

# Top trends in marine generator sets

INCREASINGLY BEING USED FOR HYBRID APPLICATIONS, MARINE GENERATORS ARE EVOLVING INTO SOPHISTICATED, MULTI-SPEED SYSTEMS THAT CAN ALSO HARNESS RENEWABLES TO SAVE FUEL

JAKE KAVANAGH AND CRAIG RITCHIE REPORT

**“BOATS ARE BECOMING** more like houses,” says Riccardo Snaidero, sales manager for Italian generator manufacturer Volpi Tecno Energia (VTE). His statement reflects the general opinion of the marine off-grid power sector as it evolves to meet an almost insatiable appetite for AC power afloat. “Owners want their boats to be as comfortable as possible, with equipment such as air conditioners, watermakers, and modern kitchen appliances installed on board. All of these require a high consumption of energy.” ➔

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ANDREW GROWCOOT, CEO  
BETA MARINE

*Customers are looking for quiet, clean and maintenance-free equipment that is on demand at the touch of a button*

▲ Owners increasingly want all the comforts of home, and with an energy requirement to match, wherever they are



▲ Dino Salvemini is vice president of Mase

But it doesn't end there, as Dino Salvemini, vice president of Italian-based Mase, remarks. "Whilst the market demands more power, it also demands a better power-to-dimension ratio, less weight and minimal noise and vibration. In other words, a high 'power concentration'. These characteristics have always been requested, but now they have more importance than in the past."

Greg Klompenhouwer, senior product manager at Kohler Marine, echoes these sentiments. "Demands for electrical power have never been higher, and the space the yacht-builders leave for the generators has never been smaller. After all, more living space translates to more yacht sales, it's as simple as that. So therein lies the design problem: how to design a power solution that maximises the output while simultaneously minimising the space

required. After reviewing some of the load profiles of existing installations at the time, we found that most installations oversized the generators to handle the largest loads onboard, but ironically under-loaded them for the majority of their life, which resulted in long-term engine fouling problems."

### DEPENDABLE POWER MANAGEMENT

Another major factor in recent years has been the sheer number of current-sensitive electronics being used offshore, all of which require an uninterruptable power supply (UPS). More people are choosing to use their boat as a mobile office, running computers, TV screens, printers and sat comms equipment, so there have been some big advances in dependable power management. These allow a boat to automatically – and seamlessly – switch between shore power or batteries, and fire up the generator to fill any shortfall.

In fact, automated systems such as the MasterBus protocol pioneered by Dutch specialist Mastervolt or the automotive G1939 used by French-based Dolphin Charger are very much in demand as the level of sophistication grows.

"Customers are looking for quiet, clean, and maintenance-free equipment that is on demand at the touch of a button," says Beta Marine's Andrew Growcoot. His company produces generator sets based on Kubota, Scania and John Deere blocks, with a specialisation in hybrid installations. "Even the button itself is becoming obsolete as clients are looking for fully automated systems. They want to return to their vessel knowing the batteries will be fully charged and ready to go. We are now supplying a lot more gensets with our on-demand starting capability, both for battery charging and for on board AC."

Beta, VTE and Mase offer dedicated marine generator sets to the leisure boat market, but along with other manufacturers, including the giants like Kohler, Cummins, Onan, MAN, Perkins and Scania, also provide generators for commercial applications as well. As with all OEMs, innovation in one part of the market filters down to others, and one of the main drivers in R&D is fuel efficiency. Huge strides are being made in the diesel-electric propulsion sector, with the three-day Electric & Hybrid Marine World ➔



## Ultimate power efficiency – the Volvo Ocean Race

TO ILLUSTRATE JUST how efficient power generation and management has become, take a look at the most recent Volvo Ocean Race. Each identical 65ft yacht had exactly the same Mastervolt set-up, with a Volvo diesel spinning up a pair of high-efficiency alternators. With limited fuel to save weight, the charge cycles were few and far between.

