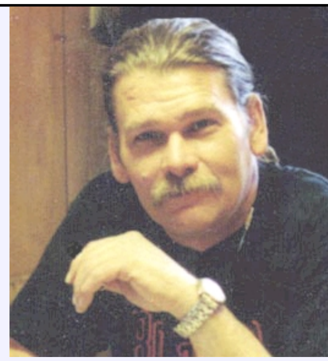
Off-Grid Living
Biofuels
Hydro
Solar
Wind

Happy New Year!

May 2006 be a Year of Peace, Prosperity, and Respect for our Home

A Rebel Wolf Energy Systems Publication

TABLE OF CONTENTS



Rebel Wolf Energy Systems

Page

2	From the Editor's Laptop
3	12VDC Command Center Update
5	Little Houses
8	The Wind Bag
13	Letters to the Editor
14	The VeggieGen
17	How Do Relays Work?
21	Happy New Year!
22	Classified Ads

From The Editor's Laptop

by Larry D. Barr, Editor

Happy New Year! From me and all the staff at ESSN, our wishes for a very happy, prosperous and peaceful 2006.

Our first year of publication for ESSN has been interesting, exciting and educational. I hope that y'all have enjoyed reading and learning from our magazine as much as we've all enjoyed bringing it to you. I encourage you to give us some feedback. Let us know if we're telling you what you want to know in your quest for energy self sufficiency. Just email us at essn@rebelwolf.com.

I'm not a devotee of New Year's Resolutions, but I do believe that we all need goals. So, maybe this is a good time to set a few goals. Let's look ahead another 365 ¼ days and see if there are any goals that we can set for ourselves that just might be attainable. Always make sure that your goals are attainable, that way you won't get disillusioned by not achieving them.

It just might be the right time to set a goal of minimizing your electric bill. Then, when you get down to figuring out how to do that, you might decide to put up a couple PV panels and run part of the house, or your computer and ham radio, or whatever just from PV. That could lead to an off-grid house eventually. And that's a good thing. Make a goal and see where it leads you.

Think maybe this might be the year to get back in shape? Why not build a exer-cycle generator and pedal some volts right into your battery bank? Old bikes are easy to find just about anywhere, and the favored Ametek computer tape drive motors can generally be found on eBay, or other on-line exchange forums. I know it wouldn't hurt me to have to exercise to keep the 12 VDC TV glowing for the nightly M*A*S*H reruns. Seems that we promised an article on building a bike-gen. I guess I'll get the chance to pay for my TV viewing after all, since that article is still in the works.

Some of my goals for this coming year are to get every possible device in my house running on 12 VDC, build a biodiesel powered genset, make ESSN a bigger and better magazine, and get my General class amateur radio license. I'd also like to finish the script I'm working on for a film with a renewable energy theme. It's about a third done right now, but it's not a front-burner project. I work on it on those rare occasions that I simultaneously have a bit of spare time and feel creative. It'll be fun when I get it done. But that one may not happen this year.

I encourage each of you to set your goals for 2006. Make sure that they are attainable or, at least, admit that they're a bit of a reach. Always be honest with yourself. And remember that the only time we fail is when we cease to try.

May this New Year be a year of happiness, prosperity and peace. ldb

Circulation Info The First Year

Monthly circulation of ESSN in its first year of circulation steadily rose to over 23,500, firmly establishing it as one of the most popular and informative global sources of practical information about off-grid living and energy self-sufficiency. With your continued interest and support, our aim for 2006 is to build on this successful start by offering articles on an even wider range of subjects. So please do not hesitate to contact us if you would like to contribute your experiences to ESSN. ldb

12 VDC COMMAND CENTER UPDATE

by Larry D. Barr, Editor

It's been a bit of a while getting there, but the Command Center is on the way. I had to modify my original design for the mounting of the West Mountain SuperPWRGate and the 4012 RigRunner, simply because I needed to be able to disconnect them and take them portable for use in emergency comms situations and to our Tarleton Area Amateur Radio Club meetings to demonstrate ways to connect a 12 VDC system for ham radio use. They're not what I originally planned, but they work darn well – and they're portable. As you can see in the photo.

Here are the main components of the 12 VDC system for the command center. The West Mountain Radio RigRunner 4012 is on the top left, with the SuperPWRGate on the right. The 45 amp Circuit Specialists power supply feeds the PWRGate and the PowerSonic SLA battery is charged by the PWRGate. In this image, the system is only supplying the ham transceiver and charging a handheld transceiver. However, it's been operated with the computer and TV/DVD online too. And there's an Icom R-75 shortwave receiver waiting to be connected as well.

I was going to include an updated image of the computer, TV and ham radio on the desk, all working just spiffy on 12 VDC. And they did – and still do (see above). However, I ran into a little tech glitch the other day that I hadn't envisioned, so I'm going to wait for that shot until I've solved that little problem. "What was it?", you ask. It's one of those things that won't affect more than probably 0.005% (yeah, I guessed at that number) of the folks who'll set up 12 VDC systems. I set out to capture some video the other night, from a DVD to the computer and ran into some frame dropping problems. Seems that with everything running off the battery system, the FireWire connection was missing the ground connection it wanted to see. Everything cleared up when I took it all back to the AC mains power. I'll get that little problem solved and then we'll publish the triumphal picture of all the gear running and capturing perfect video in its 12 VDC glory.

The system as it stands right now consists of a Circuit Specialists CSI 1869 45 Amp linear power supply, a PowerSonic PS-121000U SLA battery, West Mountain Radio SuperPWRGate and RigRunner 4012, and the various loads. Presently, the loads are the Dell Inspiron 1150 laptop, Orion 9" TV/DVD and Yaesu FT-2800M 2 metre amateur radio transceiver on the 12 VDC system. I also charge the Yaesu VX-170 HT on 12 VDC. On the desk and still to be added to the 12 VDC system are a 320 GB USB HDD, Sprint DSL modem, Belkin 7-port USB hub and HP PhotoSmart 7150 printer. All the power connections are made with Anderson PowerPoles from Ken and the rest of the ham operators at Powerwerx. The auto/air adapter for the 1150 is from Lind Electronics.

Continued on next page

When you order, be sure to get an additional input cord with bare wires on one end. That way you don't have to cut off the cigarette lighter plug to put the PowerPoles on.

The gear that's still powered by the grid breaks down like this:

- The external HDD requires only 12 VDC to operate (since it derives the 5 VDC internally), so all I need to do to bring it online is to modify the power cord with Anderson PowerPoles so I can plug it into the RigRunner. Just haven't had the time yet.

- The Sprint DSL modem has a 12 VAC input. All I need to do is figure out where in the circuit I need to connect the DC power, bypassing the rectifiers and filters and it's a done deal. Finding the time (and the schematic) to trace the circuit to that point takes a little more time.

- The USB hub needs to see 5.0 VDC at a max of 3.8 A, so that will require building a DC/DC converter. I'll use a 7805 regulator and a pass transistor to satisfy those specs. It's possible that I won't need to build an external power supply for the hub if I don't start adding USB accessories with high current draw. I'm running it powered right now, but I'm not really sure that I'm drawing enough current load with the USB devices to need the external power supply. If I am, I may be able to get by without external power simply by only plugging in what I need at the time.

- The HP printer line lump supply provides 32 VDC at 940 mA. I already have a 300 watt MSW inverter and no inclination whatsoever to spend the bucks for a 12 VDC to 32 VDC converter. So, I'll run the printer off the inverter. I'll wire it with a switch so that the inverter will only operate when I need to print something. The inverter is from mpja.com and only cost $30. I don't know what the idle current is, but I'll check it out and let you know.

So where does the project actually stand at the moment? Well, I've proved that several devices operate really well (except in one particular configuration) on 12 VDC. I've gotten to the point where I'm going to have to get off my posterior and make a couple modifications and build a bit of gear to get some other pieces to run on the system. Also, I've gotten to the point where I can use either an inverter or simply throw a bunch of money at the printer. OK, you've guessed it, I'm going to use an inverter – but then, I'm cheap! You can buy the DC/DC converter if you like.

What's lacking at this point is the PV input to the system and one more battery. As you know, I'm in a rent house and there are limits to just how many modifications I can do and still keep the landlord smiling. I'm getting closer to buying the house. I talked to my banker the other day, and as he didn't fall about laughing or immediately run me off the premises, there's hope on the horizon!

I have two Uni-Solar 64 watt PV panels that are waiting to be mounted and which will keep the backup battery charged through a Xantrex (formerly Trace) C12 controller. I can't drill holes in the roof to mount the panels – and I really wouldn't choose to mount them on the roof since the ridgeline runs north/south anyway. So, I'm working on a decent pole type mount that'll get the panels up in the sun and not aggravate anyone. Especially my landlord. That's important, you know. If my banker smiles on me, the task gets much easier.

The other part of the project is to add at least one more PowerSonic SLA battery. As an amateur radio operator, I'm a member of several nets that are expected to provide emergency communications if needed in our area. So, I'd like to have more on-air time if TXU, our local grid utility, goes down than is provided by just 100 Ah of battery capacity. I use the SLA (sealed lead acid) batteries because, since they are sealed, they can safely be used indoors without outgassing. I'm going to add another 100 Ah battery here soon. That'll give me right around 24 hours of on-air and computer time, even if we're overcast and there's no input from the PV panels.

