Portable Power

One couple's solution to onboard power generation

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Once away from the dock and disconnected from shore, our power is limited to what we can produce. Our 40' powerboat has no generator, so we must either cope with the noise and expense of generating power with our boat's engines, or make do with less. Quiet and cost-effective options include wind and solar power. But we investigated another option: portable power.

THE POWER PROBLEM Few boaters want to run a generator 24 hours a day. Even fewer want to be near those that choose this option. Instead, an increasingly common approach is to install an inverter and large house battery bank that charges while the boat is underway. This is a wonderfully silent solution at anchor. You have power on demand without the noise, expense and maintenance headache of a generator. All that's needed is an inverter that can support the power draw and a battery bank sufficient to supply both the inverter and the 12-volt power consumption.

Sizing an inverter to meet your budget and the load requirements of your boat is neither difficult nor particularly expensive. Even high-output inverters are becoming fairly affordable. The important requirement is that the inverter capacity exceeds the wattage sum of all devices that must run at the same time. Common inverter choices range from 2,000 to 3,000 watts. The final choice might preclude running certain devices at the same time, such as a microwave and a hair dryer. For most, this isn't much of a hardship.

While choosing an inverter isn't difficult, installing a house battery bank sufficient to allow a day or even more between charges can be. Even relatively small amperage draws add up quickly over time. For example, a pair of six-volt golf cart batteries have a combined capacity (at 12 volts) of 225 amp hours. A modest current draw of 10 amps per hour will completely exhaust those two batteries in less than one day. A single 1,800-watt hair dryer with an inverter that is typically 86 percent efficient requires 174 amps. At this usage rate, two golf cart batteries would be exhausted in just over an hour. Clearly, the hair dryer isn't on all the time, but other devices are.

Power consumption, like the weight of a boat, just seems to keep going up. Most boaters who aren't using a generator full time eventually develop a "power problem." Fortunately, as we discovered, there are options.

POWER SOLUTIONS The first important option to remember is that no approach is as quiet and inexpensive as conservation. Many boaters find that simply installing an inverter gives an illusion of ample power and leads to greater use. Avoid unnecessary load. Although conservation is a good place to start, for most of us it's not the full solution.

The next approach to consider is a larger house battery bank. After power conservation, the best way to avoid the need for frequent charges is to install a larger house bank. This approach definitely has limits. Batteries are both big and

heavy. A golf cart battery is relatively small, yet weighs 28 kilograms. At the other end of the spectrum, 8D batteries can weigh more than 60 kg. The weight, cost and space requirements eventually limit the house battery bank size.

For those with permanently installed generators, the solution is simple: run the generator periodically when and where it won't disturb others. Many boats don't have space for a permanently installed generator, and the installation cost of even a moderately sized one can easily exceed $10,000. Besides, a permanently installed generator isn't always an option.

Only two reasonable choices remain: either run the boat's engine to charge the batteries or use an auxiliary power solution. Running the engine can be an expensive choice when all the maintenance costs are considered, and in our boat the engines are distractingly loud. Wind and solar power are possible auxiliary power solutions. But for our consumption levels, the number required would be a challenge in terms of aesthetic and cost. We instead opted for a portable power solution.

Control panels like this one are invaluable aids to monitoring battery charging and/or inverter draw, and much more.

PORTABLE POWER A new breed of quiet, lightweight, inexpensive generators are now broadly available as portable power. The units run on gasoline, can be carried with one arm and are comparable in noise to a permanently installed generator. The most common sizes are 1,000 and 2,000 watts. These typically range in price from $1,000 to $2,000, significantly below the installed cost of most built-in generators. Our recommendation for those with larger power requirements, and the choice we made, is to buy a larger unit. This shortens the necessary daily run time.

A CO detector is an important piece of safety equipment—even more so if using a portable generator.

We chose the Honda EU2000i as our portable power generator, but Yamaha and others make similar products. The Honda weighs only 21 kg and, compared to a normal conversation of 60 decibels, is rated to produce 59 dbA at full load and only 53 dbA at one quarter load. This is significantly quieter than our boat's main engines.

When selecting a generator, read the fine print on the specifications. While a 1,000-watt generator may sound like just the right answer, it likely can produce 1,000 watts only for very short periods of time. Most manufacturers promote the peak capability that is higher than the sustained or continuous output rating needed for charging a house battery bank. The Honda EU1000i, for example, can produce 900 watts continuously and the EU2000i can produce 1,600 watts continuously.

