

# REPOWERING 101

Rebuild, replace or switch to diesel?  
The experts weigh in on dealing with aging gas engines.

► BY PETER A. ROBSON

**L**OVE YOUR BOAT, but wonder if that tired old gas engine is going to last another season? Maybe it's time to consider rebuilding it, replacing it or switching over to diesel power. Here are some tips from the experts to help weigh the options.

## Rebuilding

Dave Milner of Stem to Stern Marine in Vancouver has been rebuilding and replacing gas and diesel engines for 13 years. In his experience, most of his customers with tired old gas engines choose overhauling over replacing. "The import-

ant thing to remember when rebuilding," he said, "is to do it right. In addition to the engine overhaul, you need to go right through it. You need to get the carburetor, starter, alternator and probably the exhaust system redone. You can't do a half-assed job."

He estimates it costs about \$8,000 to properly do a complete overhaul on a standard 350-cubic inch, 200-horsepower V-8 engine. Milner noted it is important to budget for other expenses such as haul-out fees, forklift charges, core charges (if the engine block is no good), and the inevitable "unforeseen damage"—corrosion, stringer or transom rot or damage, wiring problems, control cables, and so on—things you can't really see until the engine comes out.

In the end, if the rebuild is going to cost more than about 40 percent of the cost of a new gas engine and drive package, rebuilding may not be the best option.

## Replacing with New Gas

While more expensive than rebuilding, installing any of the new generation of fuel-injected gas engines will result in instant fuel savings of 10–20 percent over carbureted engines. However, replacing an old carbureted engine with a new carbureted engine will provide only slightly better fuel efficiency.

Dave Muir of Mercury Marine in Vancouver explained the new generation of computer-controlled gas engines is also more powerful for the equivalent horsepower (which is now measured at the propeller shaft), easier to start and much cleaner

◀ **Left** Time to replace those tired old gas engines?



burning. Harmful exhaust gas emissions are also greatly reduced because all new gas engines produced in the U.S.—beginning in 2010—must be equipped with catalytic converters. He noted that today's gas engines, such as those produced by MerCruiser, also come with excellent monitoring systems and digital LCD readouts that not only provide basic engine data such as rpms and fuel consumption, but also tie into other ship systems to provide information on estimated range, water tank levels, bilge monitoring and so on.

Muir explained that when considering a new gas engine, customers should be prepared to replace the entire drive train—whether it's a stern drive package or regular inboard with shaft drive—and possibly the exhaust system. Many of the new engines are no longer compatible with existing stern drives and inboard transmissions. The good news is that most new engines are designed to fit onto the original engine stringers, though they won't likely bolt into the same holes. When pricing a new engine, remember that some engine packages come with a closed cooling system (for saltwater heat exchangers) as standard, and others are optional. It is also important to figure in the cost of extras such as new instrumentation and controls, and whether they come with the engine/drive package. Dave Milner said customers should add about \$2,500 to the cost for labour to remove the old engine and install the new one, assuming no major modifications to the stringers and/or exhaust/fuel/cooling systems are required.

### Repowering with Diesel

"The first things I ask a customer thinking of replacing his gas engines with diesels," said Milner, "are do you really love the boat, and do you plan on keeping it for a long time? The bottom line is to convert from gas to diesel is extremely expensive and I usually tell customers that if they really love their boat and are going to keep it, then it's worth doing. If they're just doing it to flip it or planning on selling it in the foreseeable future, it's not worth it because you'll never get your money back. You can buy a hell of a lot of gas for the cost of converting."

Some customers come to Milner with the idea of buying an older boat with gas engines and replacing them with diesels. "I usually tell them they're better off to go and look for the boat they want with the diesels already in it," says Milner. "I hate turning away work, but you've got to be realistic about it too." ▶

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Price \$25,935



\* Complete fuel-injected engine package with transom plate, stern drive, closed cooling kit and SmartCraft ready. Does not include controls, installation or associated systems modifications. Only engines produced in 2010 will be equipped with catalyst.

#### MerCruiser New Gas Inboard\*

300 hp MerCruiser 5.7 litre Horizon V-8

\$16,160

320 hp MerCruiser 6.2 litre Horizon V-8

\$18,334

\* Complete fuel-injected engine package with transom plate, stern drive, closed cooling kit and SmartCraft ready. Does not include controls, installation or associated systems modifications. Only engines produced in 2010 will be equipped with catalyst.

► Source: Dave Muir, Mercury Marine, Vancouver.