I'm not fully energy self-sufficient yet and, as long as I live in this house, I can't be. It's that air conditioning thing in the humid Texas summer. It'd take more space for the PV panels to support that alone than the lot size allows. So, I'll do the best I can. That's all any of us can do, and I encourage you to do the same. If you can't go completely off-grid, make a start! Use renewable energy to support part of your loads and you'll be on the way. Only a very few folks can afford to do it all at once – the rest of us have to do it a piece at a time. But we have to start somewhere. Go for it!

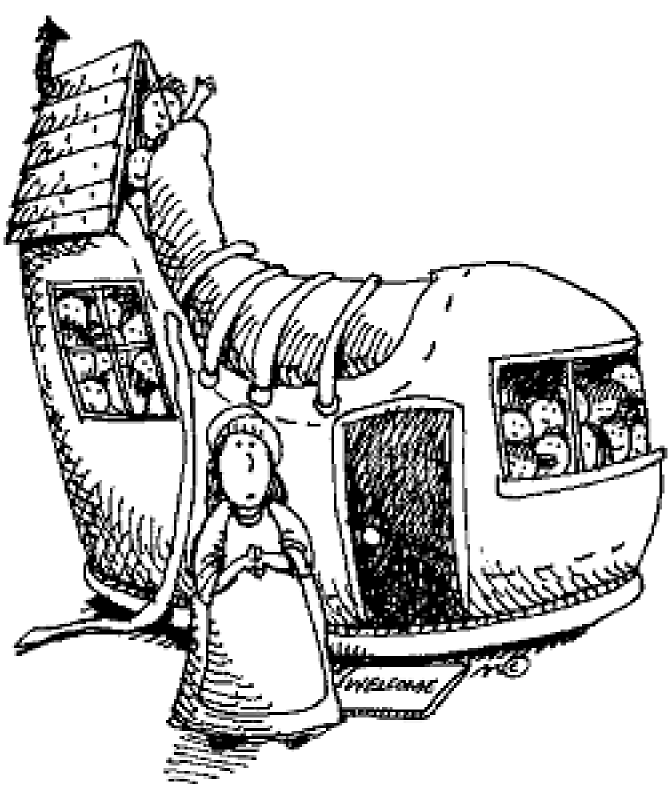
Peace,
ldb

LITTLE HOUSES

by Suzanne Ubick

It comes to all of us – the time when we have to move house! Our friends Steve and Saelon will be moving in with Steve's father at the end of January, and there's a lot to do to get the place ready. The younger folks will take over the basement whilst Steve's father will continue to live on the upper floor.

I was overcome with amazement at the complexity of houses when I saw the furnace, heat pipes, venting systems, water pipes, and electric wires criss-crossing the still-to-be-ceiled roof of the basement. Since self-sufficiency is always on my mind, and energy is becoming particularly urgent, my immediate thought was how inefficiently houses are designed for energy usage.



I came home preoccupied with house designs – little/tiny houses are another major passion in my life – and pulled out a heap of books for browsing. Even books like "The Sun-Inspired House" don't seem to have clustering as a priority. By "clustering," I mean the deliberate grouping of areas that need energy inputs; for example, kitchens, bathrooms, and laundry rooms should be clustered. This way, the furnace could be directly underneath this area, and perhaps the water heater could be somehow linked to the furnace so that hot air used for warming the house could first heat up water. Small on-demand heaters could add the finishing calories at each point-of-use. Laren Corie's houses are all designed with efficiency in mind; the bathroom and kitchen always abut to make the best use of the utilities.

This is a touchy subject in my own home; my mother-in-law has a laundry fetish. She washes three loads of laundry on each of three days – surely she must be raiding chests and closets to get that much stuff to wash, seeing it's only her and my father-in-law upstairs and they're not athletes – and she believes in using hot water for the wash and warm water for the rinse. Our PG&E bill is downright embarrassing! When she was in Croatia for a month earlier this year, before I fled to Sipan, our natural gas bill dropped by two-thirds! The water heater is in our kitchen, many feet away from the washing machine, and many feet away from the folks' upstairs kitchen (which is on the other side of the house!). The bathrooms are not too far. How much energy is wasted in all those yards and yards of water piping?

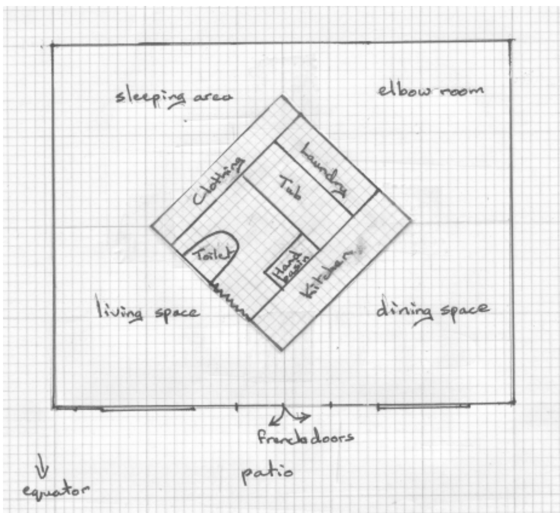
I stumbled across the website www.abito.co.uk and experienced a cosmic YES!!. Abito calls itself the intelligent design company, and it has brought clustering to a fine art. In fact, it has a central block about 8 feet by 8 feet which holds a bathroom, kitchen facilities, clothing storage, and a control centre where the washing machine and drier live, together with the iron and all the necessary laundry paraphernalia. This control centre also holds the breaker box and the water inlet valve. All the piping, all the major wiring, and all the exhaust vents are concentrated in one small area resulting in economy of material as well as of energy use. "Waste heat" from cooking, washing, clothes drying, and ironing could all be channeled directly into the living space in winter.

There is free-flow space all around this central block, and so much clever storage it makes me wonder how anybody could ever use it all up! Even the bed folds up into the wall. And to put some extra bells on the whole thing, the central block part can be used as a sleeping loft or small study or sewing space. The entire apartment – Abito is pushing apartment blocks – is only 327 square feet but there is oodles of real space. Fewer outlets would be required because one outlet could serve several areas, as also fewer artificial lights because there are so few walls to block light flow. Fewer light bulbs on the budget,

Continued on next page

with corresponding drop in environmental costs and threats.

Naturally I was immediately inspired to pull out a block of graph paper and start playing with Abito's ideas.



In its present incarnation, one could indeed build a small house to this design, in a space 23 feet by 14 feet. With a long wall facing south, and the kitchen facing east, passive thermal efficiency should be a natural. For those who don't fancy an open sleeping area, or who have more than two or three people to house, the design is easily reconfigured to 24 feet x 16 feet, and two bedrooms could be added on the north wall, each 12 feet by 8 feet, for a total footprint of 576 square feet.

And here it is – courtesy of Abito

My imagination took flight. What if photovoltaic panels were mounted on the south facing slope of the roof? What if all greywater were channeled via a heat-recovery unit into a small wetland scrubber a la Andy Lee, and then into the garden to grow food? Laren Corie designed a clever system that heats a whole house through the combustion of junk mail; how could this be figured in for maximum efficiency?

So that's one major part of planning for energy self-sufficiency; clustering of usage points so each system feeds as many parts as possible and there can be cross-linkage.

The other part brings me back to my mother-in-law's laundry habits. Planning to reduce the amount of energy needed in the first place; every watt you don't need is a watt you won't have to pay for, right? And pay you will, whether in glass for window walls, or photovoltaic panels, or directly to somebody like PG&E.

Does laundry HAVE to be washed in hot water? I wash mine in cold water and rinse it in cold water – we're not field hands and seldom get noticeably dirty. MIL says her preferred detergent doesn't dissolve properly in cold water; could it first be dissolved in a gallon or so of hot water and poured into the machine before starting the wash cycle? That would save an enormous amount of energy, if she really can't bring herself to use a cold-water detergent in the first place.

And then there's dish soap, and shampoo. Low-sudsing varieties get dishes and hair just as clean as the foamy varieties, with much less rinsing required. Thanks to a tip on the Simple Living Forum, I tried out baking soda as a hair wash – it works well and doesn't use a lot of water for rinsing out. I sprinkle a teaspoonful of dry soda into my hairbrush before giving my crowning glory a thorough brushing. After all, soap is made up of grease (naturally present in hair) and lye or soda. Then I wet my hair and massage it - I'm making soap in situ!

A tablespoonful of either lemon juice or cider vinegar in a pint of water, dribbled slowly through the hair after rinsing, restores the natural acid mantle of the hair and really lets it shine. And speaking of energy, I am no longer responsible for the making and disposal of all those fancy plastic bottles I used to buy. Baking soda also washes dishes nicely, just in case you were wondering! I've been saving up fat drippings for a while now, and recently came across a very easy recipe for soft soap. Put 3 ½ lb of clean fat into a large enamel or plastic bucket, add 2lb of washing soda and 2 gallons plus 2 ½ quarts of hot water. Stir daily; it'll take about 2 weeks to emulsify all the fat. When it's formed a jelly, add ½ cup of ammonia. This should be pleasant to make, without either the choking fumes or the potential danger of lye.

Less rinsing means less water. Even cold water uses energy – unless you have a cistern on a stand high enough to gravity-feed into your house, it takes energy to pressurize the water so it'll spurt from faucets and shower head. And even if you do have a cistern on a stand, it's going to take energy to pump the water from the ground to the inlet!

