

Emergency Power Options

By Steve Maxwell

A good electric generator makes your home blackout proof. It's relatively inexpensive insurance against complete loss of household power. Plus, portable units are convenient when you need electricity beyond the reach of an extension cord.

All generators combine an internal combustion engine with electrical components to create electricity for powering appliances and tools. Choosing a generator involves several key decisions. How much power do you really need? How often do you expect to use it? Will it be for emergency household backup? For tools? Both? What level of quality makes sense? What kind of fuel? How will you get the power from the generator to items in your home?

More Power to You

The first thing to consider is generator output. What size is right for your situation? This sounds simpler than it really is because not all items on your wish list are going to be used all the time or at the same time. Also, some appliances (such as furnace fans, sump pumps, washing machines and refrigerators) require more start-up power than their specified ratings.

Generator output is measured in watts, a unit of power derived by multiplying electrical flow rate (amps) by electrical pressure (volts). One typical household outlet, for example, delivers a maximum of 1,800 watts (15 amps x 120 volts), or the equivalent of a small portable generator. Many people buy a small generator but regret it later because they didn't understand the basic issues. I'm one of those people.

The generator I've used for the last 20 years has a maximum rated output of 3,500 watts. That seemed like enough when I bought it, but it's proven barely adequate for emergency backup. By the time the submersible well pump kicks in (1,500 watts at start-up), the basement freezer is running (800 watts) and a few lights are on (100 watts for several compact fluorescents), there's not much power left for other things. If we want to use the microwave or toaster oven, we have to make sure that most other items are switched off. For sample wattage data for common appliances, see [How Much is Enough?](#) (Guardian has an online calculator to estimate the size of generator that's best for you).

There's also the issue of sustained output. When a manufacturer rates generator output, it usually refers to a maximum, short-term level only. In practice, most generators can sustain only 80 percent of their maximum rating for the long haul. If you continuously demand more than this, you'll shorten the life of your investment. Unless stated otherwise, always consider advertised generator output as overly optimistic and apply the 80 percent rule.

Because of the reasons listed above, I'm planning to upgrade to at least a 5,000-watt gasoline generator. Unless you have particularly frugal power requirements, you'll find this to be a good basic size. But there's still more to know before you buy.

Watt's Up with Start-up?

Any appliance with a motor — a refrigerator, circular saw, drill, water pump or furnace blower — creates what's called an "inductive" electrical load. This means energy demand skyrockets for the first second or two

after start-up. *You should allow two or three times as many watts for start-up compared to watts required while running.* Heating elements (in stoves, toasters or space heaters), lights and small motors don't draw significantly more current on start-up. In cases where no wattage consumption figure is stamped on an item, use the "volts x amps = watts" formula. You'll almost certainly find volt and amp numbers stamped somewhere on an appliance.

As you do the math, you may discover that you want more than 5,000 watts of backup power. If that's the case, you should consider a stationary generator wired directly into your home's electrical system. These units are covered by weatherproof shrouds and are ready to kick in either manually or automatically whenever the power goes off. Stationary units cost more than portables, but they deliver more power. Prices for units large enough to run multiple appliances and lights during a blackout range from about \$3,000 to more than \$10,000.

A Dirty Little Secret

The quality of power is important, too. Most generators create a specific frequency of alternating current (AC) by precisely governing motor speed — or at least they try to. But in reality, governor engine control is mechanical and pretty crude, especially on cheaper generators. That's one reason generators typically produce such dirty (irregular) and potentially damaging AC power, filled with lots of high-voltage spikes (see "Pure Power" below). But the latest generation of "clean power" generators, often called inverters, takes a different approach.

These generators have a fuel economy feature that tailors engine output speed to electrical load demanded. Traditional generators run full blast, regardless of how much power you need. The engines on today's best generators run only as fast as needed to create the power required. Switch on a light bulb, for instance, and the motor speeds up slightly from an idle. Plug in a 1,500-watt hot plate, and motor speed increases further to meet the electrical demand. It's a smooth, quiet and economical system that's easier on the environment. It also significantly reduces noise output.

At the other end of the spectrum are less expensive generators with basic engines, no-frills electronics and less than optimal mufflers. These are worth consideration if you'll only be powering large, simple electrical items such as cooking appliances, water pumps or basic power tools.

So how do you tell the difference between premium-quality and economy generators? Engine design is one way. The most durable generator engines have overhead valves and commercial-duty chrome or cast-iron cylinder sleeves. Economy models have side valves and aluminum cylinders.

Prices reflect quality, too. Top of the line generators cost about two or three times as much as economy models for a given wattage output.

The Right Fuel

Regardless of the amount and quality of power you need, there's also the question of fuel type. Most portable generators run on gasoline, but there are advantages to propane- and diesel-fueled models, too.

