

The China Diesel...

The case for a generator-based electrical system

By Skip Thomsen

Way back in 1977, we bought a beautiful 108 acres of forest in north-central Oregon. There were no buildings on the property; we were going to start from scratch. In 1979, we packed up everything we owned and moved there. We spent the year before our move making plans, gathering information and supplies. Since we were determined to produce our own electrical power, we paid a lot of attention to how other folks were dealing with their lack of “store bought” electricity. Most of them handled it in a way which was, to us, curious. They often relied on smelly, dangerous kerosene lamps for most of their lighting. Of all of the people we visited, and of all of those who would eventually be our neighbors, nobody had what we considered an acceptable alternative electrical system.

Amid the growing movement toward the exclusive use of renewable energy resources, it might seem out of place to consider the use of an internal-combustion engine to drive a power system. But we feel that there is indeed a place in today’s alternative-energy scene for a generator-based system; especially where there is no wind, no running water, and clouds hide the sun for four months every winter.

We knew exactly what we wanted our system to do. Although we were going to be living in our owner-built home in the middle of the woods, sixteen miles from the nearest town, we were reluctant to give up what we considered life’s pleasures. These included a high quality, powerful music system, a washer and dryer, microwave and other small kitchen appliances, and an office which would

ultimately include two computers, two printers and a copier.

Near the house, we were also going to be building a shop in which we would earn our keep using all sorts of power-tools ranging from table saws and jointers to a commercial air compressor. It was the operation of this shop which we felt justified the use of this power system.

We knew in advance that a 3600-rpm portable generator would not do the job. None of them is designed for any kind of continuous-duty service, and even if they were, their noise level is completely unacceptable, their fuel consumption unbelievable, and their maintenance requirements are at best, a nuisance. We also knew that we would not be satisfied with having to trudge outside to start and stop a generator when ever we needed some power. Matter of fact, we knew that we wouldn’t be satisfied with having to start a generator every time we needed some power, even if we could do it with a wish!

Knowing what the electrical system had to be able to run made it possible to set its parameters.

It had to deliver at least six kilowatts of dependable 110 and 220-volt electricity during those times when the shop was in operation.

It had to be able to deliver at least 1200 watts of clean, stable 110-volt power 24 hours a day.

It had to be fully automatic and remote-controlled, so that it would never be necessary to leave the house or the shop to start or stop it.

It had to be quiet enough so that we could not hear it from the house.

It had to be nearly maintenance-free, and it had to do all of this for a maximum operating expense of \$25 per month.

We had an initial-outlay budget of \$5000. Piece of cake.

Well, we did it for \$1000 under budget. We designed and built the ideal

system for the family with a home business requiring the use of power tools. It dependably ran our place, home and shop, for about \$25 a month total cost for ten years without a blackout. During the winter storms, TV news programs informed us that the local rural electric service was down because of tree limbs that had fallen on ice-covered lines.

System basics

The basics of the system are simple: a generator, a bank of storage batteries, an inverter to change the stored power into usable 110-volt electricity, and a charger to keep the batteries charged.

So why is this particular system so special? After ten years of use, it had evolved into the ideal combination of components; a balance had been achieved which allowed each part of the system to work at its best potential.

The engine which drives this system is a diesel. Diesel engines are wonderful: they have no spark plugs, carburetor, or ignition systems; they never need tune-ups; they are unbelievably dependable; they produce their amazing amounts, of torque at very low rpm; they use less than half the amount of fuel per horsepower/hour as gas engines; diesel fuel doesn’t pollute the air with lead; and they last almost forever. They are also very expensive.

We called every supplier of commercial diesel-generator sets we could find, and were quoted prices from several thousand dollars for a “good used set” to figures that made us start thinking in terms of gas engines again. Then we saw an ad for diesel engines made in, of all places, China.

We did a lot of research on this equipment, including talking to several people who have run these amazing little engines for thousands of hours. One was a mechanic who had just torn down one with fifty-thousand hours

on it, and the bearing and cylinder walls were like new.

By the way, fifty-thousand hours figures out to eight hours a day, seven days a week, for seventeen years. And the engine comes with all of the parts and tools to do an overhaul.

Right after we phoned in our order, we started building our new sound-proof generator shed. We installed a 275-gallon fuel tank right next to it so the fuel could gravity-feed the engine. About a week later, the generator was installed and running.

Thermo-siphoning cooling system

Our cooling system consists of a fiftyfive gallon drum of anti-freeze/water mix, installed at the proper height to create a thermo-siphoning coolant circulation loop. This cooling system works well in any weather, but in cold weather it really has an advantage over a more conventional radiator-type system.

For normal cold weather, the thermo-siphoning cooling system works really well. While the engine is running, the hot coolant from the engine enters the top of the tank. As it cools, it drops to the bottom of the engine.

When the engine is shut down, the thermo-siphon effect comes to a stop, and eventually reverses. Now the warmer coolant at the top of the tank flows down through the engine and back into the tank to get re-warmed. The net effect of this is that after being shut down for 12-16 hours over a thirty-degree night, the engine will still be warm. It's a lot easier on the engine to start it warm than at thirty degrees.

Buried 55-gallon drum acts as muffler

The exhaust is routed through another fifty-five gallon drum buried in the ground behind the shed. The drum acts as a giant muffler, and the exhaust is barely audible.

The engine is indeed made in China. It is a fifty-year old design, and the very essence of simplicity. The only thing in a current engine which deviates from an original is the metallurgy,

and the design and materials of bearings and seals.