Continued on next page

I've been experimenting with stove-top baking. I purchased a large second-hand turkey roaster, the old-fashioned enamel kind with double walls. This goes over a gas burner on my stove top. One of those burner surround rings goes onto the bottom of the roaster. The item to be baked goes onto that, then the lid goes on and I light the gas – no preheating. And it works! I have baked bread, biscuits, and cakes with complete success – and far less energy than is required to heat up the oven.

However, there are still times when it's cost-effective to use our standard oven. I'm a great fan of the Once-A-Month cooking method; it takes the same amount of heat to roast one chicken as it does to roast four, or even eight. I usually prepare four at a time. While the chickens are roasting happily on one shelf, I load the other with other foods having compatible cooking times and heat needs – say several loaves of bread, or casserole dishes full of curry. The cooked foods are cooled, portioned, and frozen. During the work week, it's easy to pull out a frozen lunch for my husband to take to work. A frozen dinner can be popped into the fridge to thaw slowly during the day, and is quickly heated when I come home after my afternoon job assisting a tax preparer. My calculations show that a meal costs us around 31 cents per person, prepared in the Once-A-Month way. That's protein source, veggies and a starch. I can make a month's supply of muffins in one go and freeze them for breakfasts. All the money freed up this way goes into building capital so we can spend progressively less life energy earning money to pay for various other forms of energy to make our lives easy and pleasant.

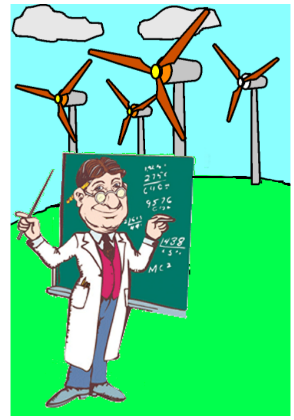
And that's the serpent's tail back in its mouth: the fewer watts, calories or therms of energy we need – the easier it'll be to become energy self-sufficient. And the quicker I can retire to my dream life of puttering about on Sipan.

Oooh, I just thought of something else to say - water cycle, light cycle, biorhythms cycles - all of these are energy cycles and all of them flow into and through each other. Money itself is a visible form of energy; I've seen it called "frozen desire" but much prefer the term "energy unit."

I now have a great job assisting a tax preparer; I work from noon to 5pm, Mondays through Thursdays. It's a 1.4 mile walk, so I'm getting enough exercise and my jeans seem to be stretching in the wash. I get paid more than I've ever been paid before per hour, and in ninety days I start getting benefits. The work is really easy and downright fun for a nitpicking compulsive obsessive perfectionist. I get lots of time to think and to write – and to remember Šipan.

Suzanne Ubick

THE WIND BAG

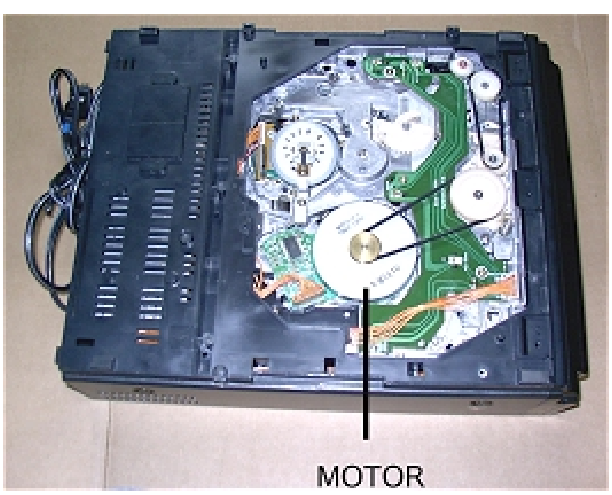


Letters to Dan Fink

In the November 2005 issue of ESSN, I talked about science fair wind turbine experiments for students. Last November, Glen Hurd posted a very fun, educational, and simple tiny wind turbine design on the Otherpower Discussion Board, and gave us permission to use it. Glen's business is the manufacturing and wholesaling of custom LED lighting products and solar power systems. Thanks Glen!

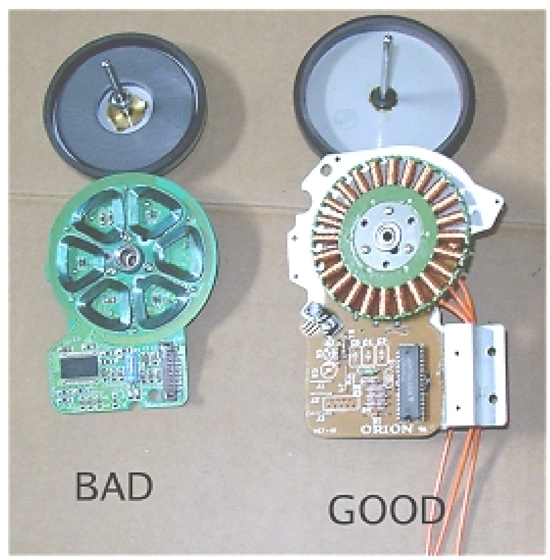
This was a lot of fun. There was no stress about anything really needing to work, but it does!
It started as killing time with stray parts, and grew into a simple little mill that has potential for a nice paper and project about wind power, from permanent magnet power generation to blade design.

The 3 phase permanent magnet alternator is from a VCR. Only the bottom plate of the VCR was removed for the photo. Most of these motors are held in with 3 screws from the top, and are very easy to remove. First unplug the wires connecting the motors.



The large disk on the front of the motor was held in place by magnets and a small plastic washer on the axle. Often the shaft can be pushed, removing the assembly as the washer slides down the shaft, but sometimes they need to be cut off. Save the washer if it comes off easily.

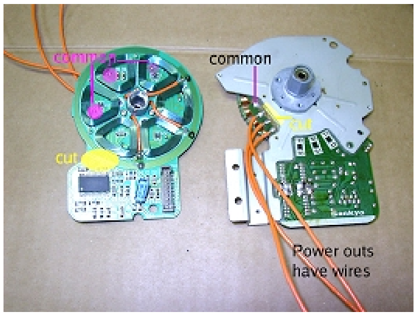
There seem to be 2 common types of this motor. The bad motor is subject to very strong eddy currents in the metal backing plate, and is not very usable because as the RPMs increase the drag increases to an extreme amount.



These motors are wired in 3 phase star, meaning the 3 phases are connected together in one place, and each of the 3 phases have the other end going out of the motor. An Ohm meter is needed to tell where the 3 motor output wires are located. The 'good' motor in the photos has the common connections and output wires very easy to see and connect wires to. The traces or conductors on the circuit boards were scraped away with a utility knife, just to be sure no power was being fed to the circuits. The 'bad' motor had 3 holes drilled to get the wires out the rear. Output wires are soldered to the ends of each phase.

Continued on next page

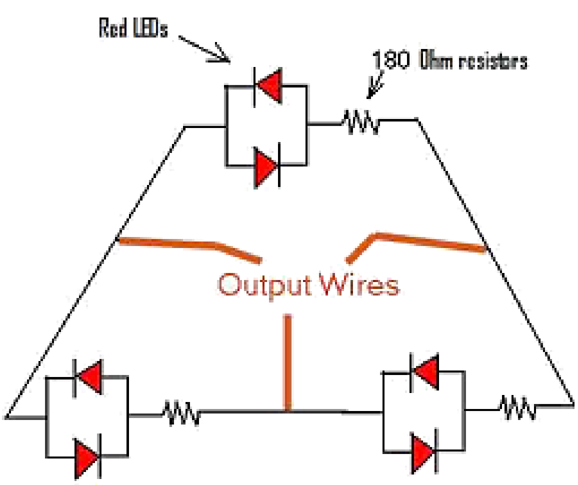
Dan's note – for a detailed explanation and diagrams of 3-phase stator wiring, take a look at Windstuffnow.com's 3-phase basics page. You might also give this discussion board posting a look.

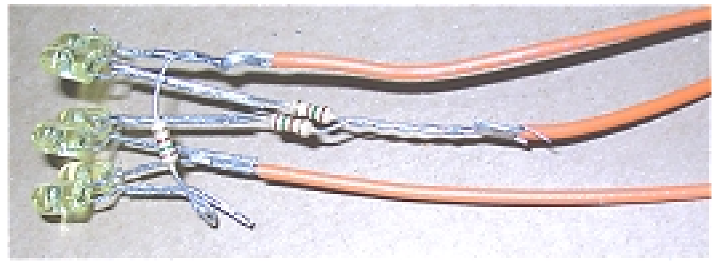


Each phase has the same Ohm reading. This 'good' one is about 4 ohms, so from the common to any output is 4 Ohms. From any output to any other output will be 8 Ohms.

From any common to any other common is about 0.4 ohms, but that is from the wires on the meter, and is almost the same as the ohm meter itself from test lead to test lead.

Now seems like a good time to show the lighting wires. Red LEDs light quite easily, and I recommend only red LEDs. Other colors need higher minimum voltages to light up, and draw more current. LEDs only pass current in one direction, but the alternator makes current back and forth (Alternating Current), so each section needs a pair of LEDs connected backwards from each other. The resistor is to limit current so the LEDs do not burn out, but will have very little effect on the LEDs lighting up. LEDs also have the advantage of not conducting any current until they reach a certain voltage, and that helps get the windmill turning before there is a load dragging the speed lower. A regular light bulb will result in very poor, if any, operation. It can be fancy or simple, but the wires cannot touch each other where they shouldn't.



