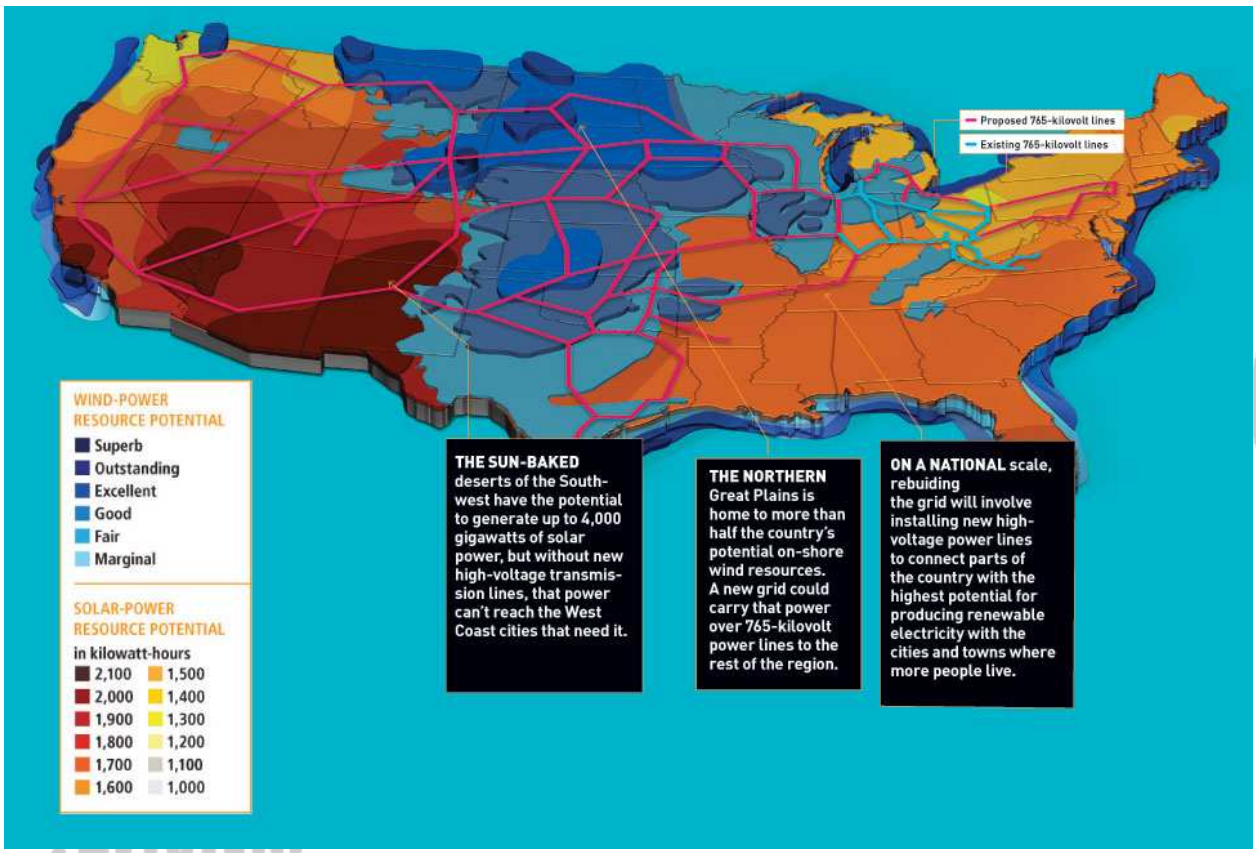
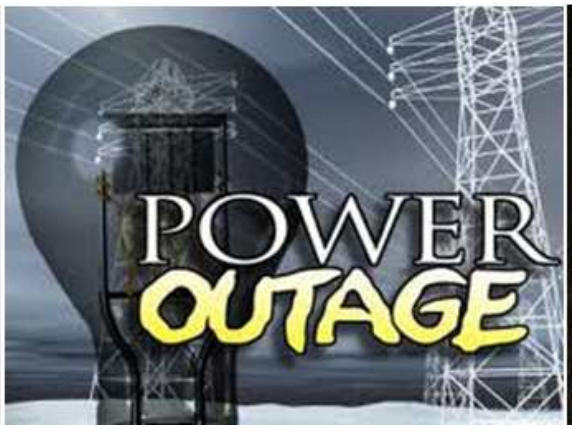
Oh No! The Power is Out – Now What?

There are really only three reasons a “residential” person would want to generate power:

- They live away from the electric grid.
- They wish to be electricity independent and this includes lowering or eliminating their electric utility bill.
- The gridded power has gone out for one reason or another.



Off-the-grid enthusiasts look at generating their own everyday power needs that can be anything from complete electrical self-reliance to just generating and storing enough electricity for a few hours and they deal with energy storage too. Off-Griders generally look at solar, wind, hydro and geothermal for energy generation. This article is NOT about energy independence – It is about Emergency Energy.



The greater majority of us fall into the power failure category, especially since electricity has become a necessary *convenience* to a large portion of the population. To many of us any power outage longer than a couple of hours is much more than just an inconvenience, it feels threatening too!

There are a good number of things that can cause a power failure from an accident, brownouts, high usage rolling blackouts and severe weather, to some kind of electromagnetic disaster.

These kinds of incidents have us thinking about alternatives to gridded power and for most urbanites that means some kind of Home Emergency Electrical Generator.

Small Portable Generator

Emergency Power is typically for 3-7 days. Some industries have emergency back-up power for up to 10 days. Very few, if any look beyond that.

Generac Guardian 17 kW home generator model 5873

Understand that "whole house" *emergency generator power* is NOT the same as full scale off-the-grid. You still have to unplug and turn off non-essential appliances and devices. If you are truly looking for a *full-house-no-change-in-personal-electrical-usage* system then you need to look at Alternative and Off-grid systems, even if you only plan to use it in emergencies.

There are many kinds of emergency electrical generators for home or residential use from portable to stationary, from back-up power for the entire house, to just minimal back-up power for a few key appliances and devices. Each generator type has its own pros' and cons' and uses different types of fuel to generate electricity.

Options and accessories are many. *Keep in mind just what kind of electrical outage you are preparing for.* If you are looking at some kind of wide spread CME or EMP, then the more digital your generator and accessories are, the more you will need a Faraday Cage for each piece to guarantee the generator and its devices are operational. If you are just worried about several days to rolling outages, then how much you need to power while the grid is down will be one of the most important points you are looking for.

Key decision makers for us are usually the overall cost, followed by ease of use and maintenance.

Ok with that said lets go over some essential things to consider *before* deciding on your generator.

Types of Residential Generators

Overview:

An **electric generator** is a machine that converts energy from mechanical to electrical. So, any generator needs a source of mechanical energy.

Steam, water, fuels like petrol, diesel and others, compressed air, wind or even a hand crank are all used to produce mechanical energy which is then converted to electrical energy.

> *Electrostatic generators* do not use any of the above but work according to the principles of electrostatics. They generate extremely high voltages at very low currents. The Van de Graaff generator is probably the most famous of these.
>
> *Electromagnetic generators* on the other hand are based on Faraday's law. They have rotating electromagnetic machinery. Dynamos are electromagnetic generators.
>
> *Linear generators* also use Faraday's law, but unlike a dynamo these have a magnet moving back and forth through a solenoid.
>
> *Magnetohydrodynamic generators* have hot gases moving through an electric field to generate electricity. And unlike dynamos, they do not have any kind of rotating machinery.

In places that are commonly effected by storms, hurricanes, tornadoes and other natural disasters having **Home Electric Generators** is a good idea to keep you with power so that you don't ever have to worry about being without lights, heat or power. It converts mechanical energy to electrical energy so that you can maintain life as you know it in even the toughest of storms. It should be used sparingly, however, as it won't last forever. Because the engine and the alternator are mounted together, they are often called a genset or engine-generator.

An emergency generator can be used in a residential or commercial setting. A home generator or residential generator can be purchased at a hardware store, from an authorized dealer, a home improvement store or through an online retailer. A stationary or standby home generator is designed for permanent residential use. The size of a standby generator ranges from one kilowatt to one-hundred kilowatts. Portable gasoline powered generators are designed to be used temporarily. The portable generators can be used wherever you need electrical power. Most generator engines run on gasoline, propane, diesel or natural gas. A home generator has become an essential piece of equipment especially during unexpected electrical outages.

Electric generator type depends on the type of generating equipment employed, the electrical energy produced is either direct current (DC) or alternating current (AC).

> **AC generators** are classified as single-phase or polyphase. A single-phase generator is usually limited to 25 kW or less and generates AC power at a specific utilization voltage. Polyphase generators produce two or more alternating voltages (usually two, three, or six phases).
>
> **DC generators** are classified as either shunt, series, or compound-wound. Most DC are the compound-wound type. Shunt generators are usually used as battery chargers and as exciters for AC generators. Series generators are sometimes used for street lights. The emf induced in a DC generator coil is alternating. Rectification is needed to direct the flow of current in one direction. The generator rotating commutator provides the rectifying action.

