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Greetings,

Thank you for choosing www.witchwellenergy.com as your source for solar and wind power products.

This following document is an example of some different systems that you can use as a general guide to determine about how much money you are going to need to budget for your project. These are a guide only. You may want to download our free SolarGuide (77 pages) at: <http://witchwellenergy.com/solar-downloads/solarguide1.pdf> The SolarGuide is a basic guide to what is contained in a solar system and how it works.

Current prices as of April 16, 2007 for a few standard items are listed below: (solar panels must be ordered in pairs to insure shipping as this is factory packaging.)

SunWize SW60 panels without mounts	\$399.00
SunWize SW90 panels without mounts	499.00
SunWize SW150 panels without mounts	699.00
Sanyo 200 Watt 140200SE no mounts	1199.00
ProStar 30 Amp Charge Controller with meter	199.00
TriStar 60 Amp Charge Controller with meter	320.00
TriMetric 2020 System Meter 12/24volt	199.00
Surette 6 volt deep cycle 1156 Ah battery	1199.00
OutBack Power FX2012 Sine Wave Inverter 2000 Watts	1995.00
Xantrex 4024 Sine Wave Inverter 4000 Watts	2800.00

Thank you,
Floyd Humpherys

Examples for Planning and Sizing



Remote Home Solar Electric Power Initial Planning Questions-
12 Volts, 24 Volts, or 48 Volts for your batteries?

Battery voltage is difficult to change after your system is built, so choose carefully at the start.

12 volts is simplest and most standard, used in vehicles, RV, and boats. If you want a small simple power system, 12 volts will probably be easiest. You can use 12 volt DC directly in very small systems, adding 120 volt AC with an inverter.



24 volts battery systems have some technical advantage. SYSTEM SIZE: If you think you will have more than 1000 watts of solar modules, consider 24 volts. A technical advantage is that 24 volt wires can run longer distances. If you must place solar modules over 100 feet from the house for adequate sun exposure, or if your wind generator or hydropower is over 300 feet away, choose 24 volts. Most of your power will be changed to 120 volt AC power. Voltage converters are available to run 12 volt DC equipment from 24 volt batteries.

48 volts has great advantage if longer wire run is unavoidable to reach the only good solar location, up to 400 feet from the house, or hydro turbine 1,000 feet from the house. Presently there is limited selection of 48 volt charge controls and inverters, but these are the best quality, well suited for larger power systems. Voltage converters are available to run 12 volt DC equipment from 48 volt batteries.

Charge controls by Outback Power Products and Blue Sky Energy can charge a 12 or 24 volt battery from a 48 volt solar array. With these, power systems of any battery voltage can reach longer distances to place solar modules in the best sun location.

Separate Components or a Power Center?

A prefabricated power center is the other choice to decide on at the outset. This costs a little more than separate hardware and components of equal quality, but can save as much in cost of design and installation. You get a clean, safe electric system with just 3 components in the power room: inverter/standby charger, a power center with charge control, and the batteries. A power center may be the only way to pass your local building code inspection. Consider your long term goals. Separate components are suitable for smaller systems, and may allow budgeting for an additional solar module. But where you will be adding on, increasing the power of your system over the years, a power center approach is safer, neater, makes expansion easy, and passes building and electrical

codes.

LET'S BEGIN finding the right size and cost for your power system.

The exact sizing of solar is not terribly risky, since solar modules can be added any time, and since a backup generator can supplement charging if there is a shortfall. There is some flexibility because the power you receive varies with the sunshine of each year and with seasonal changes in weather. Your own flexibility in energy usage, plus use of a backup generator allows you to adapt to temporary shortages, while the automatic charge control manages any overproduction.

We caution against the temptation to start with generator, batteries and inverter, but postpone solar modules until later. If you can, start with enough solar modules required to do the job, since this is where most of your power originates. If budget requires, perhaps start with half or a third of the panels, and add the rest in subsequent years. This will help avoid battery problems and save many generator hours. Solar charging is what made home power systems practical! Solar power is modular. When the family grows or the cabin becomes a full time home, you add more solar modules. If you need to upgrade a charge control or AC inverter, Witch Well Energy takes your trade-in if originally purchased here. But two things are more permanent decisions: choice of battery voltage, and selection of a Powercenter. Consider your long term objective in making these decisions.