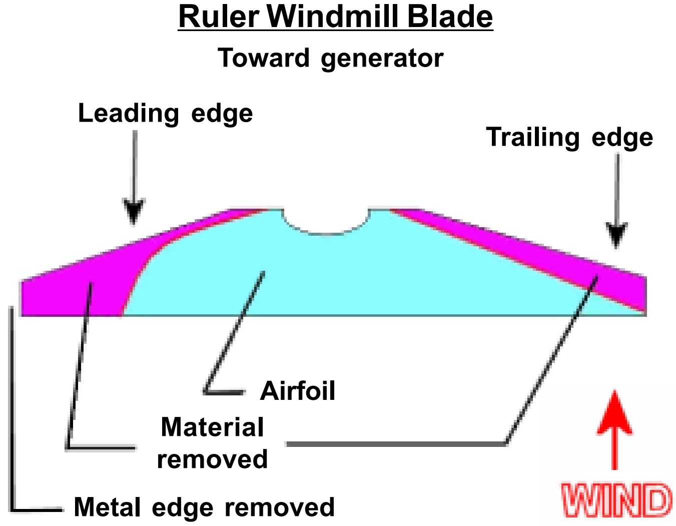


After the soldering is done the large disk with the magnet ring is replaced and a quick spin of the shaft should light the LEDs!

Now onto the blades.

Wooden rulers make simple blades. Part of the angles are ready to use! I removed the metal strip, marked and cut off 3/16" along that side, from 3 and 1/2" to the end. The blades are sanded for a trailing and leading edge. A bench mounted sander will make things faster and easier. The root, or center, is not changed. The root angle is needed later for fastening to the hub.

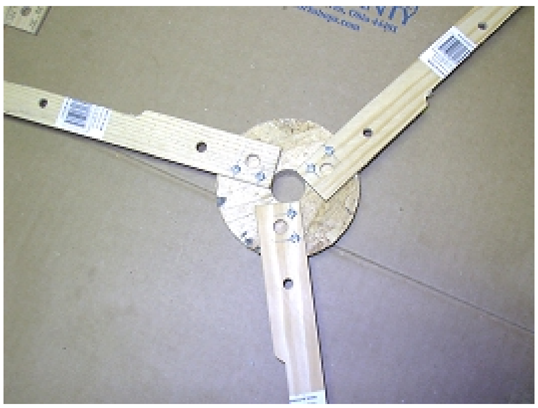
Ruler Windmill Blade

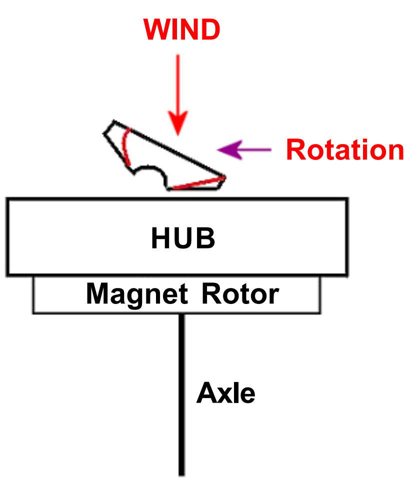


Continued on next page

A hub holds the blades together and on the front of the alternator. It is not a motor any more!

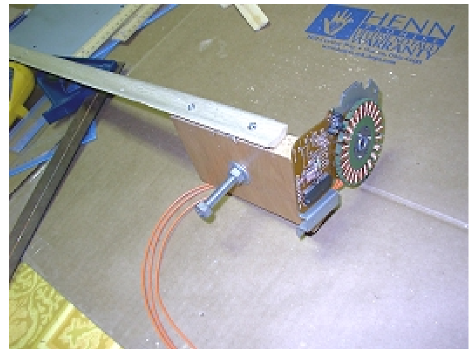
This hub is a donut of wood 3/4" thick. Use smooth, good wood. The chip board in the photo caused some problems later. The center hole is as close to the pulley diameter as possible. A set of hole saws helps make the hub easier.The hub is marked with 3 lines 60 degrees apart. Each line is marked twice and small holes drilled for screws that will hold the blades. The blades are marked and drilled with a bit that is a little larger than the screw threads. Now the blades can be attached to the hub. The more accurate everything is done the better. The hub should now fit over the alternator, and the blades should look something like this.





Some rulers have a lower or higher angle than others. This set of blades has 2 layers of a business card under one side of each blade to increase the angle as viewed from the end. About 8 degrees seems like a good angle. After the blade angles are adjusted if they needed it, a bit of wood glue is a good idea.

Now for the frame to hold it all together.



This shows the main piece of wood with everything attached. The center is drilled for a 5/16" bolt about 3-1/2" long. The bolt is placed in the hole, then a washer (so it turns smoothly), then a tight nut. Next, another nut is screwed half way up the bolt. The end of the bolt, on the side, was smacked with a hammer to badly damage the last 3 or 4 threads at the very end, and the second nut was screwed toward the end until it is firmly held in place by the damaged threads. Then the alternator was screwed to the base.

A suitable tail and tail boom were then assembled from scrap paneling and moulding, and attached. A good quality double sided foam tape holds the hub to the magnet rotor and shaft.

That is why wood is better than chip board... nothing seems to stick very well to chip board, and chip board is damaged by water sooner. The blade assembly is then slid back into the alternator.

Next, blade balancing is needed. One side will probably come to the top, again and again, after a few slow spins. The top is the lightest side, and a little extra weight to that side will help the windmill run much more smoothly. A rubber band around the hub, holding a couple washers or maybe a nut, should show how much weight is needed and where. The weights can then be screwed to the hub. Don't rely on a rubber band to hold any weights, because it will not!

This 'tower' is a section of 1/2" metal conduit. The photos show the 1/2" conduit inside a piece of 1" copper at the bottom because that is one of my test towers. The windmill nuts and bolt are simply placed in the conduit.

Continued on next page

A few notes:

This windmill can make about 8 or 9 volts AC per phase under a load of about 25ma when spun by a flick of the fingers. I have no idea what the RPM is at that time. These LEDs were placed in a half clear plastic tube in the first photo. The whole thing lights up very nice on a dark windy night.

Red colored plastic red LEDs are hard to see lighting up in daylight. 'Water clear' red LEDs show up when lit the easiest, by far, because as soon as they light they turn red!

The blades could be a little shorter, maybe about 10" each, or even 9" for this particular alternator. Then the windmill would spin a little faster and the LEDs would light up sooner. This particular windmill needs about 14 miles per hour wind, steady, not gusting, to light the LEDs with the 12" blades and 24" diameter. Different alternators will perform differently, so your mileage may vary!

The blades do not spin very fast at all in front of a fan. The air is too turbulent. They work far better outside. These blades could surely be improved upon, but these are easy to make, work well, and have a decent airfoil, good enough for a school paper.

It is very hard (I can not do it at all) to light the LEDs by hand spinning the shaft after the blades are attached. The LEDs light very easy without any blades. For a school project that must be deomnstrated indoors under a fan, you might want to have an alternator for the windmill, and an extra to light the LEDs by hand, just so everyone can see it light up!

Accurate blade placement and making all the blades the same is important, it seems quite important for a decent balance. Good balance is important for the windmill to start turning in a low breeze. Danger! These blades get turning very fast. A blade that flies from the hub or hits a person will hurt, and could cause injury. Be safe!

My next plan, if the coils can be removed, is a dual rotor alternator with 2 of the same magnets, or maybe HD magnets, mounted on speaker plates. The speaker plates will be drilled and threaded for all-thread shaft, and a set screw will be added. The air gap and magnet disks will be adjusted by turning the disks so the magnets line up, then tightening the set screw. There is no need for jack screws from disk to disk, the magnets are not dangerously strong. This should allow for maximum area in the center, and use of common bearings. Finding suitable bearings are always a major problem for me.

Dan's note — http://www.fieldlines.com/story/2004/10/4/22201/3047 This discussion board posting shows 2 more tiny alternator designs, much like what Glen wants to try on his next one. Be sure to scroll all the way down the thread to see photos of these clever designs! The homebrew wind power enthusiast community has some extremely ingenious people, and I'm glad our readers have had a chance to meet some of them. Thanks again, Glen, and all of the other Otherpower Disscussion Board regulars too.

From Scott G:
Dear Mr. Windbag: What is MPPT, as in an "MPPT Controller" for solar photovoltaic (PV) panels? I read an advertisement that said buying one could boost my PV performance by 10-15 percent. Is this for real? And could I hook one up to my wind turbine too?

Hi Scott. Good question! MPPT stands for "Maximum Power Point Tracking." It is for real, and it could actually give you an even better performance gain than the ad you looked at claimed. To explain what it does and why it can boost the output of your existing solar panels, I first need to explain a bit about PV panels and batteries.

Anyone who uses PV panels and lives in a cold climate can attest to an interesting phenomenon—when it's cold outside, PV panels put out more power, and have a higher open circuit voltage. It very hot weather, PV panels make less power and have a lower open circuit voltage. 'Open circuit' voltage is measured with no load on the panel, only the voltmeter is in the circuit. A typical 120 Watt PV panel might be rated 7.1 amps at 17 volts, for 120 Watts rated output, in moderate outdoor temperatures. Why is the rated voltage so high? Because in hot temperatures it might be giving only 15 volts, and the panels must be designed to run in all climate conditions.