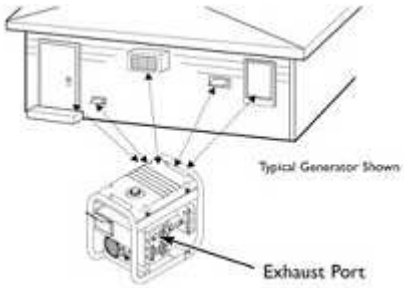
Generator Size Variations: With the latest advancements in the field of electrical engineering, generators are now available in a wide range of sizes. Generators with power supply capacities of 5kW to 50kW are readily available in the personal and home use markets, while industrial generators are anywhere from 50kW to over 3 Megawatts. Handy and portable gensets are available for homes, RV's and small offices, but larger businesses, data centers, buildings, plants, and industrial applications need to use the much larger sized industrial generators to meet their higher power requirements.

Choosing a generator can be tricky because every home is different. Something that you may have had in your previous home may not work in the home that you are in at the moment.

Bottom Line: ***Every power generator is NOT ideal in every situation!***

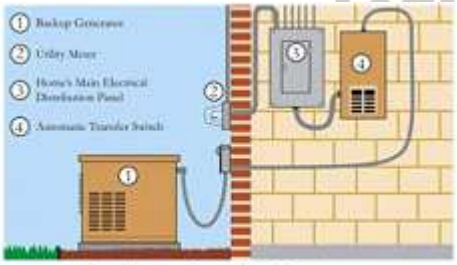
Home electric generators are electric generators that feature a convenient push button start, as opposed to their industrial counterparts. With these home electric generators you can easily start up your home generator with the push

of a button, the turn of a knob, the flick of a switch or even a remote control that you can use from the convenience of your living room couch.



Portable Generator

Portable Generators: Portable generators are "light" generators units that are designed to be moved from place to place and come in many sizes and power output ratings. This category includes any unit that is *movable*, from the handheld "ultralite generators" to units mounted on a "cart" that can be wheeled around a garage or jobsite. Portable generators are the most common types of generators out there. They are more affordable and can be taken almost anywhere; like camping or used in an RV. They can run on various fuel sources; usually gasoline or diesel. They come with 120-volt outlets similar to the ones in your home. Some generators also include 240-volt outlets. You can connect tools and home appliances to the outlets or directly into a transfer switch, allowing you to use the power outlets in your home directly.



Stationary Stand-by Generator

Standby Generators: Standby generators, or residential generators are a lot pricier than their portable counterpart, but they pack enough power for your entire home and are usually fueled by liquid propane or natural gas. These units are designed to provide partial (or all) electric power to a home when the utility power fails and come in several sizes and options. They can be wired directly into your home's electrical circuit system. Standby generators are installed in a permanent location. The number of circuits to which a standby generator can provide power--and the number of appliances you can run on those circuits--is determined by the power capacity of the generator. One of the advantages of a standby generator is that it can automatically detect a power outage and start automatically (usually with a few seconds delay). Unlike portable generators, they require professional installation with the proper permits. Depending on the model, a transfer switch may have to be purchased separately.

Select Circuit: As the name implies, a select circuit home generator will automatically provide power to some, but not all, of your home's electric devices. The ones that get the power are determined before installation, and only those are connected to the generator. This saves money initially because the generator doesn't have to be as large and it will save money as the machine is running as well by saving fuel. These will keep lights and appliances in important rooms (like the living room and kitchen) functioning for as long as the fuel lasts.

Whole House: Basically the King Kong or Mega of home generators, these are expensive to buy and to run. If you have the means, however, and want to be sure that everything in your house runs for as long as possible, these are for you. They have liquid cooled engines like an automobile, and can produce up to 45 kilowatts of energy at a time. The price ranges from the $1000s to the $10,000s, but owning one will insure that you will never be left in the dark until you run out of fuel.

A Silent Generator is *designed to drastically reduce or eliminate* the noise of home power generation. Most of these 'silent' generators are propane or natural gas. However ,in the last few years home diesel generators have gotten much better at reducing noise levels.

RV generators are a special class of generator sets (gensets) that are designed to be installed into various types and sizes of vehicles available in the RV industry. This could include special conversion buses, Winabago type campers, large towable campers and even some smaller camp trailers. They are installed inside an enclosure underneath the main RV body, but some may be roof mounted or even rear or front rack mounted. These generators can be powered by gasoline, diesel fuel or even propane gas depending upon what makes the most sense for the particular installation. RV diesel generator applications are available where this makes sense depending upon the available fuel source. RV motor homes that use diesel fuel for their primary engine fuel many times will have a *Onan* RV diesel generator onboard. If you require a diesel RV setup *please make sure* that the RV unit you want to purchase comes with that option directly from the manufacturer.

Marine generators are specially designed to provide power for boating applications. These units are generally highly compact, have special cooling and exhaust systems and designed to operate in a wet "marine generator" environment.

Inverter Generators: These are not really generators. What they do is convert DC power into AC power, the kind of current that everyday appliances use. A common use of an inverter is to connect one to your car cigarette lighter and then plug in a small home appliance to the inverter. Inverters have added features over the years and today many inverters include emergency radios, lights, or their own internal battery to store power.

Inverter

Inverter Generator

When you purchase an inverter, you need one that can handle the wattage of the appliances you intend to connect to it. Some inverters are made specifically to power low-wattage appliances, like portable phones or digital music players. Others can handle heavy-duty power tools. If you're buying an inverter that's powered by its own battery, you'll have to consider how many hours the inverter can provide power before needing a recharge.

The so-called **Gas Inverter Generators** are gasoline powered generators types, typically smaller and run quieter than the open frame generators and they often vary the engine speed to the required load, saving gas and wear and tear on the

generator end. These generators are great for camping where noise may be a concern and for powering sensitive electronic equipment.

Fuels

Diesel and Gas Generators: With up to 6000-watt outputs, the higher end models can provide relief during a power outage. Make sure to keep the generator outside as they produce carbon monoxide (an odorless gas that is very dangerous). The nice part about them is that they are usually portable and can be used for a number of tasks away from the home. The price, which will be less than most home generators, isn't bad either. The advantage of diesel generators, which can be either portable or standby, is that efficiency is higher than gasoline engines and these motors tend to last 2 to 3 times longer than gasoline.

Natural Gas Home Generators: These generators can be portable or standby machines. Although somewhat more expensive they burn cleaner and longer on less fuel than gas generators. Storage of propane tanks is possible without fuel deterioration over long periods of time, whereas gasoline has to be replaced every year or so. Propane or natural gas is also safer to store. These are usually reserved for bigger electrical outputs; some can provide power to an entire house. They run on either natural gas or liquid propane that is *piped into the house from a municipal plant* or storage tank. This kind of emergency home generator is permanently fixed to the outside of a house, not unlike a central air conditioning unit. If your concerns are strictly to provide power to your home during outages, then these are the way to go. If yours is a direct hook-up with your natural gas line, you won't have to worry about filling tanks. They are also set to turn on automatically when your power goes out, so you don't even have to turn them on.

Benefits and Disadvantages of Gas and Diesel Types of Power Generators: If you're using a portable generator, you'll need one that is either gas, propane or diesel-fuel powered. A propane generator can also be used as a standby generator and hook directly into a large stationary propane tank. The other type of power generator is a natural gas-powered generator. This is a standby generator that will hook directly into your natural gas lines at your home or business and be used as a backup in case of electric failure.

Natural gas and propane generators present some risk because of their connection to those fuel lines. Thus, they typically have several safety features installed like automatic shutdowns in case of overheating, high oil pressure or other problems, to prevent fires and explosions.

Gasoline and diesel-powered generators are the other two types that are available in both portable generators or for use as an industrial generator. A gas generator isn't a good option as a standby generator, but a diesel-powered generator can be. Each has certain advantages and disadvantages in certain situations.

> Most experts recommend propane, diesel and natural gas as the better choices for emergency fuel. As opposed to gasoline, large quantities of diesel and propane can be stored safely in large containers. In addition to this, these types of fuels deteriorate much less over time than gasoline.

Propane has practically unlimited shelf life (well, at least 2 years) and is the only type of fuel that does not require electricity for a refill. Although home improvement stores carry mainly gas gensets, propane models can be found online.

Diesel is less flammable than gasoline. It likewise may be not available during a widespread blackout, but it can be stored in large tanks. Diesel gensets are the most efficient and reliable of all types, but they are also the most expensive. Today's diesel gensets will usually run on biodiesel as well. A prototype of a device that works on food, paper and plastic trash has been developed at Purdue University, but currently it aims for a military use.