LIMITING THE DRAW The final challenge is delivering the power to the house battery bank. One obvious solution is to simply plug the shore power cable into the generator. On most boats, however, the combined load of the battery charger and the house electrical draw far exceeds the charging rate that the typical portable generator can provide. Rather than supplying power, the generator's overload circuit breaker will kick out almost immediately.

Power draw must be limited below the maximum continuous output of the generator. The two broad solutions to this problem are to limit draw via the

GENERATOR SIZING TIPS

SIZING A PORTABLE generation system means finding a delicate balance between cost, weight, daily charging time and overall power requirements. Larger generators reduce charging time but are expensive and heavy. Smaller generators avoid those flaws at the cost of longer daily generator run times. Also, the charging spectrum is limited both high and low. On the high side, a charge rate beyond one quarter of a flooded lead acid banks' total amp-hour capacity is bad for the batteries. Our bank has eight golf cart batteries with a total of 900 amp hours, so the charge rate shouldn't exceed 225 amps. On the low side, charging at or below the discharge rate will never charge the bank.

In balancing the trade-offs for our boat, we first inventoried our daily power consumption. A simple and accurate method is to monitor power consumption using either an inductive hand-held ammeter or an inverter monitor such as the Xantrex Link 2000. Note the maximum, minimum and average consumption rates. Our boat averages 12 to 14 amps per day at 12 volts. To be conservative, we used 14 amps as the steady state, continuous discharge rate.

At 14 amps/hour, we discharge 336 total amps over 24 hours. Our goal was to purchase the least expensive generator that could return that total 24-hour draw within four hours. 336 divided by four yields 84, so the generator would need to produce 84 amps/hour. Since most generators are sized in watts, we needed a generator that could produce 1,008 watts at 12 volts (watts = volts x amps.)

This seems like great news, but lead acid battery charge/discharge cycles are only 70 to 92 percent efficient. At 85-percent efficiency, we would need 1,185 watts. And our battery charger is only 85 percent efficient, so the required wattage increases to 1,395. This is well beyond the capacity of a 1,000-watt generator, but the 1,600-watt continuous Honda EU2000i would work fine. And we'd have headroom, so house load spikes during charging would not trigger the generator's overload protection.

Before purchasing a unit, we verified the math through a rent-to-own arrangement. The cost of the rental was deducted from the purchase price if we chose to buy. *–JH*

inverter or install a dedicated battery charger that draws less than the generator's continuous output.

Most inverters have built-in battery chargers, and many have an option designed to solve exactly the problem we face here: a feature to limit the total current draw. The Heart Interface inverter that we use calls this power sharing. This option provides a way to limit the power consumption of the charging component. As the house electrical load goes up, the inverter decreases the charging rate to keep the total draw below the set limit. We set the limit below our generator's continuous output rating and simply connect the generator directly to the boat shore power using a standard house power cable.

Not all inverters support this feature, nor do all boats have an inverter. The other option is to use a battery charger that draws less than the maximum continuous rated output of the generator. Wire the house battery bank to the battery charger, and run a power cord to the generator. This solution is not quite as elegant as just plugging the shore power outlet into the generator, but is just as safe and reliable. The important thing is that you choose some approach to limit the power draw from the generator. Otherwise, you'll constantly be popping the circuit breaker rather than charging the house battery bank.

As you shop for a portable generator, you'll notice that most advertise a 12-volt charging adapter, which, it would appear, can be directly attached to the battery bank to avoid having to use a separate battery charger. Here, too, you need to read the fine print. This adapter is meant to be used as an automotive trickle charger and is inadequate for deep-cycle battery charging. For example, the Honda EU2000i 12-volt adapter produces only 96 watts (8 amps). This isn't even enough to keep up with consumption on most boats, and certainly won't effectively charge a substantial house battery bank.

SAFETY Internal combustion engines produce carbon monoxide (CO) as a byproduct of combustion. All boats, whether gas or diesel powered, should have CO detectors. This is particularly true when using a portable gasoline generator. Ensure you have a CO detector and only use the generator outside where the fumes won't be drawn into the cabin. We run ours in the cockpit.

QUIET AND HAPPY We used to charge our batteries at anchor by running the main engines. Since moving to a portable power solution, we love the reduced noise and the decreased main engine maintenance. Also, the generator fuel burn is remarkably low. The 4.1-litre tank on ours will run the generator for four hours, enough to charge the house bank. The fuel burn is hardly noticeable.

If you are like most boaters, you consume enough electrical power while at anchor that some form of additional generation is required. Portable power is one battery-charging option that avoids the expense of a built-in generator and the noise and wear of running the main engine.