Why is 15 volts the minimum designed output? Because though a typical 12 volt battery bank stays between 11 and 12.7 volts when not charging, when it IS charging the voltage when it's near full is often in the 13.8 to 14.5 volt range. If the solar panel voltage is lower than the battery voltage, no charging happens. And the closer the battery voltage gets to the higher solar panel voltage, the less current the battery is charged with—the battery charges slower and slower as it fills.

This is where MPPT comes in. The battery bank effectively 'clamps' the solar panel's potential 17 volts output down to the battery's level. In cold weather, PV output could be higher than 17 volts, and with low batteries the voltage while charg-

Continued on next page

-ing could be 13.0 volts or lower. So when you do the math, 17 volts * 7.1 amps = 120 Watts output. But really, you are getting 13.0 volts * 7.1 amps = 92 Watts. What happened to your missing Watts? They were lost (never produced) as a result of the voltage mis-match. The MPPT simply matches the solar panel voltage to the battery voltage so as to produce the maximum current (amperage) into the battery. Since maximum charging amps into the batteries are what we are looking for, that's why MPPTs can boost PV panel performance, especially in cold weather. In hot weather with full batteries, the loss is much less. If the battery bank is sitting full at 14 volts while charging and the panels can only do 15 volts because of the heat, there's not much room for any gain from MPPT there. The maximum benefit happens in cold weather with low batteries—that's where the biggest mis-match is.

There are a few different ways to accomplish this DC-DC conversion. Some MPPT designs are analog, and a homebrewer could build one. The newest commercial models are digital. They continuously scan the voltages of both the panels and the batteries at high frequency (20 kHz or more), adjust output for maximum amperage, and compensate rapidly if a cloud moves over the PV panel to cast a shadow.

There's another interesting aspect of MPPT controllers, too. You already know from your own PV install how badly low-voltage DC current travels in wires—the resistance (heat) losses are large. That's why most newer systems are designed for 24 or 48 volt battery banks instead of 12 volts. But the manual for the MPPT controller says it can accept a maximum of 140 volts! Yes, this is another opportunity to gain power (actually, to reduce resistance heating losses). With an MPPT, you could re-wire your PV array into only a couple 120-140 volt series strings of PV panels instead of the existing array of a whole bunch of 12 volt PV panels in parallel. Depending on your array size and wire size, you could easily conserve a few percent of PV output this way, too.

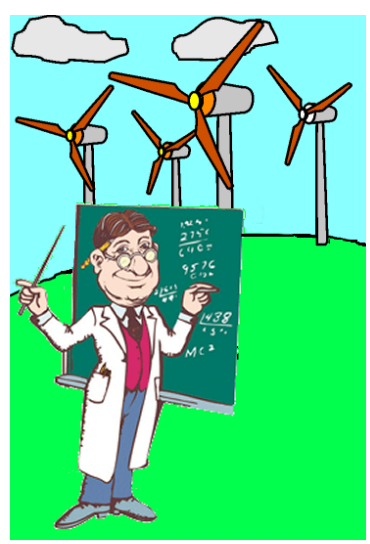
Now for your last question – do MPPT controllers work with wind turbines? The solar PV kind currently available will certainly NOT work for wind. As for a dedicated wind turbine MPPT system, there are direct, battery-less, grid-tied inverters that perform similar voltage conversions as an MPPT, for example the SMA WindyBoy. But these don't do the same thing as the MPPTs we just discussed—you can think of the grid as a giant, infinite battery, it never changes. Real battery banks DO change. There are no MPPTs out there yet for off-grid battery-based systems. But keep your eyes open! Rumors are flying in the wind power community about up-and-coming, soon-to-be-released MPPT controllers for small turbines. Watch for possible press releases this year from Outback, Magnum Energy, and Magnatec.

The problems to be overcome in a wind turbine MPPT design are immense. It's one thing to program the photovoltaic MPPT CPU to match slowly changing sunrise and sunset conditions, slowly changing temperatures, and the possibility of clouds moving over the PV panels. Matching a rapidly changing wind turbine alternator that varies FAR more in voltage than a PV panel is much more complicated! For example, after a high speed wind gust, the turbine rotor will have lots of extra inertia and speed for a short time, but the extra wind itself has already dropped. If the MPPT tracks this and adjusts the loading for the extra power, the turbine will quickly stall—the MPPT was feeding off of that brief surge of inertia. As soon as that's gone, the extra load the MPPT applied is now too high, hence the stall.

What will the solution be? How much could be gained with a wind turbine MPPT controller? Just like PV MPPTs, it would gain the most during the conditions of greatest mismatch. But unlike PV panels, the changing loading from the MPPT would affect the turbine's rotor RPM. PVs couldn't care less how you load them, their output is unchanged. But the load on a wind turbine alternator is critical to it's performance. External windspeed sensors? Fancy controller CPU programming that predicts what will happen? But then what happens if you move from sea level to 8,000 feet elevation, or if you replace your wind turbine with a new model? Can the wind MPPT figure this out, or does it need to be re-programmed for the performance characteristics of the new turbine or air density? You can see the magnitude of the problem.

I'm anxiously awaiting the possible new announcements this year for new commercial MPPTs for wind. I'm not sure how much I would gain from them in my own wind turbine, but I just love this stuff and can't wait to experiment with it.

DAN



LETTERS TO THE EDITOR

Larry,

Enjoy your mag, congratulations on your 23,000 downloads of the most recent issue.

Question for you: It seems that many of the ESS power generation schemes that are discussed in your mag, while innovative and ingenious, are more suitable for a rural or semi-rural lifestyle than an urban household. Take for example, me. My family of 4 lives on a 50' x 110' lot in the middle of a city of over 2 million people in the rainy and dark northwest.

It is simply not possible for us to do things like generate methane in our lot, cut down enough trees to heat the house with a wood stove, put up a tower to capture wind power, capture enough solar power in this part of the world, run a biodiesel generator in the backyard for any length of time, and so forth. There are zoning rules, building inspectors, and neighbors to contend with, as well as the reality of a small lot in a crowded city.

On the other hand, biodiesel and veggie oil fuel for cars seems a reasonably practical solution, provided I don't burn the garage down while doing it!

An article such as 'top five ESS power generation ideas for city dwellers' would really hit the spot for me, and I imagine also the 90% of the population who are city dwellers. And I am talking about something more substantive than the standard conservation ideas such as buying more efficient appliances, cars, and lightbulbs. Many of the conservation ideas discussed in the ESSN are great and are suitable for both rural and urban environments. I am suggesting an article on generating power specifically in an urban environment.

Again, enjoy the monthly read. Keep up the good work!

Dan McCallum Vancouver BC

Thanks for the note, Dan. You're entirely correct in your observation. The reason for what may seem to be a bias in favor of rural projects isn't really a bias. It's just that our writers experience lies in rural projects. So maybe our readers can help us out. If any of you have any experiences in urban energy self sufficiency projects, please share them with our readers. Just send them to us at essn@rebelwolf.com with enough pictures to adequately illustrate the story and we'll be glad to publish it. It's a facet of our mission that we haven't dealt with much and it's about time. We'll be waiting for your submissions.

Thanks again, Dan. Peace, ldb

Larry:

Re your question of low efficiency vs. available resources.
DO IT!

I want to see home-brew systems that may make an engineer cringe, but at least are doing SOMETHING.

Not all the resources we have to think about are renewable or non-renewable. Some are in our left hip pocket. If we can show people that they can do SOMETHING, even if less than perfect, by using only a little of that very important resource, then we are at least making a dent.

If we have a site, like your Irish one, with a whole lot of energy available, let's show people how to use it even if is not the latest, greatest, lightest, flashiest, whiz-bang technology.

In the world of wind, Michael Hackleman's work with half barrel S-rotors or Eugene Eccli's idea of using a truck rear axle with a horizontal axis machine need to be reviewed and maybe updated. In both cases you got the complicated electrical stuff down to the ground where it could be worked on without having to climb a tower. That is just plain scary to most people. How many quietly walk away from the idea of wind power because of this unspoken fear?

I am thinking also of the current interest in the Listeroid diesels. Old, slow, heavy, inefficient (maybe not), 100 year old technology that works just fine. Thank you very much.

The same can be said about hydro. Even if it only works during the spring thaw, at least it is something.

I remember an article about a farming sciences class that built a digester out of a old LP tank. What did they learn? Was it ever improved? What happened to it and them?

I am sorry, but I am seeing to much of the classic "flim-flam" types in the "renewable industry." They may have pony tails and wear Hawaiian shirts instead of polyester pants a white shoes, but the effect is the same. Too much money for not enough result.