Natural gas can assure practically unlimited run time, but it is used primarily in permanently installed standby devices. Natural gas powered portable gensets are rare, relatively expensive, and need professional installation of the fuel line, which defeats the purpose of portability.

For non-emergency applications price may be the main factor in choosing the right model. If so, a cheap gasoline model may be your first choice. For a disaster preparedness however, the main considerations should be given to the convenience of fuel storage and fuel availability during an emergency. In this case, in my view the preference should be given to diesel and propane.

Benefits of a Gas(oline) Generator: Gas generators generally cost less than diesel models. They're often more lightweight because they offer less power. The engines are larger but the other components usually are a bit less heavy. Gas generators are a good choice for small applications and for highly portable uses. Because gas is so readily available, the fuel is easy to come by. Gas, by the gallon, is usually cheaper than diesel fuel. Gas engines typically run more quietly than diesel engines.

Benefits of a Diesel Generator: Diesel generators are also powered by readily available fuel. Diesel is often more expensive than gasoline but because diesel engines use much less fuel, diesel is actually a more cost-effective choice. Diesel engines don't use sparkplugs. That means not only will you be able to start the engine without worrying about worn sparkplugs, but there is no spark which means there's less risk of fire and explosion than with a gas combustion engine.

Diesel fuel burns cleaner than gasoline and is less flammable. It doesn't evaporate as quickly, either. So if your generator is going to be used infrequently, diesel fuel is a better choice because there will be less evaporation between uses and storing the fuel means less risk of fire or explosion than with a petrol generator.

Main Differences Between Gas and Diesel: For business uses, diesel generators are usually the better choice. Not only will you find a cost savings in the fuel, but diesel engines break down less often and require less cleaning and maintenance than any other type of fuel-powered engine. Purchasing diesel generators that offer huge amounts of wattage gives you the option of using them for more applications than you originally planned. If you buy a gas-powered generator that can't handle that kind of wattage, it's not safe to use because an overloaded generator poses a great risk of fire or explosion.


Produces power to run laptop and cellphone during camping trip


Mobile Solar Generator

MySolarBackup portable solar generator

Solar Generators: Simplified: Emergency solar generators have at least one solar panel and one battery for storage of energy, an inverter and then the place you plug your appliances and devices into. They fall between the small backpacking type for your GPS, to the stationary type for your home. Just remember you are looking at *emergency solar power* and NOT whole house. These are also some of the most costly of all the generators. Of course not having to store combustion able fuel is a great advantage, which depending on your needs, may or may not outweigh the need to keep the battery charged for emergency use and the battery's maintenance requirements.


The Powerenz LFP200 Portable Solar Power Generator System ,
approximately 300W Foldable Solar Array,
200AH LFP Battery, 60A MPPT Solar Charge Controller,
120V & 220V 2000w Pure Sine Inverter Options,
Modular System Allows for EZ Expansion & EZ To Handle Light Weight Modules.

Advantages of Solar Generators

- No fuel or electricity needed.
- Decrease your dependence on conventional emergency energy sources.
- Portable solar chargers can be carried with you wherever you go.
- Government tax incentives and grants offered for many solar items.
- Sunlight is renewable, free and clean.

Disadvantages of Solar Generators

- Too small to power an entire home.
- Smaller batteries (although these batteries do last around 5 years or so and they are easily replaceable. They are cheaper and easier to handl than the industrial sized batteries of a traditional solar system).
- Batteries must be kept charged and maintenanced.
- Expensive initial cost, the savings are on the backend.

Power Transfer Switch: A power transfer switch is created to take a power load from one source and to apply this load to multiple electrical sources. The standby or stationary home generator is *required by government regulations to have an automatic transfer switch*. This type of switch was made to connect a home's electrical wiring system to a stationary generator or to the home's utility power source. When power use is normal, there is not an electrical outage. The voltage goes from the utility power source to the electrical applications being used in the home at the time. When this power connection to the grid fails because of an outage, the automatic transfer switch transfers the power from the utility line to the home generator line. The switch isolates the power from the main line.

It is against the law to connect home generators to any type of electrical wiring without installing an automatic transfer switch. This is because if an automatic transfer switch is not used, interconnection or back feeding could occur between the generator and the utility line. During a situation such as this your home's line transformer will become energized. When this occurs it serves as an electrocution hazard for utility employees and for your neighbors. A home generator may become severely damaged if this does occur. To prevent a situation of this caliber an automatic transfer switch is required, and it must be "double pole double throw".

The **term double throw means** that you can place the automatic transfer switch in two positions. Automatic transfer switches come with three separate positions. These three positions are as follows: OFF, GEN and LINE.

The **term double pole means** that the switch is capable of transferring both line wires. An automatic transfer switch is manual, automatic or a combination of both. The main purpose of this switch is to disconnect a load of electrical power from one source to another source. The switch performs all of these above-mentioned operations on its own. When the switch has transferred the power from the generator back to the utility source it will automatically put the generator in cool down mode and then shut off on its own. Once a home generator is installed with an automatic transfer switch you do not have to worry about manually operating it. This takes some of the stress out of an electrical outage.

Emergency Home Generator Installation: You might think that a home generator is just a big appliance that you can plop down in your basement and hook up to your electrical system. In truth, you need a flat, load-bearing surface with adequate water drainage and ventilation. Some homes may need more work than others to responsibly install a generator - rarely is it a project for the homeowner themselves. Whether to ensure your generator serves your home for a long time or to ensure the basic safety of your household, do yourself a favor and find a reliable, experienced contractor for your emergency home generator installation. Connecting the generator to your electrical distribution system is a job for a qualified, licensed and bonded electrician who is familiar with local building codes. *Electricity is dangerous, respect it.*

Pros and Cons of Different Types

Standby systems provide the highest level of comfort, but of course it comes with a price tag. Depending on wattage and options, complete systems with a transfer switch may sell from $2000 to $10,000 for home use.

You may also need to spend several thousand dollars for professional installation and fuel hook up. Before the installation, you will likely need to obtain permits for electrical wiring and fuel connection. You would also need to pass the inspections after the work is done. All this, obviously, takes time.

So, if you are looking for a home generator because there is a hurricane or an ice storm in the next week's forecast, a standby type is not for you. Another issue is service. A hard-wired appliance that weights 400-500 pounds is not something you can easily disconnect and ship back or bring to a repair shop. Should you need a repair, you'll have to wait for a service technician to come to your home or for the manufacturer to send you a replacement part.

Portable generators are much cheaper-- their prices start at around $120 for 1000W model. Unlike stationary devices, they don't have to be hardwired to your house unless you choose to-- their control panel has several outlets of various types into which you can plug cables from your electric loads. This can be both an advantage and a disadvantage.

On one hand, you can start using a portable unit, so to speak, right out of the box. This would work only if you want to run just stand-alone appliances, such as refrigerators and window a/c. You can just unplug them from the wall outlets and connect via extension cords to the generator.

However, when it comes to lights, central a/c, boiler controls, sump pump and everything else that is hardwired directly into your house electrical lines, you'll face problems powering them up.

This is something homeowners often don't realize and dealers may neglect to mention to you.

You might ask, why can't I just hook up my genset to a wall outlet? First of all, it is illegal and dangerous to connect any power source into any electrical wiring connected to the grid. By trying to energize your house you are also feeding voltage back into the utility lines. This may hurt line workers or your neighbor's who may think the main is down. Aside from this, unless you are the only one who lost power, you would actually be trying to power up all the neighbor's houses who lost electricity. This would likely overload your generator and trip its circuit breaker.

Because of all of the above, if you want to run your built-in, hardwired appliances and lights from a portable backup source you still need a transfer switch. In this case it has to be a manual one.

This connection method is the safest one, but you would still have to deal with the professional installation, permits, inspections, etc.

You would also have another hurdle to overcome if you buy a portable model equipted with GFCI. The GFCI will trip when you use it with a regular transfer switch. *Again, this is something the manufacturers and retailers may not always tell you.* If you choose a model with GFCI, you need to buy a special 3-pole transfer switch or otherwise discounnect genset's ground wire in the transfer switch.

In any case, such a setup is still cheaper than a stationary one because portables cost less than standbys and manual switches cost less than automatic. (In case of emergency, if you have no choice and you really need to connect your genset into a wall outlet, first flip the "disconnect switch" on the main service panel. This would isolate your house from the outside lines. This is not a recommended method though.) You also need to remember that a standard outlet is rated for 15A. So, you can't use it for more than 120x15=1800 volt-amps. If you draw a higher current you may overheat the socket and the wires, which is a fire hazard.