With this flexibility, several methods of estimation can give a close idea of what equipment you need.

1. SIX EXAMPLES of power systems from smallest to largest are described and priced at the end of this page. Choose from these balanced and expandable designs for the FASTEST way to a good starting point.
2. CALCULATE how many watt hours you will need, then find the number of solar modules to produce that much power in your climate. The method is best learned from one of the books we sell, which contain worksheets and instructions.
3. VISIT INDEPENDENTLY POWERED HOMES in your area. Notice what works for folks with life-style, family size, home, and climate like yours. The amount of electricity needed depends on the number of people in the house, their hobbies, business activities and conservation habits. Ask about their use of special energy saving appliances.
4. CALL or WRITE US AT Witch Well Energy. We will be glad to personally help you estimate your power and solar equipment needs. Write, call, or visit with us to discuss your life-style needs and suggest a power system.

Six Examples of Home Power Systems of Different Sizes

The six examples below are not packaged kits, but flexible suggestions to find your starting point easily. These examples fit six different levels of life-style or budget. Most people shopping at our web site fit in example #2 through #5. Each example shows the cost and the watts of solar modules required in a northern US climate. Each is a well balanced system, but still gives a range of choices in quality. It's easy to use one of the examples or make small changes for your own needs. Prices include mounts for the solar modules and cables for batteries and inverter where required, but these

items may vary with each installation.

The solar watts recommended are calculated for the central to northern US (Utah, Wyoming, Idaho), and are about 50% higher than needed in the desert Southwest or the Caribbean. In really sunny climates, you can use the equipment list and cost from one example, and expect to receive benefits more like the next larger example.

Solar modules range from under 50 to over 200 watts each. Examples are based on total watts of solar modules installed, which applies to all sizes of solar modules or any system voltage.

Backup generators cost from \$400 to \$9000 or more. Many of our customers already own one. That cost is NOT added to the total in the examples, and you may need to allow for purchase of a backup generator.

#1 STARTER SOLAR POWER SYSTEM
\$1000 to \$3800

PRODUCES ABOUT 0.25 - 1.0 USABLE KILOWATT-HOURS ON A SUNNY DAY

Minimum solar power for a small cabin, motor home, boat, or weekend retreat. A very conserving person can start with 60 to 120 watts of solar, to power a few 12 volt lights and stereo. Closer to 240 watts of solar allows lots more lights, a 12 volt TV, 12 volt pumped water pressure system and a small inverter for some power tools. Northern winter weather requires backup charging with a generator. One or two pairs of 6 volt deep cycle golf cart batteries make a 12 volt set.

SOLAR 60-300 WATTS (one SunWize SW60 up to two SunWize SW150s & mounts)
CHARGE CONTROL (Trace C-12 or SunSaver 20 & box, plus fusing)
BATTERIES: (2 or 4 Trojan T-105 six volt & cables)
DC BREAKER BOX (QO612 with two 20 amp breakers)
INVERTER: (None; or any unit up to Xantrex DR1512, cables & fuse)
Add Battery Booster engine/alternator kit, or Honda EU3000 AC generator.

#2 CONSERVING COTTAGE
\$4500 to \$7500

PRODUCES ABOUT 1.5 TO 2.0 USABLE KILOWATT-HOURS ON A SUNNY DAY

Cottage power system runs high efficiency lighting, TV, stereo, & DC water pumping. The AC power inverter runs color TV, VCR or satellite receiver, stereo; and limited use of vacuum, sewing machine, hand held power tools, computer, blender, DC powered deep well pump. An AC generator is used for large appliances like clothes washer, AC deep well pump, or a table saw, and it charges the battery at the same time. Battery is usually 12 volt but can be 24 if expansion is intended.