Go for it, and purists be damned.
Ken Sachs Antioch, IL

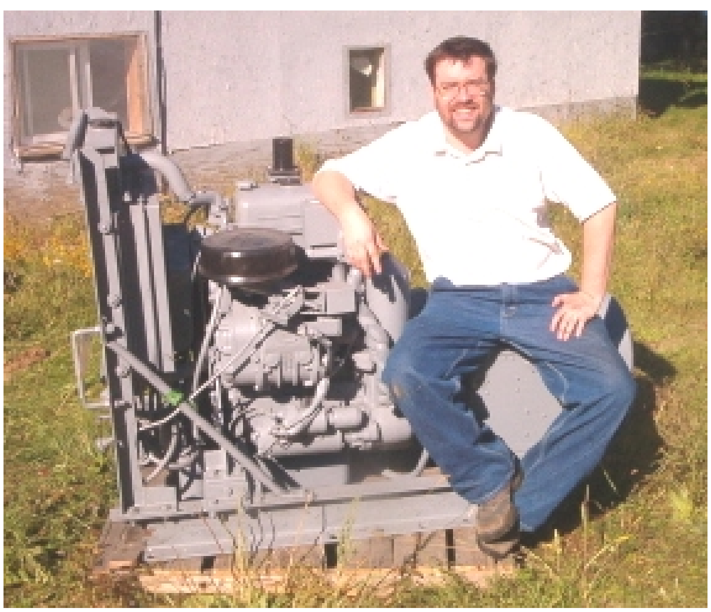
Hi Ken,
Thanks for the note — and the support. Too many folks, I think, do nothing because they can't afford the best or latest. If the wind is blowing by your house, reach up and grab at least **some** of it. The same goes for all of Nature's resources. You want a water pre-heater? Put a roll of black poly pipe in the sun. The only mistake you can really make is to do nothing. Gotta run, the purists are pounding on my door . . . and they have a rope. Peace, ldb

THE VEGGIEGEN

by Steve Spence

Winter has come again, and the cold temps have been playing havoc with the fuel filters on the VeggieGen.

For those new to this saga, we generate most of our electricity for heating and powering our off-grid home with a used-fryer-oil (UFO) fueled Detroit Diesel 2-71, 12.5kw diesel generator obtained from AffordablePower.



This year I decided to eliminate the problem, once and for all.

To start with, I should perhaps describe the generator system, starting with the diesel generator itself, and I can do no better than to quote from the AffordablePower website.

The generator is driven by a 2-71 Detroit diesel engine effectively designed to run on a variety of fuels, including vegetable oil.

Now most diesel engines equipped with conventional injector pumps will experience catastrophic injector pump failure within a few hours if straight "cold" vegetable oil is introduced into the fuel system. The reason is simple enough – vegetable oils can be quite thick and viscous at low temperatures, first gelling and then, if the temperature is low enough, even solidifying. To reduce the viscosity of vegetable oil, it can be heated, or made into biodiesel (biodiesel is produced when vegetable oil chemically reacts with lye and anhydrous alcohol).

The 2-71 Detroit Diesel doesn't have a conventional, close tolerance injector pump that balks when fed straight vegetable oil. Instead, it uses a positive displacement fuel pump which supplies fuel continuously to the injectors, and each injector incorporates a plunger pump in the injector itself. This enables the injectors to function perfectly with a wide range of oil viscosities, and make the 2-71 Detroit Engine unique in its ability to run a variety of fuels.

However, viscosity is one thing, but solids will quickly gum up the works. So, in addition to having a compatible injector system, two other requirements are necessary to run on waste vegetable oil.

The first requirement is that the waste vegetable oil must be filtered through a system which removes all particulates larger than five microns. The second is that the fuel system must have the capability to heat the vegetable oil prior to introduction into the engine, especially during cold weather. The reason for the heat requirement is that vegetable oil is a higher viscosity liquid than diesel fuel and will gel at a much higher temperature.

Conventional wisdom therefore dictates that the engine be run first on a low viscosity diesel to warm things up before switching over to veggie oil, and to revert to diesel before shut-down to purge the fuel lines to prevent veggie oil from

Continued on next page

gelling and blocking those lines during cold winter nights.

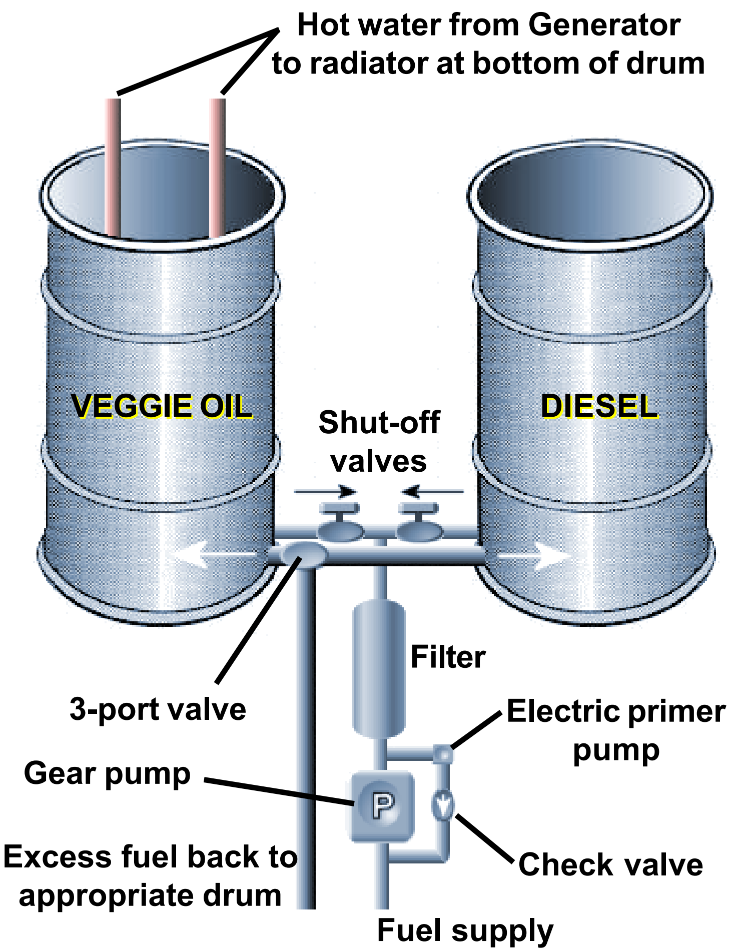
So, what do you do when it is knee deep in snow outside and bitterly cold? You go inside of course, where it's sheltered and you can get nice and warm – and this is exactly what I did with my generator!

No – I'm not that keen on self-suffiency that I'm willing to share home and hearth with a diesel engine! There are limits to my madness! However, what I could do was give it a home all to itself, and came in the form of a Geodesic Quonset Greenhouse.

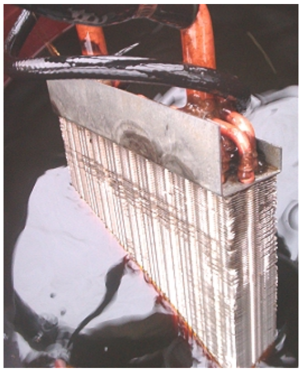
Open Plan – before covering

Plastic covering for the Little House in the Prairie

The next step was to set up the fuel system for the generator.



A rear heater core of of a schoolbus was first set in the bottom of the 55 gallon drum connected to the heater hoses and attaching the fuel pickup line to it.

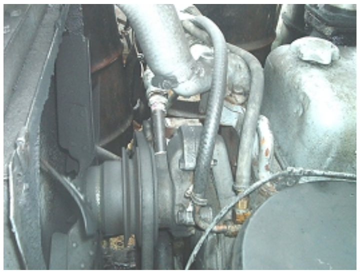


A new heated filter was constructed by taking a length of heavy sheet metal, curving it into a pipe, welding the seam, and sealing it top and bottom to a truck filter.

Water fittings were then welded to the sides. Engine coolant was run through this homemade water jacket.

Continued on next page

That worked for a while, but I was still using the original engine filter and strainer, so this week I cut out all the old fuel plumbing and went directly from coolant heated 55 gallon tank to the new heated filter and into the fuel pump on the engine. From there, the fuel goes to the injectors, and the surplus goes back to the veggie tank.



It's 28^{0}F and I'm able to start and stop on straight used fryer oil without using diesel at all! This is properly called V100, but I like "UFO" better! After 6 hours of operation, it's over 80^{0}F inside the greenhouse on a no-sun day. This heats the other barrels of veggie oil and gives some thermal mass to moderate greenhouse temperatures. You can read more about our VeggieGen at the Green-Trust website.

Steve Spence
Director, Green Trust,
http://www.green-trust.org
Contributing Editor,
http://www.off-grid.net
http://www.rebelwolf.com/essn.html

HOW DO RELAYS WORK?

by **Arnold Offner**
Motion Control, July/August 1999

Arnold Offner is the interface product marketing manager at Phoenix Contact, Inc.
Contact him at P.O. Box 4100, Harrisburg, PA 17111-0100
tel: (800) 888-7388
aoffner@phoenixcon.com

Steve Spence is starting a project in which he will be using quite a number of relays, but sensibly confesses that he was a bit bewildered by the variety of different types that are available. After reading reams of material on the subject, he hit on this article by Arnold Offner in "Motion Control".