COMPARISON OF CATEGORIES BETWEEN PORTABLE AND STATIONARY GENERATORS FOR HOME STANDBY USE http://www.generatorjoe.net/				
Category	**Typical**	**Portable**	**Stationary**	**Winner**
		6,000 Watts	**12,000 Watts**	**Stationary**
Models	**Portable vs Residential**	**Winco WC6000HE**	**Onan RS12000**	**Onan RS12000**
Time of Need	Usually at night, bad weather	Must be protected from rain.	In protected cabinet.	Stationary
Powers	% of House	50%	100%	Stationary
Largest Single Load	Due to plug restrictions	20 Amps	100 Amps	Stationary
Remote Control/Start	Automatic Preferred	No Auto-start	Auto-start Standard	Stationary
Auto Choking	Automatic Preferred	No Auto-choke	Auto-Choke Standard	Stationary
Move In/Out	Permanent Desirable	Required unless shelter	Move not required	Stationary
Setup or Connecting	Permanent Desirable	Required unless shelter	Always Connected	Stationary
Transfer of Power	Automatic Preferred	Manual Only	Automatic	Stationary. Automatic
Unattended Operation	Unattended desirable	Short Periods Only	Runs Unattended	Stationary
Operation by Family	Desirable	Usually difficult	Automatic Operation	Stationary
Weather Protection	Desirable	Requires shelter or move out/in	Enclosure Standard	Stationary
Security	Desirable	Easy to steal if left out	Anchored to ground	Stationary
Security During Operation	Highly Desirable	Must go outside during storm to start and refuel	Runs Automatically	Stationary
Security Storage	Highly Desirable	Must keep inside and drain fuel	Secure Outside	Stationary
Fuel Tank Type	Strongest Preferred	Usually plastic	Usually steel	Stationary

Fuel Tank Size	Larger better than smaller	4.5 gallons	50-100 gallons	Stationary
Run Time per Tank	Longer is better	at 1/2 load 11.2 hours at full load 5 hours	200 gallon tank lasts 40 hours	Stationary
Refueling	Automatic Preferred	Every 5-11 hours @ 1/2 load	Every 40 hours	Stationary
Storage of Fuel	Desirable, if safe	Fuel cans outside, not inside	In Tank Outside	Stationary
Fuel Economy	@ Full Load	Poor	Excellent	Stationary
Refueling System	Automatic Preferred	By hand with cans, stop generator	By Fuel Supplier	Stationary
Layout	Simple is Preferred	See Diagrams	See Diagrams	Stationary
Number of Parts	Smallest number preferred	4, generator, switch, outlet, cord	2, generator & switch	Stationary
Generator Cost	Lower is better than higher	$1,918	$4,202	Stationary
Transfer Switch Cost	Lower is better than higher	Gen-Tran 200600, Manual, $235	Onan Indoor, 100 Amp, Automatic, $670	***Portable, Manual***
Other Parts	Outlet box, cords, plug	Gen-Tran $125	Fuel Tank, $200	Stationary
Estimated Install Labor (electrician)	Lower is better than higher	$500	$900	Stationary
Total Initial Cost	Lower is better than higher	$2,778.00	$5,972, ($3,194 more)	***Portable***
Cost Per Hour to Run @ 1/2 Load	Lower is better than higher	0.53 gallons per hour or $1.50 hr	54 cu.ft/hr, < $1.00 hour	Stationary
Estimated Life Hours	Longer is better than shorter	2,000	10,000	Stationary
Years of Life	Longer is better than shorter	555	15	Stationary
Cost per year life years	Lower is better than higher	$574	$398	Stationary

Noise	Lower is better than higher	79 db(A)	<70 db(A)	Stationary
Oil Capacity	Larger better than smaller	1 Quart	3 quarts	Stationary
Adds to value of home?	According to RE appraiser	No	Yes 50% Minimum	Stationary
Need Permit?	According to City of Santa Rosa in California	No	Yes, $25	***Portable***

Buying a generator can be a daunting process. However, you can take control by being informed and getting organized.

Most importantly these generators are NOT something you can purchase, store and only worry about when the power goes out. They need regular maintenance no matter if they have been in use or not. The fuels utilized have various shelf-lives and risk factors too.

Use the following check list to help you organize and determine your emergency generator requirements:

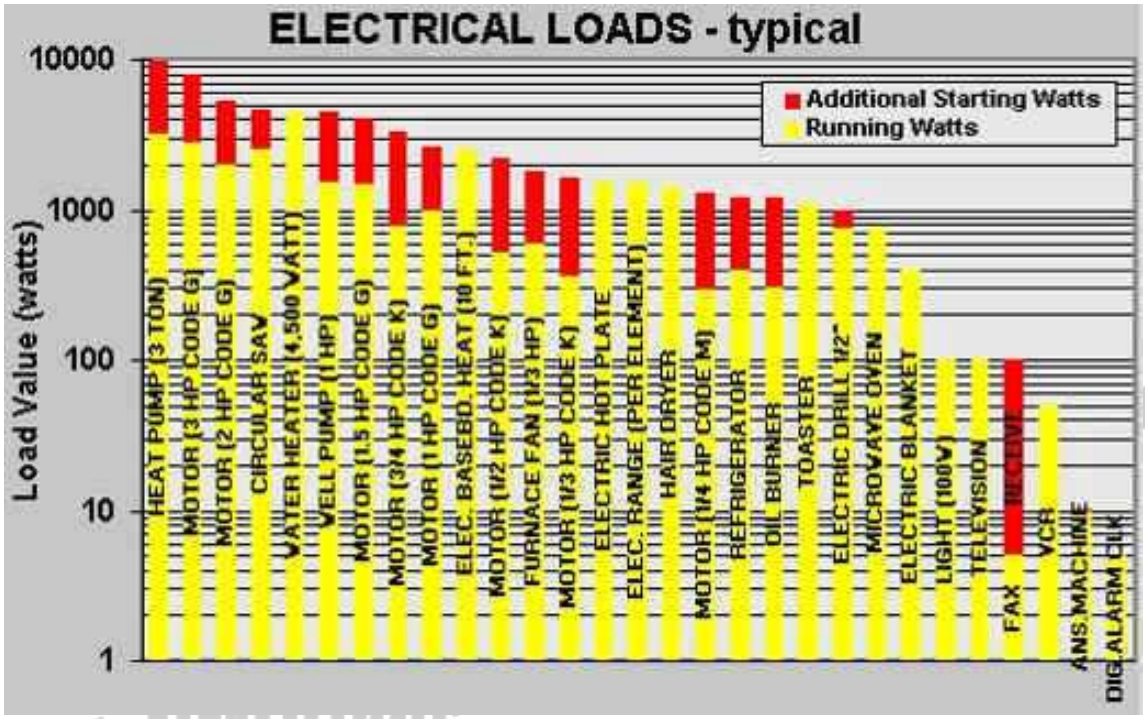
- **Understand electrical terms.** You'll see a lot about watts, volts, amps and more. Review the glossary link at the end of this article for definitions.

- **How long do you expect to be on emergency power?** If you are looking for a reliable backup power device for a possible major blackout, the main factor to consider is how you are going to keep your emergency source fueled.

- **Which fuel type are you considering?** How much of this fuel can you store safely on your property? Many areas have fire codes that restrict how much combustionable fuel can be stored on residential property and what kind; so be sure to ask about this. For instance with gasoline the challenge is storing. Its fumes are highly flammable, which makes storing of large amount of gas unsafe. *The NFPA fire code allows storage of no more than 25 gallons in residential buildings.* A typical 5000W generator running at rated load will consume its tank of fuel in about 25-30 hours. So, you may run out of fuel in one day, while during a wide-spread power outage gas pumps may not work. Also note that gasoline has a typical shelf life of about six months to a year tops, although some stabilizers are claimed to extend it for up to 2 years.

- **How much of your house do you want to power?** *Plan now or pay later.* Decide which appliances and devices are your "necessity to life" items. Like refrigerator, freezer, alarm system, etc. Remember too that if you have a chest freezer it will maintain the items stored in a frozen state much longer than an upright freezer (cold air sinks). So you can keep your frig plugged in to your generator most of the time and then unplug it for a few hours every couple of days to plug in your freezer for those few hours.

- **Determine Wattage and Horsepower needs.** Determine how much power you need for the items you care about. Knowing how much power you will need is also very important. *Know the difference between continuous power versus surge or start-up power.* Understanding the requirements for the size of your home is really essential before making your purchase. **The *average* home requires from 5000 to 7000 watts to power *essential* items only.** That is a sharp contrast to **the minimum wattage** provided by a generator **for the average sized home during a power outage, which is between 2,500 - 3,000 watts.** There are links at the end of this document to help you determine your wattage requirements. Buy the generator that provides a little more wattage than you need.