“The boats went through a charge cycle every 24 hours,” says Mastervolt’s Ton de Winter, EMEA business leader at Mastervolt’s Dutch headquarters. “Each 59-minute cycle supplied roughly 240-280Ah of current to the Mastervolt Lithium-ion batteries at 24V, and is also used to run the watermakers. The two Mastervolt alternators produced 300Ah at 24V, so they could get the Li-ion batteries recharged very quickly. Every electrical circuit ran through our Mastervolt CZone Digital Switching Platform. This system needs the same resilience and redundancy as the Li-ion batteries, as it runs 24/7 and all the critical systems rely on its ‘up time’. Everything from the canting keel pump, water ballast tanks, media desk and satellite communications needed power for continuous operation.”

Despite this limited charging regime, and the high draw items needing power, the systems worked beyond expectations, saving fuel, weight and recharge times.

STEVE JELINEK, MARKETING MANAGER  
CUMMINS

*Regardless of where they live, boaters generally want all the equipment that makes boating more comfortable and enjoyable*



▲ Manufacturers such as Mase and Fischer Panda are all striving to reduce the footprint and noise of their generators, whilst boosting the power-to-dimension ratio. Variable-speed motors and the use of permanent magnets are all helping

Expo now in its fifth year. Efficient power generation afloat, including minimising wastage and maximising storage – increasingly with Lithium-based batteries – is a major aspect of our modern world.

For this feature, we’re looking at trends in stand-alone generator sets, which require their own fuel supply and exhaust system. These sets can be broadly divided into two types – ‘fixed speed’ and ‘variable speed’ – and into two categories – ‘main’ and ‘harbour’ (sometimes called ‘day’ and ‘night’ sets).

### FIXED SPEED VS VARIABLE

Generally speaking, a fixed-speed generator is optimised to deliver its maximum load at its most efficient setting, commonly at either 1,500rpm (1,800rpm for the US) or 3,000rpm. A variable-speed set adjusts itself through a pre-set rev range to be most fuel efficient for the load at the time. Due to the nature of an alternator, the speed at which it spins governs the AC frequency, so electronics are needed to adjust the variable output to maintain either a 50Hz or 60Hz delivery. The main, or day generator, is used to meet the peak

loads during daytime operations, whereas the harbour set is much smaller, and runs quietly at night to deliver reduced air conditioning, a few courtesy lights and battery charging.

Historically, US-specified boats were the most power hungry, but other nations have since closed the gap. “We are a global player, we sell in North America, Europe, Asia, South America and Australia,” says Steve Jelinek, generator business marketing manager for Cummins. “Regardless of where they live, boaters generally want all the equipment that makes boating more comfortable and enjoyable. The biggest difference from one region to the next are the various emissions standards and regulations that have to be met.”

In addition, there has been a steady increase in interest in hybrid systems, inspired by the success of the automotive industry, and benefitting from big leaps in battery and motor design.

So what are the current trends in marine generator sets? We spoke to key OEMs, end users, boatbuilders and maintenance engineers to see where the market is heading. **IBI**



# Key trends

The trends within the generator market subdivide into three main categories: design and efficiency, installation and maintenance, and system integration. Each category has been seeing some major innovation

## DESIGN AND EFFICIENCY

### Increased reliability

Most generator manufacturers specify proven engines that meet the strict new emissions regulations. These are either own-brand units, or base engines from other proven manufacturers. Kohler and Perkins use their own base engines, whereas Beta Marine, for example, uses either Kubota or Scania blocks and Mase uses Yanmar, amongst others. However, diesel-engine technology is changing all



▲ OEMs such as Mase are constantly marrying the latest generators with the very latest engines, such as with this Mariner 11 set-up

the time, so genset manufacturers are constantly reviewing their portfolios.

“It is very important to use state-of-the-art technology,” says Mase’s Salvemini, who is proud of his company’s ability to create custom gensets for specific projects. “The latest engines are very compact with low emission levels, less noise and minimal vibration. But that means we are constantly designing new generators using the latest model

of engine. We cannot afford to stop this process.”