Terminology

AC	alternating current
DC	direct current
TTL	transistor-transistor logic
EMR	electro-mechanical relay
SSR	solid state relay
NO	normally open
NC	normally closed
Hz	Hertz = cycles per second = frequency

Relays come in many different flavors, but all have the same purpose – to control what happens in one system by what happens in another, completely separate system. Power steering is a good example of a mechanical relay at work. The steering wheel, which can be easily moved with the lightest of touches, controls a very much more powerful hydraulic system that moves the vehicle steering linkage to the road wheels. Electrical relays do much the same thing – they enable changes in one electrical system, or circuit, to control what happens in other systems that may have completely different characteristics. For example, pressing a button may cause a small current to flow in a circuit powered by a flashlight battery, and this can be used to operate a series of heavy-duty switches that turn on all the street lights of a city, trigger a huge display of fireworks at a festival, launch a ship, set all your house burglar alarms, or just about anything you want to do!

Electrical relays have two forms – electromechanical and solid-state. An electromechanical relay uses an electromagnet in one electrical circuit to physically open or close electrical contacts in a completely separate electrical circuit. A solid-state relay achieves the same result, but with no moving parts. The purpose of both is the same – changes in one electrical 'control' circuit determine what happens in another, completely separate 'controlled' circuit. Both can interface to different control systems and, depending on the application, are used to either isolate sensing, counting or high frequency signals or to create a link between the same or differing voltage levels.

Not every control signal has the same voltage potential, yet systems from different manufacturers must share or communicate with one another. Using a relay allows digital (ON/OFF) signal transmission between different control components. Basically, relays are electrical switches that control electrical circuits by opening or closing contacts in other circuits. Manually, one could operate a switch every 300 milliseconds; however, relays have response times ranging from about 5 to 20 milliseconds, far faster than the human hand.

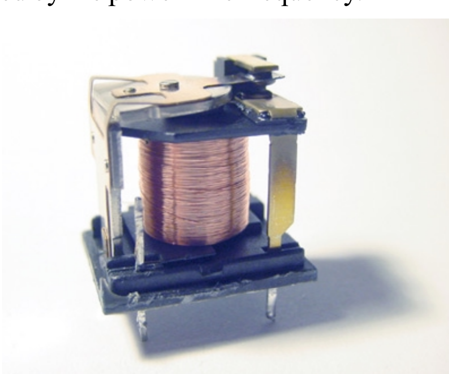
Input Voltages

The most popular control voltages are 120 volts AC, 24 and 12 volts DC and TTL (or 5 volts DC) signals. While other voltages are used in specific industries, those given here comprise more than 90% of all new and existing control-system installations. The control, or coil, voltages are connected to the electromechanical relay (EMR) via the input coil. On a solid state relay (SSR), an electronic input circuit replaces the coil.

Due to the application requirements, relays (also called interposing relays) connect different voltage signals without having the voltages connected to one another. In other words, while isolation is required to ensure the integrity of each voltage potential, reliable interfacing of the ON/OFF signal state must be guaranteed.

An important feature of relay output is the contacts' ability to switch large currents and power loads (although some relays are designed to work the other way – a large current/power variation on the control side triggers a low current/power circuit, eg. large fluctuations in electricity grid power lines trigger low power warning or control systems). Alternative coatings on the relay contacts allow the reliable switching of low-level signals of only a few milliamperes. Relay choice depends on both the required result and expected lifetime of the circuit, so it's important to understand the structure and design of both electromechanical and solid-state relays.
EMRs consist of an input coil that's wound to accept a particular voltage signal, plus a set of one or more contacts that rely on an armature (or lever) activated by the energized coil to open or close an electrical circuit. The input coil, by design, accepts either alternating current (AC), or direct current (DC). DC coils can be energized with far less current and, since DC can be switched quickly from ON to OFF, they can be operated at higher frequencies than AC coils that depend on the relatively slow rise and fall times of alternating current. For example, the standard mains frequency in North America is 60 Hz, so the rise time from zero to full voltage in each half cycle is 4.2 milli-seconds. This is a very long time compared with DC rise times.

A contact's mechanical limitations dictate a relay's switching frequency. Since contacts possess inertia upon opening or closing, they can bounce before coming to rest. This bounce dictates the maximum operating frequency, and if exceeded, can lead to reduced service life, arcing, and-with sensitive control systems- can even be responsible for signal errors. With an SSR, higher frequencies of a few hundred kilohertz can easily be attained. In the case of both relay types, AC load switching is limited by the power-line frequency.

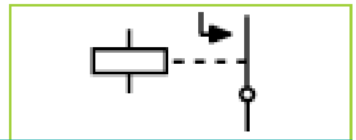


Relay Contacts

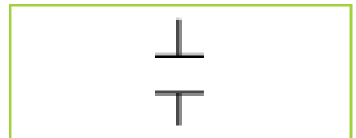
A relay contact that is open when not energized is called a 'normally open' (NO), 'make', or 'form A' contact. Figure 1 shows the graphic symbol used to depict a Form A contact. On the left is the symbol representing the coil with its two input wires, and on the right is the open contact. The schematic symbol, figure 2, is shown as two open plates that face one another, and will be most commonly seen on circuit diagrams of control cabinets.

If the contact were closed when not energized, and open when energized, the term 'normally closed' (NC), 'break' or 'form B' contact are used (Figure 3). The contacts are electrically connected with one another, and Figure 4 depicts the contact set that can be interrupted, or opened, when energized.

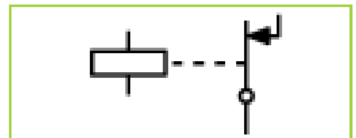
Some control applications call for a combination of a NO contact with a NC contact, and a common termination for power. The relay changes the state of both the contacts simultaneously, and is referred to as 'form C', 'make after break', 'transfer' or 'changeover' contact. The form C contact in Figures 5 and 6 combines the form A and form B contacts.



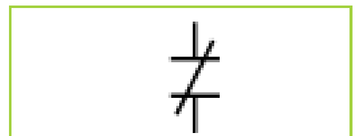
1 Normally open (Form A) contact graphic.



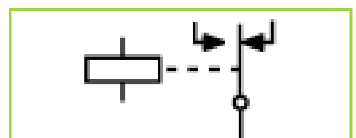
2 Normally open (Form A) contact schematic.



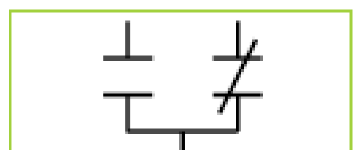
3 Normally closed (form B) contact graphic.



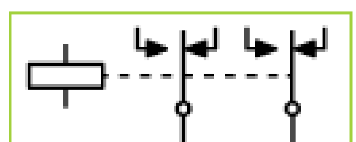
4 Normally closed (form B) contact schematic.



5 Changeover (form C) contact graphic.



6 Changeover (form C) contact schematic.



7 A double-pole, double-throw contact.

Any relay description should include the number of contacts. If the relay only has one NO or NC contact, we refer to it as a 'single-pole, single-throw' relay. If there are two sets of NO or NC contacts, the designation is 'double- pole, single-throw'.

The form C contact is a double throw, and depending on the number of contact sets is called a 'single pole', 'double throw' or 'double pole, double throw' as shown in Figure 7.

Activating Relays

In triggering a relay, input voltage is another factor to consider. A relay coil's input range is nominally -20% and +20% of the rated voltage. This can also be considered as the switch-on voltage, and, since a relay coil's holding voltage of a relay coil is lower than its switch-on voltage, the switch-off voltage is equally important to the correct use of a relay.

International standards require that DC-driven relay coils have a switch-off voltage equal to or less than 5% of the nominal input voltage. For AC-driven relay coils, that value is 15%.

Nominal current is what the coil typically draws when operated. Depending on the winding's resistance, current consumption is high for coils with low resistance and lower for those with higher resistance values. Trends are towards higher resistances, with a corresponding decrease in current consumption. Thus energy-efficient relays are leading the way in new designs.

An EMR's operational life can be defined in terms of either mechanics or electrical contact. These two values are significantly different; mechanical life is normally 10 times greater than the electrical contact life.

Mechanical life is the number of times a relay's mechanical parts operate before failure. Present mechanical life spans are in excess of ten million cycles. Newer relay designs can operate for more than 30 million cycles.

Electrical contact life is less definable, and consists of the results of both current values and voltages that are switched. AC or DC load switching also has a bearing on life expectancy. To increase life expectancy, protective elements can be added to limit arcing, dampen transients and inhibit the damage to the contacts that can be expected from inductive AC or high-voltage DC loads. The addition of protective components such as resistor/capacitor networks, diodes, and varistors helps protect contacts and other sensitive devices incorporated in the switching circuit.

Solid State Relays

An SSR is a semiconductor-based, electronic switching device with no mechanical contacts, and thus, no mechanical wear. The SSR relies on an electronic circuit to fulfil the required specific input and output characteristics, and is limited in both these aspects to closely defined input and output ranges. The output is typically capable of either an AC or DC load (depending on design) and is, therefore, not as universal as a relay contact.

A basic SSR has the following components:

1. Input circuit—designed for a specific input voltage range (similar to an EMR coil)
2. Optocoupler chip—designed to provide a certain voltage-isolation level and a switching capacity for low to very high frequencies (similar to the EMR armature) . This works by one part generating light (usually infra-red) and the other part sensing that light – the two parts are electrically separated but coupled optically.
3. Output circuit—designed to switch either an AC or DC voltage.

SSRs may be characterized by the method in which the relay turns power to the load on and off. To switch AC loads, it's important to do this at the nominal frequency range of an AC power circuit (47- 63Hz).