Many people believe smaller generators can be used for standby electric power because they are not running all the time. This is not only a myth but can actually be very detrimental. Unfortunately, generator under sizing is one of the most common mistakes committed by buyers. Not only does it involve the risks of damaging your new asset (the generator), but it can also damage other assets connected to it, create hazardous situations, and even limit overall productivity of the unit and/or the business relying on it. If nothing else, the key thing to remember here is that more is always better than less.

Going to a dealer and buying the best or cheapest generator available without any other consideration is clearly not the best approach. It is always better to delve deep into your power generation requirements before making a choice.

While there is no substitute for having a certified electrician perform an inspection and calculate everything for you, the guidelines below do offer some great starting points and should at least get you started in the right direction - **Know Your Requirements:**

- Make a list of the items that need to be powered by the generator
- Make a note of the starting and running wattage of the respective items

- Calculate the total power requirements in KVA or KW

http://www.generatorjoe.net/		
Rated Watts	**Description**	**Degrees of Power**
5 kW	A basic system that can restore power to multiple "survival appliances".	Four lights, furnace fan, sump pump and refrigerator/freezer
6.5 kW	A small system to keep all the survival appliances operating and a few extras.	Survival appliances plus family room.
8 kW	A mid-Sized system to help you weather powerless days and nights.	Survival appliances plus family room and home office.
10 kW	An emergency backup power system providing comfort and security.	Survival appliances plus family room, home office and kitchen.
15 kW	A powerful system with enough energy to run a small home.	Survival appliances plus family room, home office kitchen and laundry room.
25 kW	A mini-power plant that can run a small to mid-sized home or business.	All of the above plus an air conditioning system.
30 kW and up	A mini-power plant that can run a mid-sized to large home or business.	All of the above and more. Live in total comfort.

Appliances and equipment with electric motors, ***especially compressors and well pumps***, have a much higher start up amperage called *Locked Rotor Amps (LRA)*, than the running amps shown on most nameplates. A general rule of thumb is *a minimum of at least twice the amperage to start a device as to run it.* However, some devices can require up to 6 or 7 times the amperage to start as to run. If you have water wells, large air-conditioners, sump-pumps, or other heavy duty motor applications you need to find out what the locked rotor amps of the largest piece of equipment is.

You may often find power requirements of devices stated in amperes.

- For resistive load: Wattage = amperes x volts
- For reactive load: Wattage = (amperes x volts) x load factor

- Electric generators have two power ratings. The *continuous power rating* (also called continuous watts, run watts, and rated watts) tells you how much power the generator can supply continuously. For appliances with large motors, generators have a *surge power rating* (also called surge watts). This rating is used to determine whether a generator is large enough for the motor-driven appliances you intend to connect to the generator.

  - **Motor Starting Loads:** In addition to load or wattage requirements, it is important to consider motor starting load. Selecting a generator, which is inadequate for your motor starting needs, may make it

difficult to start motors in air conditioners, compressors, well pumps or freezers. In addition, the starting load causes voltage dips, which is why the lights dim when a large motor is started. These voltage dips can be more than annoying – voltage dips can ruin delicate electronic equipment such as computers. You must make sure you account for starting loads, if you can't start the load you can't run it.

- ***A common rule of thumb is that starting a motor requires up to three (3) times more wattage and twice(2 times) the amperage to start the device than running loads to keep it going.***

- **Output Power:** Manufacturers usually specify ***running watts and starting watts***. The former is the amount of power the device can produce continuously. The latter is the short burst of power it can produce to run appliances whose surge current can exceed steady state current. **NOTE:** That manufacturers often advertise their portable gensets by starting watts rather than by running watts. Also note that single-phase gensets are usually rated for loads with power factor PF=1, that is for loads with volt-amps equal to watts. Since all motor-driven appliances (such as refrigerators and air conditioners) as well as old computers and electronics without power factor correction have relatively low PF, their VA demand may be 25-70% higher than their nameplate wattage.

Under Sizing Symptoms - There are many symptoms that will let you know your generator cannot keep up with your energy needs, such as:

- Unreliable or sporadic performance
- Frequent unexplained shutdowns
- Complete system failure
- Shutdowns when additional appliances turn on
- Maintenance problems
- Shortened lifespan for your system
- Risks to you and your property

- **RPMs** A related aspect of generator motors is the speed at which they run, as measured in RPMs. *Generators made for the US market operate at one of two speeds:* 1800 RPM or 3600 RPM. 1800 RPM motors will last longer and run quieter; 3600 RPM motors are smaller and lighter.

- **The Right Fuel Source:** When choosing a home generator purchasers **must** be aware of the fuel sources available in their area. Home generators should operate by using a popular fuel source available in your local surrounding area. *Most stationary home generators are constructed to be a bi-fuel participant.* This means that the power generators are capable of using natural gas or liquefied petroleum gas. To change over from the use of one fuel source to another an easy field adjustment is needed. If your house is fueled by either gas or propane, a bi-fuel home generator is your best choice. With a permanently installed natural gas powered home generator you do not have to ever refill the generator. Plus this type of home generator model has an unlimited amount of available running time – ie as long as the fuel flows thru the pipes.

NOTE: If an electrical outage occurs for several days the generator system must be shut down and the motor oil must be changed every other day. This practice ensures the continued safety and maintenance of your home generator.

If you decide to purchase a natural gas home generator it is wise to check what the required gas pressure is to operate the generator. Some home generators may require more gas pressure then is given for standard residential use. The power generator will not work if it does not meet the minimum fuel requirements set by the manufacturer. If you find out that your generator does not meet your home's standard gas pressure, or if it exceeds that amount, call your local utility company immediately. Your gas utility company can either set up a separate gas meter for your home generator or change the amount of gas pressure allowed on your pre-existing meter.

It is important to keep in the back of your mind that if a natural disaster does occur your gas service may also be shut off. This would render your home generator powerless. This is why bi-fuel power generators are such a popular choice when choosing a home generator. A generator, if bi-fuel, can be switched to run off of propane. Propane fuel has a long shelf life and is available during energy crises. Power generators that operate with diesel engines are considered to be more efficient but also more costly. This type of power generator is usually used to power different types of industry.

- **Decide: Portable or Stationary?** Considering your budget, convenience and power needs, choose which type of generator you want. If you want to haul a generator outside or put one outside in a shed and plug in cords when there is a power outage, it can be done. You will not necessarily save any money doing it but if you have a use for the portable generator for non-emergency times then it might be an alternative. It is usually more economical and less hassle to purchase a stationary system and power the whole house or business. Not only do you get more power for the dollar but your family and/or employees don't have to do anything to have emergency power.
    - If you're getting a portable generator, consider the size of the fuel tank and the fuel source.
    - If you decide to purchase a portable generator, don't forget you will also need a transfer switch to safely power the circuits in your home.
    - Standby generators require a permanent location. Determine the location, and measure the area. Find out from your town if a permit is required, and be prepared to pay extra for installation.

- **Stand-by or Prime?** The first determination you will need to make is whether you will require stand-by or prime power.
    - **Prime power** is required when you have no other source of power or you are using the system as you prime means of power. Any generator that is used everyday or on a fixed schedule to provide power is considered a prime power generator. Another word for prime is "continuous". If you need a prime power generator, use the generators prime or continuous rating as a guide.
    - **A standby set** is a backup to normal utility power. Standby units are used only when your utility power is not available and will not be used frequently. Many stand by generators run at 3600 RPM and are not designed for constant daily use. Another word for standby is "emergency". If you need a standby power generator, use the generators standby or emergency rating as a guide.

- **What is the fuel consumption rate or run-time for the generators you are considering?** This consumption rate will vary from type of generator, brand and quality, how many appliances and devices it is running, to fuel quality – to name a few.

- **Take care of home power issues.** Locate your existing electrical service panel and gas line to target any potential problems before buying a generator.

- **Determine wiring needs:** Does your generator need to be directly wired into your home or recreational vehicle or can you get by in times of emergency with 2 or 3 extension cords run from the portable generator to a select few appliances? Also, consider the advantages of a transfer switch and whether or not it should be automatic or manual.

- **Noise factor –** Some generators can be very noisy and may cause a disturbance to others. In my research I found that price also had a factor in noise reduction. Some of the pricier models are a lot quieter, so be prepared to pay a little more if your concerned about noise. Some offer extra features to reduce the noise created during operation. Look for large mufflers if noise is a concern.

- **Reliability and Warranty –** You want to get a brand with a long history of producing emergency generators. Let's face it, if you want your generator to last for years then you need to be careful what brand and model you chose.

