

# Don't discount a generator, especially a diesel generator, as your primary power source

By Skip Thomsen

There are three major reasons that wind, solar or hydro-electric systems are impractical for some folks: not enough wind, too many cloudy days, and no stream. In that order.

What does that leave them with? Using a generator. Ugh? Not necessarily.

An independent energy system that uses a generator as its primary power source can be efficient and cost-effective in its initial setup. The key is to make it part of a system instead of a sole source of power.

Most important in making it part of a system is full utilization of the generator's potential. A system that uses only a small portion of the generator's capabilities and stores little or no power for the times when the generator is off-line is a disaster.

## Managing and storing electricity are essential to success

There are two elements essential to the utilization of the generator's potential:

- managing generator loads
- storing electricity.

Managing your generator loads means that you operate the generator only when lots of power is required, as on the days of the week you do your laundry, vacuum the house, operate your shop, pump irrigation water, and/or other heavy use. Then while the generator is running anyway, it can also operate an industrial-strength battery charger. The charger will

charge the batteries that run the lighter loads of the house when the generator is not running.

There will, of course, be times when you will need to run the generator for a single purpose. The point is to develop a schedule of activities that makes it easy on everyone in the household to co-operate.

The ability to store electricity is what makes it all possible. Deep-cycle batteries are available in many forms and capabilities, with prices to match. The good old lead-acid batteries, like those used in golf carts and electric fork-lifts are still definitely worth considering because of their low price.

The most important factor in choosing your batteries is the total storage capacity. Your batteries must be able to handle the total load of your system between run-times of the generator.

When the generator is off-line, the low-voltage direct current (DC) supplied by the batteries is changed to regular 110 alternating current (AC) by an inverter. For this system to run at peak efficiency, there must be enough battery-storage capacity to run your house between the times you need the generator for heavy-duty use.

## Gas vs. diesel

For a permanent electrical system, the cardinal rule of generator shopping is do not even consider a gasoline-powered unit that runs at 3600 rpm . . . for several good reasons:

- Almost all of these machines are built for intermittent use only.
- Almost all of them will self-destruct when used for prolonged periods at even modest loads.
- Almost all are optimistically over-rated.

For example, we borrowed a popular-brand Japanese generator to use while our good old industrial machine was down for its first repair after years of service. Our old, industrial generator was rated at 3500 watts and would easily start any power tool in the shop even when the air-compressor was running. The borrowed unit, resplendent in chrome razzle-dazzle and complete with automotive-style operating panel (even an ignition key!) was rated at 5500 watts—but it would not even start the compressor. It just huffed and puffed, lugged down, and popped its circuit-breaker.

The generator part of hardware-store gensets (generator sets) is the absolute minimum quality that the manufacturer can get by with and still rationalize the advertised output. Neither the voltage nor the frequency is stabilized very well.

Another reason to avoid the gas-powered generators for permanent installation is noise. A 3600 RPM (revolutions-per-minute) gasoline generator, running under load, is incredibly noisy. Someone once asked me if I had ever heard a certain new imported generator run. He said that the dealer fired one up inside the showroom and it fairly whispered. But the dealer did not plug anything into the generator to bring it up to its normal operating speed.

Buyer beware. Many of the bigger (and recently, not so big) high-speed gas generators have an idle feature which allows the engine to slow way down when there is no load on the generator. But the instant the generator senses a load, the machine comes up to its full-scream speed.

These machines do have a useful application. A gas-powered portable generator with an idle-down feature is a great tool for temporary use on a jobsite, or anywhere else power tools are used in an frequent-but-intermittent manner. You can just leave the generator quietly idling along, and it will instantly come up to speed whenever a tool is switched on.

If it seems wasteful to leave it running when not in use, weigh the convenience of not having to restart it each time a tool is needed. Also, particularly in cold weather, it is easier on an engine to let it idle between run-times than to make it go through the continual temperature excursions that accompany start-and-stop operation. But remember that these machines are neither intended for nor suited to continued operation at full output.

## Good generators . . .

Some of the best industrial-quality (1800 RPM) gasoline-powered generators available have the bonus of also being electric welders. A good-quality arc welder can be a real asset on the homestead. Even if you don't know the first thing about welding, having the machine available makes it easy for someone who does know how to use it to do any repairs that require welding.

Check your yellow pages for a welding-supplies dealer who handles Miller products and ask to see the lineup of welder-generators. They come in various outputs and all have excellent engines designed for continuous operation at full-rated output. These machines run at 1800 RPM in

"generator" mode and at 3600 RPM in "welder" mode.

We ran our home, office, and shop business with a Miller welder/generator for years. Its engine just loafed along, producing its full-rated power.

