

Beginners Guide to Utilizing Solar and Wind Generated Electricity



Many of the folks who visit our site are interested in installing a solar or wind electric system for their home but they do not know where to begin. Although to a certain degree each situation is different there are a few basic things that we will need to know to get you started. Ready for more than the online reading? Visit us for an in person class on [PV](#) or [Wind](#) technology.

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Beginner's Guide to Solar and Wind Energy

Many of the folks who visit our site are interested in installing a solar or wind electric system for their home but they do not know where to begin. Although to a certain degree each situation is different, there are a few basic things that will help you get started down the path to renewable energy.

Generally speaking, solar electric systems take from 12 to 20 years to pay for themselves depending on your location and what your local utility charges for electricity. Wind power systems can take from 8 to 12 years, depending on the wind speed at your site. That said, more and more states have very aggressive rebate programs and tax credits for both individuals and businesses to reduce the initial cost of the system. Rebates can be as high as 50 or 60% of the cost of the system depending on your state. To see all of the rebates and tax credits available for your state go to the [Database of State Incentives for Renewabel Energy \(DSIRE\)](#).

A Little Homework is Required

Solar electric panels (PV) and wind generators create electricity. If we are to help you size a system for your home, we need to know how much electricity (kilowatt-hours or kWh) you use each month. If you are currently buying electricity from the utility company that information is available on your electric bill. If you are looking into a system for your RV or cabin where there are no electric bills to refer to, then please go through the process of [filling out the load calculator sheet in the Reference section of the How To area](#). Filling out this sheet requires you to supply two pieces of information - [how many watts each appliance](#) that you want to run uses and how many hours it operates in a day. Once we know how much electricity you use, we can offer system sizing recommendations. Without knowing that kwh number, we will not be able to provide recommendations with any accuracy.

Yes, the math for figuring all this stuff out can be somewhat confusing since it involves numbers that most people never really think about. The important numbers that can be read

off the appliances are listed as volts, amps or watts. Everything in the US runs of 120 or 240 volts. Electric dryers and large power tools often use 240 VAC, but most everything else uses 120 volts. You may see the voltage written as 110 or 117 volts also; it's the same difference just a different way of rounding the number off.

$$\text{Volts} \times \text{Amps} = \text{Watts.}$$

All appliances are required to list one of these three units. If the appliance only lists amps then you are ok because you know you can multiply that by 120 volts to get the watts. A kilowatt is 1000 watts and the amount of time you use a specific appliance is the number of hours. For example if you run a computer that uses 150 watts for one hour you have used 150-watt hours. After you run that computer for 1000 hours you have used 150,000-watt hours or 150 kilowatt (kWh). We will also want information about your peak load or peak power consumption which is also listed on your electric bill or can be found by adding up the wattages of every single load.

Electricity consumption varies greatly from household to household. And believe it or not, the number of kwh you use does not depend upon the square footage of your home. (A common misconception.) While it is difficult to say what an *average* household uses, for our example, we'll use a figure of about 900 kWh per month. In most North American locations, you can count on an average of about 4 peak sun hours per day over the year (different from the number of hours the sun is up during the day). Operating this average home completely independent of the electric utility grid will require about 75 solar panels (~150 Watts each) plus batteries, inverters, fuses, wire etc... A complete solar energy system for this much energy consumption will cost between \$70,000 and \$90,000. If you want to have a system that's grid intertied and does not use a battery bank, then you can expect the cost to be reduced by about a third... but don't be discouraged.

If you use as much electricity as the average home in the example above (or even more) the first step is to reduce your electricity consumption. This does not mean "freezing in the dark". It means taking advantage of new, [efficient](#) technologies and being smart about how and when you use power. Here's a list of some of the most cost effective ways to reduce your electrical use:

- Replace your incandescent light bulbs with [compact fluorescent lights](#). Compact fluorescent lights with the EnergyStar(tm) approval use a third to a quarter of the power of incandescent lights for the same amount of light. Incandescent lights produce and waste more electricity on producing heat instead of light!
- Replace your old [refrigerator](#), freezer, water heater, washing machine (or any other major appliance over 5 years old). There have been a lot of energy efficiency improvements on major appliances in the last few years.
- *If your home uses electric heat, (air):* Use [solar air heating systems](#) in conjunction with your electric heating system to greatly reduce the amount of electricity consumed by your heating systems. Depending on your location and the cost of your electricity, these systems can pay for themselves as quickly as 3-6 years - few investments have that rate of return.
- *For users of electric water heating:* Use [solar water heating systems](#) in conjunction with your existing hot water tank to greatly reduce your electricity consumption. Just like the solar air heating systems they pay for themselves in 3 to 6 years - making them smart investments.
- [Solar attic fans](#) are low cost, easy to install ways of reducing the amount of air conditioning you use. Also, if you live in a dry climate that gets very hot in the summer time, you can use an evaporative cooler (sometimes known as a swamp cooler)

instead of an air conditioner. These appliances use a small fraction of the electricity that an air conditioning unit consumes.

- Also, consider replacing large electric appliances like water heaters, dryers, and stoves for propane or natural gas models. Of course using propane/natural gas will still cost you but since propane is more efficient for heating, you will pay less and be able to use a smaller solar system.