#### Yanmar New Diesel Stern Drive\*

220 hp Yanmar 6BY2 220 6-cylinder in line

\$35,859

260 hp Yanmar 6BY2 260 6-cylinder in line

\$38,853



\* Includes MerCruiser Bravo II drive, closed cooling and electronic controls/engine instruments

#### Yanmar New Diesel Inboard\*

220 hp Yanmar 6BY2 220 6-cylinder in line

\$27,208

260 hp Yanmar 6BY2 260 6-cylinder in line

\$30,207

\* Includes KMH transmission, closed cooling and electronic controls/engine instruments. ► Source: Paul Balestra, Land Sea Power

#### Volvo New Diesel Stern Drive

225 hp Volvo D4 225 4-cylinder in line

\$36,000

260 hp Volvo D4 260 4 cylinder in line

\$40,300

\* Complete package. Includes stern drive, closed cooling, props and electronic controls/engine instruments

#### Volvo New Diesel Inboard\*

225 hp Volvo D4 225 4-cylinder in line

\$28,400

260 hp Volvo D4 260 6 cylinder in line

\$32,000



\* Complete package. Includes transmission, closed cooling and electronic controls/engine instruments. ► Source: Jim Hunt, Volvo Penta Canada

► Note: all prices in Canadian dollars as of November 2009; subject to change.

► Note: There are many manufacturers of gas and diesel engines. The companies shown here were chosen because they are the three largest suppliers to the recreational marine industry. The engine packages were selected based on their equivalency to the most popular older gas engines found in recreational boats.

**Justification** Of course, converting from gas to diesel is much more feasible for those with single-engine vessels. Investing \$50,000 for a new engine in a boat worth \$100,000 is certainly easier to justify than spending \$100,000 for two new engines in a vessel worth \$50,000.

Another way of justifying the switch to diesel is using the old rule-of-thumb: If you're using your boat more than 200 hours per year, then it's worth switching to diesel. However, this depends on the cost of fuel. The higher the cost of fuel, the less hours per year are needed to justify diesel, and the cost of fuel is significantly higher today than when the rule-of-thumb was originally coined.

While it's generally said that a diesel costs about twice as much as a gas engine, Chris Goulder, president of Volvo Penta Canada, estimates the cost difference for comparable engine packages is closer to 60 or 70 percent more, especially with stern drives, which require fewer modifications.

“ Diesels use less than half the fuel of an equivalent gas engine, and have half the cost per mile.

**The Diesel Advantage** Goulder lists four main advantages to switching to diesel: safety, fuel economy, cost savings per mile and engine longevity.

There is no doubt that diesel fuel is less volatile than gasoline and therefore much safer to handle and to store. An added bonus, said Goulder, is that insurance for diesel engine boats is much lower than for gas powered boats.

Goulder estimated that diesels use less than half the fuel of an equivalent horsepower gas engine, even those with electronic fuel injection. This means twice the range for the equivalent amount of fuel and therefore half the cost per mile. With fewer and fewer fuel stations on the coast, range is certainly a more important issue. For owners who don't need the range, half the tanks could be removed, resulting in significant weight savings and the potential for faster speeds.

Longevity of diesel engines is another plus. While the largest factor in longevity is the way the engine is operated and how it is maintained, a typical gas engine should ▶

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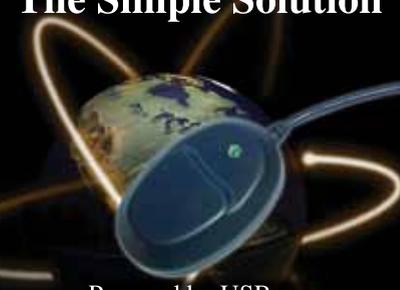
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last about 1,000–1,500 hours, whereas a diesel should last about 4,500 hours before needing an overhaul.

**The Extras** Despite the advantages, anyone thinking of switching to diesel should be prepared for a number of modifications. There's more to it than simply paying for the engine and transmission package and the labour to remove the old engine and install the new one. However, replacing a stern drive unit is typically much simpler than replacing a standard inboard with a shaft drive.

Most of today's diesels are compact and likely to be of comparable size to old gas engines. Many are designed to use the same footprint, which means they'll fit on the exist-

◀ **Above** Joe Torres of Stem to Stern Marine at work on a rebuild. Figure on spending about \$8,000 for a complete overhaul on a 350 cubic inch gas engine.

◀ **Left** Expect to pay about \$10,000 on top of the engine and transmission cost for removal of the old engine, modifications and install of a new diesel package.



ing stringers. Check whether the stringers can handle the increased torque. Modifying the stringers can be expensive. Be sure to check the footprint, and make sure the height, width and length of the new engine is compatible with the available engine room space. Consider also its new fore and aft position and whether this will require moving other engine room equipment.