- **Buyer Beware:**
    - Read the fine print before purchasing.
    - Do NOT rely solely on a manufacturers sizing sheet. For some reason the greater majority of manufacturers underestimate appliance and device wattage and they often overlook start-up and vampire power. If a wattage usage gives a range of wattage needs, use the higher number. There are resources at the end of this article for estimating wattage needs.
    - Perform product comparisons. Compare power outputs, run times, and prices, as well as what's included in those prices, such as accessories, warranties, support and installation. Product comparisons are easy to conduct especially with a little time online using the internet. Manufacturer and user reviews provide accurate ratings and feedback on various products.
    - Make sure you get the proper balance between your needs and budget limitations when your select you home backup generator.
    - Determine financing options. Some retail stores offer financing options for generator purchases. Amazon offers FREE Super Saver Shipping and provides no interest financing on select items.

- **Consider included items-Features and Benefits:** Does the generator come with a warranty or maintenance package? What about a power cord, oil, wheels, and funnel?
    - Engine block. For long life and quiet operation we recommend four cycle, liquid cooled, industrial duty diesel engines.
    - Air or liquid cooling. Air-cooled engines require a tremendous amount of air and may require ducting and they are somewhat noisier. Liquid cooling offers quieter operation, more even temperature control

and therefore longer engine life. Modern air cooled engines are suitable for many applications, especially short run, portable or standby uses.

- Intake Air. All quality generators have intake air filters with replaceable filter elements. Today even small portables have replaceable air cleaners.
- Mufflers. Most generator come equipped with an industrial grade muffler. One good investment is a residential or critical muffler that is much quieter and lasts longer. All enclosed generators should be equipped with at least a residential and preferably a critical muffler.
- Lubrication. The lubrication system should have a full flow, spin-on oil filter. Larger generators should have a filter bypass. Most generators today have low oil alarms and shutdowns, make sure the generator you select has this valuable feature, its simply a must have protection.
- Major brand of engine. We do not know why people would even consider an inferior "scrap metal" unit or "off brand" engine, you will not be able to obtain the necessary parts, service and support. Many engines come with a box of spare parts including pistons, rings and bearings because your going to need them all. Save yourself some grief and buy a major brand of engine. If you buy a junk engine, we wont service it and most other reputable dealers won't either.
- Electrical system and circuit breakers. Standard 12 volt system should include at least the following: 1) Quality starter motor and battery. Larger generators should include a charging alternator with a solid state voltage regulator. 2) Larger diesel units should come with a pre-heat switch and all generators should have a start/stop switch. 3) Al generators should have a safety shutdown system to protect the engine in case of oil pressure loss, generator over-speed or over-crank and high water (or operating) temperature. 4) System circuit breaker to protect the generator. On small systems and portables there should be a circuit breaker on each circuit.

- **Operating Speed:** Electric equipment is designed to use power with a fixed frequency: 60 Hertz (Hz) in the United States and Canada, 50 Hertz in Europe and Australia. The frequency output of a generator depends on a fixed engine speed. To produce 60 Hz electricity, most engines operate at 1800 or 3600 RPM. Each has its advantages and drawbacks. 1800 RPM, four pole sets are the most common and least expensive in large generators. They offer the best balance of noise, efficiency, cost and engine life. 3600 RPM, two pole sets are smaller and lightweight, best suited for portable, light-duty applications. 3600 RPM sets are considered "Standby Generators" and can never be considered for prime power use. In simple terms it's like operating your car at 90 mph, versus 45mph – at 45mph your car will last longer, is quieter, less maintenance and longer life. Most 3600 rpm units are twin cylinder air cooled lawn mower engines, while the water cooled 1800 rpm units are comparable to those found in forklift and tractor engines. The bottom line is the 1800 rpm water cooled units will last longer, offer less maintenance problems and be more fuel efficient. In addition, 1800 RPM generators are designed to be rebuilt, 3600 RPM units are designed to replaced and are much lower in cost (most of the time). Some 3600 RPM stationary units and most RV and commercial power units can be rebuilt at least one or more times but this process is not inexpensive.

- **Generator End:** (The part that makes the generator "generate" electricity.) AC generator should have a 4-pole revolving field. An automatic voltage regulator will provide "clean" power. Normal utility power is +/- 6% voltage regulation; most generators are even better ranging from +/- 5% or .25 % and even better. Most modern generators offer AVR – Automatic Voltage Regulation or some other proprietary brand of voltage regulation and can be safely used with modern electronics and computers. *Lifetime lubricated bearing* - Cheap

generators are not supplied with these bearings. They often require complete disassembly every two or three years for bearing replacement. Most modern power alternators, or generator ends, are provided with industrial quality lifetime lubricated bearings

- **Consider additional costs.** How much more will it cost for installation by a qualified professional? Will you need an accessory like a cover for protection from the elements or a transfer switch?

- **What Features and Accessories Do I Need?** Accessories include wheels for your generator, covers, circuit breaker boxes, transfer switches, extension cords of the proper size, gasoline or other fuel containers, cable and adapters, and backup spare parts including air filters and spark plugs. Among the most useful options to consider are electric start, a wheel kit, low T.H.D (<5%) and low oil level sensor.
    - Transfer switch - If you want to use your generator to power part or all of your home, you'll need a sufficiently sized generator and a transfer switch. The transfer switch safely closes off the utility power line to your house's electrical system and opens a direct line to the generator and reverses the process when utility power is restored.
    - Standby models can work either with a manual or an automatic transfer switch. The benefit of an automatic transfer switch is that it senses when utility power has been lost and automatically switches to generator power.
    - Wheeled Frames - As the name suggests, portable generators can be transported to different locations. The smallest portable generators are comparatively light--perhaps 50 pounds--and can be carried. Larger models can weigh as much as several hundred pounds, making a wheeled frame essential for moving it out of the garage or shed to power up when you lose power.
    - A good primary fuel filter/water separator is a must to protect your engine's fuel system.
    - Stand-by sets may require a block heater to keep the coolant/water mix at an adequate temperature for easier starting and less smoking on startup.

- **Where am I going to put the thing and what kind of requirements does it have?** Ensure the following items are considered, read the manual for the generator.
    - Air inlet for combustion and engine cooling.
    - Outlets for exhaust and hot cooling air.
    - Fuel, battery and AC electrical connections.
    - Remember to monitor for carbon monoxide!
    - Rigid, level mounting platforms (many sets are already mounted on a steel skid base).
    - Open accessibility for easy service.
    - Isolation from living space. Keep noise and exhaust away from occupied areas.
    - Space and equipment to extinguish a fire. Minimize the possibility of fire danger.
    - Remember, GenSets move on their vibration mounts. Allow clearance to compensate and use flex-joints on all lines and connections.
    - GenSets that are housed in weather-protective enclosures are designed for installation out-of-doors. Typically a cement pad is placed in a suitable location, out of sight but with easy access for maintenance and fueling. The generator is secured to the pad. Choose a site close to the electric service and fuel supply lines (natural gas, propane, or diesel). The main distribution panel, transfer switch and sub-panels are inside the building in this example, but more often the distribution panel, sub-panels and transfer

switch are outside. You should make sure that 110v power is available at the generator for battery charging. The GenSet must be a minimum of 3 ft from combustible material (NFPA 37). Leave at least 3 ft (or more if the housing and instructions for your particular unit) all around the GenSet enclosure for access to the inside (NEC Art. 110-26a, Art. 110-26b). The GenSet must be at least 5 ft from any opening (window, door, vent, etc.) in a wall, and the exhaust must not be able to accumulate in any occupied area.

- It is NOT recommend locating generator sets indoors in residential applications and small commercial and industrial applications. The primary reason to avoid indoor installation is safety.

- **Establish your budget.** Generator prices fall across a wide range, so determining how much you'd like to spend is important.

Common Mistakes

Mistake #1: Sizing Your Home Generator Too Small

Sizing your home generator correctly is the most important step in the process. Unfortunately, the most common mistake people make in purchasing a home generator is choosing a one that is too small for their power needs.

Before choosing a home generator you will need to decide which appliances and equipment you will want to power during a power outage, and make sure that the generator is large enough to support them. Undersizing your home generator can cause a complete system failure or shutdown as the loads are added, unreliable performance of the generator, premature and/or excessive maintenance problems, shortened system life of the unit, and risk to your personal safety and property.

A home generator can come with a hefty price tag, so it might be your instinct to go smaller to save some money. But the fact is that the cost of the repairs you will need to your home's electrical system and the home generator, make it worth it to size your home generator correctly the first time.

Mistake #2: Sizing Your Home Generator Too Large

Another mistake that people often make is purchasing a generator that is too large for their needs.

It is wise to purchase a home generator slightly larger than your minimum power requirements, to allow for miscalculations and possible future add-ons. The recommended amount is about 20 % larger than your minimum requirements. Larger than this is a waste of money. Not only will you spend more on the initial cost of your home generator, but this could also lead to malfunctions of the unit. If a home generator frequently operates well below its maximum output (50 % below, or more), it can have some of the same consequences as overloading it, including unreliable performance and premature and/or excessive maintenance issues.