The big no-no's for a renewable energy system all revolve around creating or removing heat - regular household heat, water heat and air conditioners.

Easing Into Renewable Energy

It is not necessary to do a complete system all at once. One option is to pull a few circuits off the main circuit breaker panel and just run the loads on those circuits off solar. If the utility power (or grid) goes out in your area a lot, then you want to choose these loads based on your priority loads - what must be on even if the grid is down. Or you can install a utility intertie (also known as grid tie) system that will feed some solar generated power back onto the utility lines turning your meter backwards and off-setting power that you would otherwise buy from the utility. This is less expensive than an off-grid system since there are no storage batteries and because it is not necessary to cover your entire load.

If you are interested in a wind electric system we will need all the same information about your consumption and we will also need some information about the average wind speed in your area. A quick way to get this information is to call your local weather bureau or airport. You can also visit the website of the National Renewable Energy Lab and find your city in their [Wind Energy Resource Atlas](#). Cost-wise a wind system to operate the *average* home in the US will cost around \$25,000 - \$50,000 depending on the wind resource and whether it is battery based or not; so it is a bit less expensive than solar. A large wind turbine will most likely require the installation experience and large machinery of an experienced installer. Be sure to consult an installer before purchasing any large wind turbine.

Selling Power to the Utility Company

Selling power back to the utility makes things more complicated. Selling power back means that you are purposely installing more solar or wind capacity than you need and hoping that the utilities will buy the excess power back. The utilities are legally required to buy it back but at what is called "avoided cost" which is generally 1 - 3 cents per kilowatt hour. Although some utilities in some states will buy it back at the same rate that you buy it from them (this is called net billing) these utilities are not the majority. This is different from offsetting power with a utility intertie inverter.

Net Metering

Most utilities do have what is called "net metering" which means that a solar or wind system installed on your property can be used to generate electricity and turn the utility meter backward. This allows you to offset power that you would otherwise buy from the utility. As long as you only generate the amount of power you traditionally use on a monthly basis and don't generate a lot extra to sell back you will fit into the net-metering category. These systems can be set-up to charge batteries for back-up power systems in addition to turning the utility meter backwards but it adds some complexity and increases cost. Be prepared to make contact with your utility to see what their rules are. If you are pursuing a wind electric system, be prepared to contact the county or township to make sure that there are no restrictions against tall towers. Some utilities or townships are very easy to deal with and the negotiations go off without a hitch. In some cases, they make it very difficult to even get the information about what you can do.

If you live in sunny Florida, Texas, southern California or the windy Midwest you may be able to install a renewable energy system for less than these average numbers indicate. Maybe you are just powering a cabin or an RV which use very little power generally. Better yet, maybe you are just building your home and you will have the opportunity to make it well

insulated, efficient, oriented properly towards the south to take advantage of [passive solar](#) heating and daylighting. Doing all of these things will dramatically reduce the amount of energy you use thereby reduce the cost of a renewable energy system.

Options

The big question you need to answer before investing is why are you interested in using solar or wind energy? Is it because you need some back-up electricity for when the utility grid is unavailable? Or is it because you want to spend less money per month on electricity? In either case it is possible to install a smaller and less expensive system that will supply a portion of your electricity needs.

If it is because you want to spend less money per month then you may want to start by hiring a solar person or energy efficiency person in you area to come into your home and suggest ways of reducing your electricity consumption. These ways may be as easy as changing all your light bulbs to compact fluorescent bulbs or as difficult as changing out your old electric water heater for a propane or natural gas model. Any of these things will save money to different degrees. Once your home is as efficient as it can be, then you may want to consider installing a wind generator for "utility intertie". This system may not cover your entire electricity bill and can be as large or small as your budget allows with certain limitations on the size of the utility intertie inverters you have to choose from. This type of system is subject to acceptance from your local utility so you may want to contact them to see what their terms are. This type of system has very limited battery storage capacity in order to keep the price down so it is not typically thought of as offering back-up power.

Free Money for Your System

Many states offer incentive programs for folks to buy renewable energy programs to offset the costs of purchasing and installing systems. The incentives range widely. Many folks are completely unaware of the programs that are offered in their states, and miss out on a large opportunity to offset the costs of their system. Want to find out what incentives your state offers? The University of North Carolina offers a great, comprehensive database of state incentives. [Click here](#) to pop up a window with their site.

Backup Power

If you are interested in wind energy to provide back up power during utility outages in your area, we still suggest doing whatever you can to increase the efficiency of your home first. A back-up power system like this is generally used to provide power for "priority loads " when the utility grid is unavailable. Every one has their own priority loads but they generally include the refrigerator, water pump, heater blower and some lights for example. The wind generator and battery bank are sized to power these priority loads for a period of a couple of days or how ever long you typically are without power. This system can be set up so that it powers the priority loads all the time or so that it only comes on when the grid goes down. This system also can be as small or large as your budget allows. The smaller the budget the more selective you will have to be about which loads to run.

If you want to pursue a back-up power system, the next step is for you to identify your priority loads, and determine the electricity draw (in watts) and hours of run time for each one.

Further information on how to do a [load calculation](#) is located in our Learn section.

Remember that if you want to pursue a utility intertie system we must have some idea of your budget or what portion of your electric bill you would like to try to offset.