As supplied from China Diesel Imports in Jamul, California, the generator set comes with just the state-of-the-art alternator we were looking for, and is set up to produce 8000 watts. Since we didn't need that much power, we ordered ours with the correct drive pulley to produce 6000 watts.

Actually, when ordered for 6000 watt output, the machine comes with both pulleys, so you could change it back to the higher output at any time. Another benefit of the lower output is that the engine runs even more slowly than it does at the higher-output setting, thus saving fuel and wear.

Our batteries were 6-volt, 260-amp hour, golf cart batteries. We chose these because of their low initial cost and high output. Using deep-cycle batteries is essential. The 12-volt batteries used in RVs don't have the capacity to run a house, and 'better' batteries than the ones we are using are also very spendy.

In our case, four of these batteries (connected series- parallel, giving us 520 amp-hours of storage) worked quite well. At five hours running-time per gallon of diesel (which costs substantially less than gasoline when purchased for off-road use), we just started the generator in the morning on the way out to the shop, and turned it off in the late afternoon.

During an especially cold winter, (15 below zero) we let it run 24 hours a day. Thus we never had to start the poor thing when it was that cold, and we could also keep electric heaters running in the tank house and other strategic places.

With the schedule of running the generator almost every day (easily justified by earning our living in the shop), low batteries were never a problem. It was on this schedule that we computed our cost-of-operation at \$25/month, including all operating costs, not just fuel. A family not operating a power-hungry home business could get by on a lot less.

Our inverter is a Heart Interface 1200-watt unit with a built-in battery

charger. Since we originally bought our inverter, several other brands notably Trace and Heliotrope have come on the market and are reported to be better performers.

Any of these inverters works like this: when the generator is running, the inverter operates as a high-powered, fully-automatic, battery charger. It delivers the right amount of charge depending on the condition of the batteries. Once they reach a fully-charged state, it switches to a maintenance charge state. The instant that the inverter senses that the generator has turned off, it switches itself into inverter mode and keeps an uninterrupted supply of 110-volt power going to the house. The next time the generator comes on line, the clever inverter jumps back into charger mode and at the same time shunts the generator's 110 directly into the house.

These inverters are nothing like the small units sold for use in RVs. The small inverters are notoriously inefficient. The Heart is not. It draws a tiny seven-tenths of a watt at idle, so it can be left "on fine" 24 hours a day. It runs the TV, VCR, stereo system, microwave, vacuum cleaner, sewing machine, two computers, and the rest of the office. It IS necessary to pay attention to the total load, however. The inverter is rated at 1200 watts, so everything in the house cannot be turned on at the same time when the generator is not running. The only thing in our house which uses enough power to have to watch is the microwave.

Leaving an inverter on-line 24 hours a day may seem extravagant, but it really isn't. Over a 24-hour period, the inverter at standby consumes less power than does a 20-watt light bulb in an hour. Leaving it on full time means that we can enjoy such luxuries as off-the-shelf plug-in clock radios, a microwave with clock and timer, a VCR to record movies automatically when we are not home, and the convenience of operating anything in the house at any time we wish. We have never paid much attention to "phantom loads."

We do not consider our level of electricity-use a luxury. In the long run, we didn't spend any more on our system than many of our neighbors have spent on their perpetual trial and-error systems, most of which are still pretty primitive. This system is not hi-tech, but neither is it primitive. It is simple, basic, extremely dependable, low maintenance, and it does everything we want it to.

Remote starting

The generator can be started by remote control from either the house or the shop. and we installed an intercom between each remote panel and the generator shed so that we could hear the engine during start-up. There are also special circuits to insure that

no on-line equipment will ever be subjected to the damaging low-voltage output of the generator coming up to speed or spooling down to a stop. Our air compressor is Varied in such a way to insure that it will never be on line when the generator starts up.

We have had people suggest that we add solar panels so that we wouldn't have to run the generator so much. Any affordable photovoltaic installation would not be able to supply the amount of electricity we require. Our system does, and it's relatively inexpensive.

(Skip Thomsen can be reached by writing 406 Pine- Ave., POB 514B, Manzanita, OR 97130. In the next issue, he'll write an article on how to service and trouble shoot the China Diesel generator.) Δ



Book Review

By Dave Duffy

More Power to You, by Skip Thomsen. Order direct from him at 406 Pine Ave., POB 514B, Manzanita, OR 97130, spiral bound, 8.5" x 11" format, \$8.95, plus \$2 S&H, 84 pages. Includes some photos and lots of diagrams and illustrations, plus a resource guide.

More Power to You is about a home power system based on the efficient China Diesel generator. (See article, page 42) We're talking about a system that produces lots of power 24 hours a day without having to run the generator full time.

The total system cost is about \$4,000, with total monthly operational costs of \$25.

The book gives a step-by-step explanation of system components and how they interrelate, shows you how to tailor the system to your power needs and tells you how to construct a sound proof generator shed and an underground muffler system.

It explains how to install each component of your electrical system for optimum performance and ease of maintenance. The electrical section covers all aspects of connecting the generator to your house and/or shop, as well as complete details on installing a multi-station remote-control.

Also covered are diagrams and explanations for several power-management circuits. These include a special circuit to isolate your equipment from the destructive low voltages produced by a generator coming up to speed or spooling down to a stop, a circuit which automatically makes sure that your generator will never have to start under any kind of a load, and others.

It includes a chapter on maintenance, complete with trouble-shooting guide; and the Resource Guide tells you where to find every component necessary to build your system.

This is a good book. It's easy to read, full of sound information. You don't have to be an electrical engineer to understand it. At \$8.95 it's a bargain. Δ