To reiterate, the process of choosing which appliances you want your home generator to power, and having them measured correctly, is crucial so that you purchase the correct size home generator.

Mistake #3: Measuring Home Generator Wattage Requirements Incorrectly

Many people who wish to purchase a home generator end up with the wrong size generator because they measure their wattage requirements wrong, usually because they have tried to do it themselves.

The best way to do this is to have a professional electrician do it for you. This ensures that it is done accurately and safely. But if you choose to do the measuring yourself, one important thing to realize is that the startup power requirements of some appliances are much greater than their constant-run requirements. The home generator has to be able to accommodate the power surge that happens when these appliances startup, so pay attention to this important measurement. Appliances that fall under this category are those that have a motor or compressor, like a refrigerator or air conditioner.

Many people don't realize that a central air conditioning unit requires an enormous amount of power to start their motor and compressor—at least 10-15kW. So if a whole-house AC is on your list of necessary appliances, as it is in many parts of the country, you must factor this in to your wattage requirement calculations for your home generator.

Mistake #4: Not Purchasing Your Home Generator from a Reliable Vendor

Not being picky with your choice of vendor for your home generator can be a costly mistake as well. This can cost you valuable time and sanity during installation or should you need any maintenance of the unit. You can find horror stories all over the internet of bad experiences homeowners have had, from inexperienced salespeople who aren't knowledgeable about the units they sell and dealers who don't take the proper steps for installation, to not being able to get return a phone call when warranty service is required.

Mistake #5: Choosing a Portable over a Standby Home Generator

Many people decide to go with a small, portable generator for their emergency needs. While these can be useful in a pinch, they are not a good backup plan. A portable generator is not meant to be used for more than short periods of time and you can only plug a few appliances into it at a time. This is why this type of home generator is best used for recreational purposes like camping, instead of emergencies.

A key factor in using a portable generator is that they run on fuel, usually gasoline, which emits harmful fumes. These generators must be used in an open area to avoid these poisonous fumes. If there is extreme weather outside, how convenient will it be to pull out the machine, drag it outside, gather extension cords, and run them through open windows? Not very. A permanently installed home generator gives you much more convenience and reliability.

3 Mistakes Almost Always Made on a First Solar Power Generator Project

Mistake #1: Not Calculating Number Of Solar Cells Needed and Size of Battery Bank

If you have any DIY experience under your belt, you'll know that this is needless to say. But a good proportion of us are over-reliant on our gut feel –- even those we consider experts. When it comes to constructing a solar power generator, estimations just wouldn't make the cut.
Standard calculations need to be made even for every part or component in the solar generator system -- from the solar panel dimensions to the diode ratings. The reward of your efforts is that you'll be able to enjoy the fruits of your labor for years and years to come.

Mistake #2: Constructing A Flimsy Solar Panel Casing

Solar panels are exposed to the elements (like wind and precipitation) since they are placed outdoors. Most of them are installed on the roof where it's exposed to stronger gusts of wind. Therefore it is crucial to implement a design that has enough structural support to withstand the natural forces coming against the solar panels. For beginners, following a proven design helps since they have no prior experience to help them judge what dmensions are most suitable for their first solar panel frame. They run the risk of constructing flimsy frames that are easily damaged even by a gust of strong wind.

Mistake #3: Failure to Vapor-Proof Your Solar Panels

Metallic joints are prone to rust and corrosion when there is moisture trapped in the inner recesses of the solat panel. But how did moisture enter in the first place? We find that vapor seeps through many types of sealant after some time. Unfortunately stays trapped in the interior of the solar panel. Therefore you have to choose the correct type of sealant to prevent moisture from destroying your hard work inside your solar panel.

These 3 pitfalls may stop your project dead in its tracks or cripple it sometime after you have put in all the hard work. Therefore you will have to keep these in mind while designing and building your first solar panel. If you avoid these pitfalls, you are already on the way to building a successful solar panel project that can generate renewable energy for you for many years.

A Final Word (or two or three)

General Safety Rules

There are several general safety rules that must be followed when using a home generator.

- Generator Safety: Always read the owner's manual and instructions for your generator and carefully follow all instructions and warnings in order to safely start and operate the generator. These tips are merely supplemental and are not intended to substitute reading of the owner's manual.
- Never run a generator indoors or in partly enclosed areas such as garages. Only use outdoors and away from windows, doors, vents, crawl spaces and in an area where adequate ventilation is available. Using a fan or opening doors and windows will not provide sufficient ventilation.
- Operate the generator only on level surfaces and where it will not be exposed to excessive moisture, dirt, dust or corrosive vapors

- Do not overfill the fuel tank. Always allow room for fuel expansion.
- Never add fuel while unit is running or hot. Allow generator and engine to cool entirely before adding fuel.
- Never store a generator with fuel in the tank where gasoline vapors might reach an open flame, spark or pilot light.
- Do not connect your generator directly to your home's wiring or into a regular household outlet. Connecting a portable electric generator directly to your household wiring can be deadly to you and others. A generator that is directly connected to your home's wiring can 'back feed' onto the power lines connected to your home and injure neighbors or utility workers.
- The generator must be properly grounded. If the generator is not grounded, you run the risk of electrocution. We strongly recommend that you check and adhere to all applicable federal, state and local regulations relating to grounding.
- Allow at least five feet of clearance on all sides of the generator when operating.
- Inspect the generator regularly and contact the nearest authorized dealer for parts needing repair or replacement.
- Do not overload the generator. Do not operate more appliances and equipment than the output rating of the generator. A portable electric generator should be used only when necessary, and only to power essential equipment.

All of your electrical wiring must be in regulation with the set local, state and federal guidelines. The electrical equipment and wiring is required to be approved by a licensed inspection agent. This individual will make sure that the wiring is up to code and that the generator will be used under safe operating conditions.

The stationary home generator must be rated with a sixty-hertz alternate current rating that matches the service voltage.

The automatic transfer switch on your home generator must be approved by the OPPD. If it does not then that switch would be illegal to use.

The generator wiring and equipment must be properly arranged to prevent the interconnection between the generator line and the main utility line. It is recommended that the new owners of power generators should read and follow all of the safety instructions provided.

Last but not least, it is required by law that a stationary home generator is installed by a licensed electrical contractor.

These safety guidelines are designed to ensure your safety, your family's safety and the safety of your neighbors.

The Benefits of Owning a Home Generator

There are numerous benefits to owning home generators. If your family experiences a natural disaster in which the power service is interrupted your daily lives will not have to stop.

A stationary home generator can begin powering your home within thirty seconds. This means that you can use the computer, televisions, lights, refrigerator and other essential electrical appliances. Plus with a stationary home generator you do not even have to flip a switch because the generator is capable of handling all operations automatically. Once power is restored your stationary home generator will automatically shut itself off.

Now, if your family is always on the go, a portable generator might be your best option. A portable generator is capable of going anywhere you go. It can power necessary electrical appliances for a shorter period of time. This type of generator is perfect for farm work, camping, or for use anywhere you need electrical power. These models are affordable and efficient.

Whatever your needs are there is probably a generator made to suit them. Because of generators, electrical outages have become less of a hassle and more tolerable. Follow the proper instructions when having your generator installed and *unless you run out of fuel, or the generator breaks*, you or your family will never be without power ever again.

Helpful Resources

Home Generators	http://www.generatorguide.net/generators-for-home-use.html
Buying a Generator - Considerations	http://www.generatorjoe.net/html/stepxstepGenerator.html
Generators for Homes	http://generatorsforhomeuse.net/
Generator Sizes and Types for Home or Business	http://www.generatorjoe.net/html/homeowners.html
Which Generator Do I Buy?	http://www.tooled-up.com/artwork/ProdPDF/SDMOWhichGenerator.pdf
Energy Usage Estimation (Find out what devices use what energy)	http://weebly-file/2/2/5/0/22509786/energy_usage_estimations_new_site.pdf
Generator Load Charts	http://www.usa-generator.com/info/load_cht1.htm
Calculate Your Wattage Needs	http://gasgeneratorshome.com/89/
Generator Sizing Guide	http://www.generatorjoe.net/html/generatorsizing.html
Starting Load Examples	http://www.generatorjoe.net/html/startingload.html
Wattage Needs Worksheet	http://gasgeneratorshome.com/wp-content/uploads/Wattage_Worksheet.pdf
Wattage Needs Worksheet	http://www.amazon.com/gp/redirect.html/ref=amb_link_85346771_49/190-4647518-7532852?location=http://g-ecx.images-amazon.com/images/G/01/th/Wattage_Worksheet.pdf&token=957BBB0669152D76BE1C614537975585163C1748&pf_rd_m=ATVPDKIKX0DER&pf_rd_s=center-3&pf_rd_r=0C0ZC0WFHX7TMY25BQ7F&pf_rd_t=1401&pf_rd_p=503141091&pf_rd_i=1000422531
Power Requirement Charting	http://www.dieselserviceandsupply.com/Power_Consumption_Chart.aspx
Common Appliances Usage	http://www.romitti.com/pages/checklist_step03.html
Online Generator Sizing	https://www.ch.cutler-hammer.com/generatorCalc/wattshow.jsp
Generator Sizing Worksheet	http://www.findgenerators.net/Generator-Sizing-Worksheet-Generators-How-To-Site.html
Home Generator Sizing	http://www.aboutgenerators.com/home-generator-sizing.html
Generator sizing worksheet	http://www.docstoc.com/docs/24602121/Generator-Wattage-Worksheet
Online Ampere - Watt Conversion	http://www.dieselserviceandsupply.com/Power_Calculator.aspx