SOLAR 360 - 600 WATTS (four SW90 or four SW150, & mounts)
CHARGE CONTROL: (Xantrex C40DD or Morningstar Tristar 45DD)
METERS: (TriMetric Battery Meter, optional but recommended)*
HARDWARE: (solar and inverter fuses, and connecting wires as needed)*
*(consider a power center kit instead of the two lines above)
BATTERIES: (4 to 6 Trojan T-105, & cables)
INVERTER/CHARGER: (Xantrex DR1512 or DR2412 and cables)
Recommended generator: Honda EU3000

#3 CONSERVING SMALL FAMILY HOME
\$8500 to \$10,000
PRODUCES ABOUT 3 USABLE KILOWATT-HOURS ON A SUNNY DAY

Year round home for 1 to 3 people. Provides 120 volt AC power for lighting, vacuum, washer, kitchen appliances & microwave. DC or 120 volt AC well pump, color TV, VCR, satellite receiver, stereo, computer, and hand-held power tools. There can be enough power for a small DC refrigerator in southern climates. In northern winters, the generator supplements battery charging while doing laundry. This system could be set up with either 12 or 24 volt battery.

SOLAR 900 WATTS: (six SunWize SW150 modules on pole mount)
POWERCENTER: (with charge control and cables)
BATTERIES: (8 T105 or 4 Trojan L-16HC, & cables)
INVERTER/CHARGER: (any 1500 watt to 2500 watt)
Or consider complete pre-fab Outback Flexware 500 Power System
Recommended Generator: Honda EM5000 or larger

#4 ACTIVE FAMILY SOLAR HOME
\$12,000 to \$17,500
PRODUCES ABOUT 4.5 KILOWATT-HOURS ON A SUNNY DAY

More power suitable for a family of 3 or 4, or home office. The Witch Well Energy home and business started with 1000 watts solar. This covers all of example #3 plus power for a SUNFROST refrigerator and energy efficient chest freezer, and extensive computer or TV use. Washing machine and 120 volt well pump run from inverter AC, with generator backup if winter is extended overcast. 24 volt battery is recommended especially if future expansion is planned to example #5. For 24 volt remember to order solar modules in multiples of two, 6-volt batteries in multiples of 4.

SOLAR 1200 WATTS: (eight SW150 watt modules on pole mounts, & wiring)
POWERCENTER: (with charge control and cables)
BATTERIES: (8 to 12 Trojan L-16HC)
INVERTER/CHARGER: (2000 to 4000 watt, true sine wave preferred)
Or consider complete pre-fab Outback Flexware 500 Power System

Recommended Generator: Honda EM7000i or Kohler 10ERG

#5 LARGE HOME / SMALL BUSINESS

\$18,000 to \$28,000

PRODUCES ABOUT 10 USABLE KILOWATT-HOURS ON A SUNNY DAY

When Backwoods was off-grid, we ran 4 computers 10 hours a day, 3 answering machines, fax, 3 wireless phones, office and stockroom lights, work bench and shop tools. We also had all the usual residential power described in example #4, including several solar electric design refrigerators. A true Sine Wave inverter runs washing machines and power tools. Stereos, ceiling fans and appliances don't hum. Includes automatic generator start as batteries or loads require. Battery voltage of 24 volt or 48 volt is recommended. 24 volt battery bank requires 6-volt batteries set up in multiples of 4, while 48 volt requires multiples of 8. This is simplified by factory assembled equipment.

SOLAR 2080 WATTS: (sixteen KC130 watt modules on two mounts of eight)

BATTERIES: (12 - 16 Trojan L-16HC or larger Surrettes, and cables)

OUTBACK Flexware 500 POWER SYSTEM: with 1 or 2 inverters

Recommended Generator: Kohler 10ERG

#6 HIGHER POWER SYSTEM

\$28,500 to \$38,000+

PRODUCES ABOUT 15 USABLE KILOWATT-HOURS ON A SUNNY DAY

Quality plus higher power for a very large family home and business, cottage industry, art studio, or shop. Backwoods Solar home and business eventually upgraded to 3,000 watts of solar to relieve our sun-less winter power shortage, and reduce generator running time. Resulting summer surplus allows a small window air conditioner during peak sun hours. True sine wave 7,000 watts of AC power with both 120 and 240volts AC. Battery voltage of 24 volt or 48 volt is recommended. 24 volt battery bank requires 6-volt batteries set up in multiples of 4, while 48 volt requires multiples of 8. This is simplified by factory assembled equipment.

SOLAR 3120 WATTS: (twenty-four KC130 watt modules on 3 mounts of 8)

BATTERIES: (16 - 24 Trojan L-16HC or larger Surrettes, & cables)

OUTBACK Flexware 500 POWER SYSTEM with 2 inverters

Recommended Generator: Kohler 10ERG