AC load-switching SSRs function best when they're able to turn the circuit OFF when the AC wave passes through the zero point, when both voltage and current are at or very close to zero. This technique is called zero crossing or zero switching.

The response time for DC loads is in the millisecond range. Switching DC loads can occur at any point since DC voltage and current are constant. Depending on design, SSRs can be made to switch at very high frequencies, serving as interfaces for high-speed counting and/or high frequency applications.

The table below lists the advantages and limitations of the two relay types.

Relay technology is moving toward smaller packaging with an increase in power output capability. With increases in automobile electronics, telecommunication networks, and the automation affecting everyday life, the future of relays will continue to be an important part of all electrical and electronic systems.

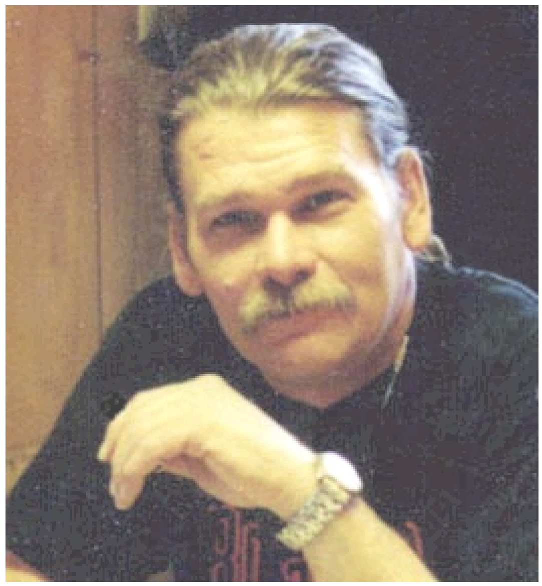
Table 1	Comparative advantages and disadvantages of EMRs and SSRs.

Electromechanical Relay Advantages	**Electromechanical Relay Limitations**	**Solid State Advantages**	**Solid State Limitations**
Available in multiple contact arrangements	The contacts wear and thus have limited life depending on loads	Infinitely long life when properly applied	Only one contact available per relay
Contacts can switch AC or DC	Short contact life when used for rapid switching applications or high loads	No moving parts	Heat sink required due to voltage drop across switching circuit
Low initial cost	Poor performance when switching high inrush currents.	No contact arcing	Can switch only AC or only DC, depending on circuit design
Very low contact voltage drop, thus no heat sink is required		High resistant to shock and vibration	OFF-state leakage current when switch is open or OFF
High resistance to voltage transients		Logic compatible to programmable controller, digital circuits and computers	
No OFF-state leakage current through open contacts		Very fast switching capability	

Maria Alovert
(Girl Mark)

Dan Fink

Steve Spence



Larry Barr – Editor

Laren Corie

Suzanne Ubick

Al Rutan

Mike Nixon

Best Wishes for 2006
from the team at
Rebel Wolf Energy Systems

ESSN Classified Ads

!!! <u>DIY AND SAVE</u> !!!

Emergency generators with storage battery and inverter, Photovoltaic (PV) kits, Solar powered hydrogen fuel cells, Biodiesel processor kits, and diesels running on used fryer oil (WVO).
Give us a call for the latest in DIY self sufficiency. 845-832-7211 or sspence@green-trust.org

WOODSTOCK, CT: GEOTHERMAL HOME FOR SALE
($479,900)

Geothermal heating and air conditioning - fuel independent. Custom designed with Australian Cypress flooring, gas log FP, central vacuum, custom tile floor in kitchen, bathrooms with marble vanities, jacuzzi tub.

Click here for full full details

$188 per month for utilities. 7.8 Acres.
Contact PATRICIA MALEK (agent): 860-779-7460
Email: 1stchoicerealty@sbcglobal.net

Better Times Almanac of Useful Information, Wisdom, Recipes, Conservation.

Free download at http://www.bettertimesinfo.org/2004index.htm, or for a free printed copy send a large (9"x11") SASE, with $1.06 in US postage to Better Times, 1524 NW 21, OKC, OK 73106.

FOR SALE -- 12.5 KW Biodiesel generators. Combines the 2-71 Detroit Diesel engine with an extremely heavy duty Delco or Emerson brushless alternator. This is the generator Steve Spence chose for his own BIODIESEL system. Rebuilt units starting at $4395. Non-rebuilt units starting at $1995.
www.affordablepower.com 1-888-454-1193 X3

Ghost Writing

Hey folks, do you have experiences you'd like to share with other ESSN readers. Many of you have energy self sufficiency related experiences or information that you'd like to share with ESSN readers. If you're comfortable writing, please submit your article to essn@rebelwolf.com.

On the other hand, if you'd rather not do your own writing, this forumis the place where you can get together with folks who'd like to do some writing with you: http://www.green-trust.org/forum/viewtopic.php?p=1050 . So, if you're one of those folks who wants to work on a collaborative article, just post here that your available and check out the posts from the folks who are looking for you.

I'm hoping to see a lot of fresh content for ESSN come from this forum. We'll be waiting for your posts. All of you!

Peace,
ldb

THE AMPHORA SOCIETY

Mike Nixon, together with his close friend and colleague Mike McCaw, founded The Amphora Society several years ago. One of the first things they did was to write a book about distillation that is now widely acknowledged as the clearest book that has ever been written on the subject – so much so that it is now used as a text by many schools and colleges around the world.

The Compleat Distiller

Why is it so popular for colleges and amateur distillers everywhere? The simple reason is that it covers the whole subject from beginning to end in a clear, easily understood way. It sweeps away all the myths and old wives' tales that have previously made distillation such an mysterious, complicated and arcane subject to understand.

A full description of this book, complete with details of the contents of each chapter, may be found at ***The Amphora Society***

Contact **Green Trust Sustainability & Renewable Energy** Website

MAKE YOUR OWN HOME HEATING OIL AND DIESEL FUEL FOR LESS THAN $1.00 / GALLON

Our Biodiesel processor kits are only $375

(includes S&H Continental US)

You just supply a electric water heater of 30 - 80 gallon capacity, and consumables, consisting of new or used vegetable oil, methanol and lye.

Assembly instructions are included

email us to order

WASTE VEGETABLE OIL CONVERSION KIT

Did you know you can run your diesel on used fryer oil? Yes, that stuff the restaurants throw away is actually fuel! Make your own fuel for your vehicle, generator, or heating oil furnace. WVO Conversions start at $850 for a passenger car and can cost as much as $2k for a large truck. Processor kits start at $375.

Drop us an email for details

BUILD YOUR OWN EMERGENCY GENERATOR

Want your own Emergency Generator? We have put together a kit which includes a 3hp vertical shaft gasoline engine, 94 amp alternator, mounting bracket, 4" pulley, V-belt, battery cables, 115ah deep cycle battery with case, 700 watt inverter, and mounting base with casters. You get both 12vdc and 120vac outputs. Will power a small TV and a 15 watt fluorescent light for 15 hours between engine charging. Can be used for pumping water from rain barrels and many other purposes. Additional battery capacity, 12vdc appliances, and custom configuration available.

2 year manufacturer's warranty on engine, 1 year on rest of system

$750 (includes S&H, continental USA)

Drop us an email for details

SOLAR PANEL KIT

Construct your own Solar Panels

Includes interconnection Components

Yes, you can build your own Solar Panels. From small cell phone chargers, to running a laptop, radio, and TV. We provide:

- New, Undamaged Solar Cells
- Interconnection Material
- Soldering Iron
- Liquid Flux for easy soldering
- Instructions, Soldering and wiring diagrams, tips for inexpensive housings

Power up your RV or off-grid home

18v @ 0.7A (12 watt panel) $99
17.6V @ 1.2A (21 watt expansion pack, cells only) $149

(S&H included, Continental US)

email us for details

AWARD WINNING FUEL CELL KIT

Offered by Green Trust: this leading educational kit to learn all about solar energy and hydrogen fuel cells

Build your own hydrogen fuel cell with this kit

- Assemble and Experiment with a Unique Reversible Fuel Cell Kit. This fuel cell kit provides an excellent introduction to one of the most significant technologies of the 21st Century. Build a model car that actually runs on water!
- The electricity required is generated by a large solar cell. Water is then electrolysed to form hydrogen and oxygen, which is stored as the fuel. When required these gases are fed into the fuel cell to provide electrical motive power.
- **The kit contains**:

Complete reversible fuel cell (hydrocycle system), wire, motor, chassis, axle, gas collector, 4 wheels, solar panel with support, syringe, tube, digital multimeter, test tube, protective goggles, labels, bag of small parts for fuel cell, bag of small electronic parts, and a comprehensive lab manual with 30 experiments and demonstrations.

$150 (Free S&H Continental USA)

Email us to order, or for shipping to other areas

ESSN

Energy Self Sufficiency Newsletter is published monthly online at www.rebelwolf.com. The publication is free and unlimited printing and distribution is encouraged for the benefit of the renewable energy community.

essn@rebelwolf.com

Circulation Info
The First Year

Monthly circulation of ESSN in its first year of circulation steadily rose to over 23,500, firmly establishing it as one of the most popular and informative global sources of practical information about off-grid living and energy self-sufficiency. With your continued interest and support, our aim for 2006 is to build on this successful start by offering articles on an even wider range of subjects. So please do not hesitate to contact us if you would like to contribute your experiences to ESSN. ldb