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There are other manufacturers of combination welder-generators, too. Be careful in your selection to find a machine that runs at 1800 RPM in generator mode. Many run at 3600 RPM all the time.

There are other gasoline-powered, 1800-RPM, industrial-quality just-plain-generators available, and they will usually be powered by Onan, Kohler, Wisconsin Robin, or possibly Briggs & Stratton "I/C" Series engines. Onan makes an excellent 4.5 kilowatt unit designed for mobile applications, like utility vehicles and motorhomes. It is well suited to permanent installation, and sells for about \$2600.

## . . . and better diesels

The most efficient and maintenance-free engines of all are diesels. Diesels have no ignition systems, carburetors, nor spark plugs. They burn lots less fuel per horsepower/hour than do gasoline engines, and their exhaust is devoid of many of the toxic emissions of gas engines.

Diesels are simple in design and extremely durable. With few exceptions, properly serviced diesel engines will run for years and years before needing an overhaul.

But there's always a catch. The catch is that diesel-powered generators in the small sizes required by the average homestead are expensive. Onan has recently introduced several versions of small diesel generators. They come in sizes from 4.5 KW on up, and are powered by Onan or Kubota engines, depending on the model. They all run at a leisurely 1800 RPM.

The Onan diesel engine is air-cooled and somewhat noisy. The Kubota 3-cylinder engine is liquid-cooled and for a diesel, amazingly quiet. Both engines have excellent service reputations. The sizes up to 7.5 KW are most useful in homestead applications, and the prices range from about \$6000 to \$7000. Ouch, right?

Our local generator dealer says that he doesn't even stock diesel generators any more, because people are so blown away by the prices that they run to their nearest discount store to drop \$2000 or more for a garden-variety, light-duty, 3600 RPM gasoline-powered generator of the self-destruct persuasion.

## Why pay the extra dough?

So what do you get for all that extra money?

An industrial-quality diesel generator will dependably and quietly putt-putt along for many years, producing its full-rated power. It will produce clean, stable power, the kind that won't destroy your computer, audio components, VCR, or other frequency-sensitive equipment. It's the kind of power that's suitable for a home, office, and shop.

It will produce that power on about half the amount of fuel that would be required for a same-size gas generator. And since you won't be paying road tax on the fuel, diesel will cost you less than gasoline.

A diesel generator will give you an amazing amount of peace-of-mind,

too. It's no fun to listen to a screaming gas generator and wonder when it's going to come apart.

What a diesel generator won't do is to keep you busy with tune-ups, repairs, and trips to your nearest warranty station.

The 8 KW and larger generators driven by small diesel engines made in China (such as the CDI units) are another alternative. The engines operating these machines burn only about 1/2 pint of fuel per horsepower/hour. It is not uncommon for these little engines to run for 50,000 hours before needing any major attention. That translates to 8 hours a day for 17 years! The 8 KW machines sell for around \$2500, no more than for a same-size gas generator. (See *BHM* back issues #5, 6, and 12 for more on these generators.)

## A used generator?

How about a used unit? If you happen to come across a good, used, military-surplus or other industrial-type machine (diesel or gas), and you are not intimate with the electrical workings of generators, have someone knowledgeable check it over for you. Older generators will often have very complex and possibly malfunctioning voltage-regulating hardware that can cost more to straighten out than the machine is worth. And remember, don't buy a generator that is capable of producing way more power than you need.

In the long haul, a diesel wins every time. When you figure in the fuel savings and replacement costs for the several gas engines that it would take to equal the life of a diesel, the higher price of the diesel generator becomes insignificant. Remember, this is your home. Dependability is what it's all about.

## Neighborhood power

An application of a larger diesel generator is an installation which

would serve several neighbors. Each neighbor's house would have its own battery bank and inverter. The generator would come on-line for a predetermined duration each day, supplying each home with large amounts of power and charging the batteries to carry the load for the balance of the day. The cost of the machine and the maintenance chores would be shared by the neighbors. This kind of arrangement must be put together very carefully, and a provision must be made for the eventual possibility of one or more neighbors either selling their home or wishing to pull out of the agreement.

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**Diesel engines outlast gasoline engines by a wide margin, burn considerably less fuel, and require no maintenance other than regular oil and filter changes.**

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## Keep it running forever

Maintenance for a diesel is pretty much limited to regular oil changes. If the engine is cleaned of the inevitable oily film on a regular basis (like at every other oil change), any leaks or other irregularities are easily spotted. Regular, timely oil changes (according to the manufacturer's recommendations) are essential, as is the use of oil rated for diesels. Diesels operate at a much higher combustion pressure than do gas engines, and regular motor oil won't stand up to the job. Lots of discount stores offer motor oil by the case for really good prices. Just look for one that's diesel rated.