(Amps x Volts = Watts)	
Fuels & Fuel Storage, The Short & Long of It	http://weebly-file/2/2/5/0/22509786/fuels_and_fuel_storage_the_short_and_long_of_it_new_site.pdf
Emergency Lighting and Heating – Non-electric	http://weebly-file/2/2/5/0/22509786/emergency_lighting_and_heating_etc._resources_new_site.pdf
Step-By-Step Guide To Build Your Own Perpetual Motion Generator	http://www.buildgreenenergy.info/build-a-generator.php
Generator Sizing Eaton white paper (GeneratorSizing_WP)	Modernsurvivalonline.COM
Generator Sizing Guide (0172610SBY)	Mygenerac.COM
Generator Sizing Guide (TD00405018E)	Eaton.COM
Generator Sizing Pitfalls (generac_newsletter_low)	Generac.COM
Sizing Our Generators - Determining What Size We Need	Eslpk.COM

Glossary of Terms

Air Filter	Filters the intake air to remove any contaminants before it enters the engine.
Alternating Current (AC)	Refers to the form in which electricity is delivered to your home. AC is voltage that increases to a maximum positive ( ) and falls back to zero and then continues to a maximum negative (-) and back to zero. This cycle is repeated 60 times for 60 hertz AC power.
Amp	A measure of electric current flow. One ampere (amp) will flow when one volt is applied across a resistance of one ohm.
Amperage	The strength of an electric current, measured in amperes.
Battery Charging Circuit Fuse	Protects the engine-mounted battery charging circuit against damage from electrical faults.
C.S.A.	Canadian Standards Association. Products that have this marking have been manufactured, tested and inspected to standards that are set by C.S.A.
Cast Iron Sleeve	A cylinder cast into the engine to extend its life by producing a harder surface between the aluminum engine block and steel piston rings.
Circuit Breaker	A thermal switch that turns off if too much current is passing through it. All receptacles on generators are circuit-breaker protected.
Continuous Load	The wattage load the generator is capable of maintaining for an extended time, assuming that the engine has been maintained.
Cranking Battery	Supplies power to start engine and keep control panel active.
Cranking Battery Charger	Cranking battery at proper level during periods of inactivity to ensure reliable, consistent starting.
Direct Current (DC)	An electric current flowing in one direction only, such as from a battery to an appliance.
Duplex Receptacle	Two 120-volt receptacles tied together, similar to the outlets you have in your house.

Electronic ignition	A solid-state ignition system with no moving parts, ensuring reliable timing or firing to the spark plug.
Endbell	The end cap of the generator section. It houses the brushes, rotor bearing and, in some cases, receptacles.
Frequency	The number of vibrations or cycles per unit of time. More specifically, the numbers of cycles per second of an alternating current. See hertz.
Fuel Regulator/Lockoff Solenoids	Controls fuel flow to home standby engine.
Full Power	Denotes that the rated power of the generator can be drawn from a particular branch circuit.
Full Pressure Lubrication	A feature found on premium engines, utilizing an oil pump and filter to supply oil directly to the internal components of the engine, increasing the engine's life.
Generator	A general name for a device for converting mechanical energy into electrical energy. The electrical energy may be direct current (DC) or alternating current (AC). An AC generator may be called an alternator.
GFCI - Ground fault circuit interrupter	An electrical device designed to prevent severe or fatal electric shocks by monitoring current flow in a circuit, to sense any loss of current. If the current flowing through the circuit differs by a small amount from that returning, the GFCI quickly switches off power to that circuit.
Ground	A connection, either intentional or accidental, between an electric circuit and the earth or some conducting body serving in place of the earth. In power circuits, a ground is done intentionally to protect people from the effects of faulty insulation on electrically powered equipment.
Hertz	A unit representing one cycle per second.
Hour Meter	Tracks the hours of actual operations on a home standby generator.
Idle Control	A device that reduces engine speed when a generator set is not being operated under load. An idler conserves fuel, reduces the noise and saves wear and tear on the engine.
kVA (kilo Volt Ampres) kVA = Volts x A	kVA is known as "apparent" power. This is because only a portion of the available kVA may be available to do real work. The remainder is simply excess current. The analogy between kW and KVA is best expressed with a glass of beer where the kW can be thought of as the beer and the KVA as the foam.
kW (kilo Watts) kW= Volts x Amps x Power Factor or [kVA x Power Factor]	kW is called actual or real power, or simply the amount of power that is available to do real work. The analogy between kW and KVA is best expressed with a glass of beer where the kW can be thought of as the beer and the KVA as the foam.
Lamp Test Switch	Checks for function of all indicator lights on the control panel.
Low Oil Shutdown	A connection feature designed to shut off the engine if it runs low on oil, preventing serious damage or failure.
Main Line Circuit Breaker	Protects your generator and connected loads from electrical faults. Used to isolate output power from operating generator.
Mode Switch	A Used to set the operating state of the generator.
Ohm	Unit of electrical resistance. One volt will cause a current on one

	ampere to flow through a resistance of one ohm.
Ohm's Law	States that the intensity (amperage) of an electrical current is directly proportional to the electromotive force (voltage) and inversely proportional to the resistance (ohms). (Amps = Volts/Ohms) or (1 = E/R). Also displayed as Watts = volts x amps.
OHV	Overhead valve. An engine design with the valves placed above the piston in the head, instead of to the side of the piston in the engine block.
Oil Drain Valve	Quick-turn ball valve with extended drain hose to speed up maintenance and eliminate mess.
Oil Fill Plug	Overhead Covers opening where you can add fresh engine oil as required.
Oil Level Dipstick	Dipstick for checking for proper engine lubricating oil level.
Phase	The number of complete voltage and/or current sine waves generated per 360 electrical degrees. Each phase requires a complete set of windings.
Rated Power	The net electric output a generator can provide continuously when functioning as designed.
Rotor	The rotating element of a motor or generator.
RPM	Revolutions per minute. A unit of measure of engine speed.
Service Access Panels	Provides access to areas where service is required on home standby units.
Short Circuit	An unintentional electrical contact between the current-carrying outputs resulting in the passage of current through an undesirable path.
Single Phase	A single-phase alternating current system has a single voltage in which voltage reversals occur at the same time and are of the same alternating polarity through the system.
Spark Arrester	A screen that covers the outlet of the muffler to stop sparks from exiting. Spark arresters are required for use in national parks and the State of California.
Spin on Oil Filter	Replaceable, disposable filter to remove contaminants from engine oil to prolong engine life.
Start-up Power/ Surge Power	The load, in excess of rated load, that the generator set is capable of delivering for a specified period of time. It should be recognized that the voltage frequency and operating temperatures might differ from normal rated values.
Stator	The stationary part of a generator or motor.
Surge Power/Start-up Power	The load, in excess of rated load, that the generator set is capable of delivering for a specified period of time. It should be recognized that the voltage frequency and operating temperatures might differ from normal rated values.
Three Phase	Three complete, separate sine waves spaced 120 electrical degrees apart.
Transfer Switch	A device which will switch a load from the main utility power source to a standby power source.
Twistlock	A receptacle or plug that has a mechanism for locking it in place to prevent accidental removal.

U.L.	Underwriters Laboratory. Indicates that the products that have this marking have been manufactured, tested, and inspected to standards that are set by U.L.
Universal Motor	An electrical motor which can be used on either AC or DC supply.
Utility Line	The wire provided and owned by a utility company which can carry a power supply.
Vibration Isolators	Rubber pads mounted between the engine/stator and the frame of the generator. They are designed to minimize the vibrations produced by the engine.
Volt	The unit of electromotive force. That electromotive force which, when steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.
Voltage	Electrical potential or potential difference expressed in volts.
Watt	Unit of electric power. In direct current, watts = volts x amperes. In alternating current, watt = effective amps x power factor x a constant dependent on the number of phases (1,000 watts = 1 kilowatt).
Winding	All the coils of a generator. Stator winding consists of a number of stator coils and their interconnections. Rotor windings consist of all winding and connections of the rotor poles.