Propane (also called liquefied petroleum gas or LPG) is more expensive than other fuel options when you buy it in small tanks like those used with an outdoor grill. But it's also more chemically stable than gasoline or diesel. Ordinary gasoline becomes significantly less flammable after several months of storage as key chemicals break down or evaporate. Diesel fuel also is susceptible to degradation by algae growth. You can expect two years of reliable shelf life by adding a conditioner to gas or diesel fuel, but LPG never goes stale, so an LPG system is

worth considering if your generator will be used for emergency backup only. But, understand that what you gain in fuel stability, you lose in generator portability.

Diesel engines are traditionally found only on large, stationary generators, but that's starting to change. Smaller diesel systems in the 4,000-watt range are now appearing on the market. Diesel engines are harder to start and usually cost more than comparable gasoline motors, but they last longer, especially for continuous use.

Got a tractor? A whole range of PTO-powered (Power Take Off) generators are available, most for medium and large power output. These units aren't usually designed to put out the kind of clean (regular) power required by sensitive home electronics. Generator systems also can be installed onto engines in cars and trucks, either under the hood or attached to a PTO. It's not always a simple installation, but it does offer relatively large power output, quiet operation and portability.

Power Delivery

There are two ways to get power from your generator to the place where you need it. Extension cords are easy to use, but limited. You have to run them from outside to indoors, and even then you can only energize items that have a plug-in cord. Powering the blower on your furnace, a household water pump or permanently installed lighting is out of the question. But if you have a generator that puts out 3,500 watts or more, it's worth creating a connection directly to your household wiring so nearly everything requiring electricity in your home can be used (at least in theory). But there's a catch: To be safe and legal, any such direct connection must pass through a transfer switch. This safety device ensures that either your home is connected to the grid or to your generator, but never to both at the same time.

While installing a transfer switch is a hassle (it involves splicing into the main cables feeding your house), it's also a mandatory safety precaution to protect utility workers. If your generator happens to be feeding power into your home while your main breaker is still switched on, it'll also deliver unexpected, phantom power to the utility lines. Work crews might have switched off incoming power to your area to complete work safely, but power from your generator would be hitting them from behind. For more safety tips, see "4 Generator Safety Tips" below.

Most of us live just one blackout away from the Stone Age, but this fact is easy to forget until the lights go out. We've all seen how vulnerable the electrical grid is to major weather events and overloads, and that's the reason I like the security offered by a backup generator. Choose your equipment well, keep it in good shape, and it will provide peace of mind that you simply can't get in any other way.

Keeping Fuel Fresh

Gasoline and diesel fuel are both perishable commodities. They simply don't burn as well after several months of storage. So take precautions to be sure your generator will start and run reliably when an unexpected power outage occurs. There are two things to keep in mind: fuel preservation and fuel rotation.

Start by spending a few bucks on a gas or diesel fuel preservative. If you always add a measured amount of this liquid to stored fuel cans, your generator will fire up much more easily, even a year or two down the road. After adding a new batch of gas, run the engine long enough to draw the preserved gas into the carburetor.

Even with preservative added, get in the habit of rotating your fuel supply. I keep six 5-gallon cans full of stored gas at all times, though I make a point to use each can in my truck, tractor or lawn mower before the fuel is more than six months old. This way I always have relatively fresh gas on hand for the generator.

4 Generator Safety Tips

Generators offer great convenience during power outages, but if not used properly they are dangerous. Follow these guidelines for safe use:

- Store gasoline outside your home — away from living quarters and livestock barns.
 - Always use a generator outside, never indoors or in an attached garage.
 - Protect a generator from rain and snow while stored and during use.
 - Use heavy-duty, outdoor-rated extension cords sized to match the power load and the length of the cord.
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Oil Alert

Read the fine print in a generator owner's manual and you'll find that crankcase oil needs to be changed more often than you might guess. Details vary, but it's not uncommon for oil changes to be required after every 24 hours of continuous operation. It's easy to clock 12 to 18 hours of usage each day when you're living through an extended power outage. That's why you should keep fresh motor oil on hand. You'll need to change the oil every couple of days during a long-term outage.

Pure Power

Not all generator power is the same, and this is especially important if you plan to run electronics, entertainment equipment, battery chargers or computer hardware. Many generators aren't made to power items like these at all. Use the wrong generator and it will create "dirty" power that could fry your electronics.

When it comes to electrical power, there are two kinds. Alternating current (AC) is what comes out of wall sockets in your home. Direct current (DC) comes primarily from batteries. But there are varying shades of gray between ideal AC and DC power. Until recently, most so-called AC generators weren't producing anything like true AC at all. Instead of the smoothly flowing waves of rising and falling voltage required by sensitive items such as battery chargers, fax machines and computers, typical generators produce an erratic and jagged rendition of AC. And while this "dirty" AC power is OK for robust items such as fridges, hot plates and water pumps, it can destroy the sensitive electronics that most of us have come to rely on. You simply can't plug everything into an average generator and expect it to survive. At the moment there's no standard rating for the "cleanliness" of generator power. Just look for models that are specifically designed to run sensitive electronics and you'll be fine.