In contrast, to keep a gas engine running in top form, maintenance includes not only oil changes, but periodic replacement of air-cleaner

elements, spark-plugs, ignition points, rotors, distributor caps and plug wires, electronic ignition modules in machines so equipped, occasional carburetor adjustments and overhauls, and general tune-ups. Add all that up to the short life-span and the double-or-more fuel consumption of gas engines, and the good old, dependable diesel really begins to shine.

So why don't we all use diesel engines? They cost more initially. Diesel engines are always priced considerably higher than similar-horsepower gas engines, and that price is of course reflected in the price of a diesel-powered genset. The bottom line? If you are building a permanent power system for your home and if a generator is going to be the prime power source, go for the diesel if you can afford the initial outlay.

There are some considerations that are particularly important when operating diesel generators. It is important with any engine, but especially so with a diesel, to avoid starting the generator just to run a tool for a few minutes and then shut it down.

Ideally, the engine should never be started unless it will be allowed to operate long enough to bring it to its full, normal operating temperature. Similarly, it should never be shut down right after producing a large amount of power. Let the engine run at a low (or no) load for at least a few minutes before shutting it down. Rapid and/or frequent temperature swings dramatically shorten the life of any internal-combustion engine, particularly a diesel.

Your fuel tank should be big enough to hold at least a six-month supply of diesel. Two reasons:

If you buy fuel in large quantities, you can usually get it delivered and there will be no road tax applicable, and the tax is a significant portion of the fuel price.

Second, your fuel is easier to manage with a large tank. Running your engine out of fuel can mean disassem-

bling the entire fuel-delivery system to bleed it of any air. It's just a lot easier to avoid the problem in the first place.

If you live in a very cold climate (below freezing), manage your fuel to be able to use winter-grade fuel when the temperature drops. Summer-grade diesel will begin to gel when it gets down below freezing. When the fuel gels, the flow stops.

As with all mechanical equipment, follow the manufacturer's service recommendations. The importance of timely oil changes cannot be over-stressed. You can save money on oil, but not by buying Brand-X. Buy your major-name-brand product of the proper viscosity (it will say it's diesel-rated on the label) in case lots when it comes on sale.

Never operate your generator without a properly installed and serviced air cleaner. It doesn't take much abrasive dust to dramatically shorten the life of an engine.

Install your generator in a clean, well-ventilated shed, out of the weather and out of the paths of dust and moisture. The shed needs to be able to contain the engine's noise, and placed in such a way that your neighbors can't hear it at all. (See *BHM* #8 for an article on how to build a sound-proof generator shed.)

Be sure that your generator has come up to full speed before applying any load. Starting a generator with an electrical load on it is hard on both the generator and the equipment plugged into it. Remember to allow it to run at no load for a few minutes before shutting it down, especially after it has been working hard.

With intelligent and conservative use, a well-chosen and properly-maintained generator can become the heart of a dependable and cost-effective alternative energy system.

## In summary

Stay away from "consumer" generators, regardless of buzz-words like "heavy-duty." The generators on most

of the 3600 RPM machines available through hardware outlets and discount stores are fine for their intended uses: occasional power tools, pumps, and emergencies. Most will fail quickly if subjected to sustained operation at anywhere near their maximum output, let alone their optimistically-rated output. The engines on these machines are well-suited to their intended use, which is occasional light-duty operation.

Almost any generator designed to operate at 1800 RPM is also designed to run quietly and dependably for years while producing its rated output. Commercial/industrial equipment is the best way to go. If you live on a homestead or farm and for some reason do not want to install a diesel generator, do consider the welder/generator combination. Again, be careful. There are welder/generators on the market that run at 3600 RPM. And though they are designed for industrial use, they will not last as long as their slower-running cousins. They are also noisier. And you will have to endure the excessive noise for the duration of its service life, even if that is shorter than you'd hoped.

Diesel engines outlast gasoline engines by a wide margin, burn considerably less fuel, and require no maintenance other than regular oil and filter changes.

A generator used as either a sole source of power or as a backup for other sources does not need to be an environmental problem. The generator should be operated in a controlled and orderly fashion, and only when required for high-load applications. Surplus power should be diverted into storage batteries for use when the generator is not on-line. A system like this can supply a home with dependable, uninterrupted 110-volt power 24 hours a day even if the generator is not started for several days at a time.

(Skip Thomsen and his wife, Cat Freshwater, powered their homestead for 10 years with an efficient generator-based electrical system. Skip's book describing this system, More Power To You is available

through *BHM*. This article was partially excerpted from their new book, A Modern Homestead Manual, which will be out this summer.) Δ