A diesel engine has different gear ratios and produces more torque than a gas engine, so plan on replacing the transmission (or drive unit on a stern drive). If replacing an inboard gas engine with an equivalent horsepower diesel, you'll probably have to replace the propeller shaft. If it's made of low-grade stainless, it might be possible to simply replace it with a stronger material, but in almost all cases, a larger diameter shaft will be required, which also means replacing the shaft log, stuffing box and struts—an expensive undertaking. To match the lower rpms of a diesel, the propeller for an inboard will have to be replaced with one with more pitch and possibly a different diameter.

The old gasoline will have to be removed

TOP LEFT: COURTESY STEM TO STERN MARINE

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from the fuel tanks and a diesel return line fitted to each tank. A set of primary filters will have to be added into the fuel system. Galvanized tanks are rare, but because diesel is not compatible, they'll have to be replaced. If the existing stainless, aluminium or plastic tanks are in poor shape, this is probably the best time to replace them as well. The exhaust system may also require replacement or modification.

If purchasing a diesel with electronic controls, the mechanical controls will have to be replaced. If the engine comes with mechanical controls, the existing controls can be repurposed. New engine instrumentation will have to be installed at the helm, and if the boat has a flybridge, an extra wiring harness and set of controls/instruments will have to be purchased.

Extra to the engine and transmission package, expect to pay about \$10,000 for the labour and parts involved with removing the old gas engine, installing the diesel and a reasonable number of modifications such as replacing shafts, exhaust and changing over the fuel system. Double that for twins.



On the upside, the new electronic diesels are nothing like the old ones. They burn clean so there is none of that oily smoke aura from unburned diesel, vibration is minimal, and there's none of that old clanging previously associated with diesel. As Chris Goulder put it, "With our new diesel engine technology, >

↑ **Above** The original gas stern drive engine on this 2859 Bayliner is being replaced with a Yanmar 6LPA-STZP diesel stern drive package. Converting from gas to diesel is much more feasible on single engine vessels.

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you don't even know you have a diesel engine in the boat until it's time to refuel—or not.”

➔ **IT'S CLEAR THAT** rebuilding based purely on cost, a worn gas engine is the least expensive option, followed

by replacing it with a new gas engine, then converting to diesel. However, while cost is certainly an important factor, diesel has many advantages over gas. As Chris Goulder pointed out, it is far more economical to operate diesels, the range is close to double that of gas, diesel is a much safer fuel and diesel

engines generally last at least three times as long as gas engines. Yet, according to Dave Milner, most of his customers end up rebuilding their existing gas engines. In the end, whether the benefits of diesel are enough to justify the costs is a matter of personal taste and financial resources. ☞

## HORSEPOWER AND TORQUE

➤ If an engine—gas or diesel—is rated at 300 hp, it will produce 300 hp at its maximum output (at the shaft). The difference is that a diesel engine can be run at 85–95 percent of its maximum rpms all the time. However, gas engines are designed to operate continuously at 60–70 percent. Gas engines are simply not built to perform at the same kind of continuous rating as diesels, and if they are, they use a great deal of fuel and will not last very long. This means when replacing a gas engine with a diesel, the same performance can be achieved with a lower horsepower engine.

A lower horsepower diesel running at 90 percent of its rpm can be equivalent to a gas engine running at 65 percent. For example, a 220 hp diesel will generally provide the same performance as a 250 hp gas engine, and a 315 hp diesel will offer the same performance as a 360 or 370 hp gas engine.

However, when an equivalent or near equivalent hp diesel engine is installed, most boats will see increased performance. Gordon Ireland of Altech Diesel in Campbell River replaced his 330 hp 454-cubic inch gas engine with a 315 hp Yanmar,

and found he could run 2 knots faster—while using 50 percent less fuel.

Alternately, replacing a large gas engine with a much smaller diesel will reduce performance, but at the same time, offer some significant benefits. Ireland has made conversions for people who own semi-displacement or planing hulls, and have decided they don't want the fuel bills associated with running at planing speeds.

“For example,” says Ireland, “say someone has a 32-foot Uniflite with twin 300 hp 454s capable of driving the boat at 22–24 knots

while burning 40 gallons per hour. They could replace those engines with a couple of 75 or 110 hp Yanmar diesels, which cost about \$16,000 each and run the boat at up to about 12 knots. They'd be using less than 10 gallons per hour.” You don't have to worry about replacing the shafts; the smaller engines mean there are space constraints and sometimes the same props can be reconfigured. I've often wondered why more people haven't made the choice to go to smaller engines. A lot of people simply can't afford to move those boats at 22–24 knots anymore.” — PR

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