### Greater DIY maintenance

Hand in hand with reliability is the service schedule. Many OEMs are making their generator sets as easy to service as possible, which appeals to long-distance yachtsmen and superyacht captains alike. “This is helped by placing all the maintenance items on one side for ease of accessibility,” says Fischer Panda’s Chris Fower. “The oil filler, waterpump and filters are all easy to reach. Having a basic DIY service ability means that owners will be encouraged to do their own servicing, and this familiarity will encourage a better maintenance regime.”

### Quieter running

“Quiet running is a major customer request,” says VTE’s Riccardo Snaidero. “This is easier to obtain with the 1,500rpm sets, but more difficult at ➔



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3,000rpm. Our cooling system is a winning point here, because both the engine and the alternator are watercooled. This means the capsule doesn't need any external ventilation, so the sound remains inside. However, the capsule is also made from three pieces, which makes installation and routine maintenance much easier."

US-based Kohler has also put a great deal of effort into quiet running, with a separate sound shield for the engine and alternator, proprietary mount cushions for the engine feet, and a redesigned ventilation system. Meanwhile, Mase's new IS series has a lightweight aluminium case and double-damping mounts, and also has an intercooler system for both engine and alternator, so no heat radiates into the engine space. These all help to mute the genset's noise levels.

### Rise of the variable speed

Historically, generator sets have been quite heavy machines running at a fixed speed, so as to deliver a specific voltage and frequency, ie 110VAC @60Hz for the US, and 240VAC at 50Hz for the EU. Variable speed generators usually involve two or more 'steps' in RPM, rather than a sliding scale, so the output can be stabilised at each stage.

"The variable speed generator is now fully proven, as it has been with us for six or seven years, and over the last two



► The Panda 4000e Neo uses Fischer Panda's own FP320 single cylinder diesel engine and is ideal for small spaces

years has seen a big turnaround," says Fischer Panda's Fower. "These gensets can save up to 25% in fuel, and can also be made smaller and quieter. Also, you only generate the power you need, rather than having to dump the excess."

### Move towards permanent magnets

An increase of up to 30% in electrical efficiency can be made by using a fixed magnet instead of an active field coil, so many companies are adapting this technology from the commercial sector. "We are still developing our range of permanent magnet generators at higher power and with variable speed," says VTE's Snaidero. "This allows us to unify the compactness of the 3000 rpm models with the silence of the 1500 rpm, whilst also saving fuel."

### INSTALLATION AND MAINTENANCE

Creating units that are easy to install and service is a major objective of genset OEMs, as seen in these ongoing trends:

#### Smaller footprint

Reducing the size of a genset increases the mounting options, so smaller is usually better. Kohler, for example, has reduced the overall footprint of its latest models by up to 16 inches, whilst VTE

and Mase have reaped the benefits of more compact units due to water cooling of both the engine and alternator.

"People still have the perception that a fixed generator can be the size of a small suitcase," says Fischer Panda's Fowey. "Sadly, not yet, but our smallest sets can fit into a space where our rivals can't."

#### Auto paralleling

When using a combination of day and night generators, there will be occasions when both need to be linked together to meet peak loads. This avoids having to over-specify the main generator, which may run a lot of the time on light loads, with detrimental effects. Traditionally, this paralleling meant a large cabinet of switch gear, now replaced by compact electronics that allows parallel gensets to seamlessly mesh. The Kohler system is called Decision-Maker 3500, and uses a single CANbus link to parallel two or more Kohler units.

#### More keel cooling

Helping to reduce exhaust noise and to allow for fresh-water cooling is the use of a keel cooler, a practice most usually found on the inland waterways of Europe.

"On the canals, a lot of customers want keel cooling, as this allows them to run a heavily muffled dry exhaust system," says Fower of Fischer Panda. ➔

CHRIS FOWER, MARINE SALES & MARKETING  
FISCHER PANDA

**On canals, a lot of customers want keel cooling, as this allows them to run a heavily muffled dry exhaust system**



## Small generator – big battery bank

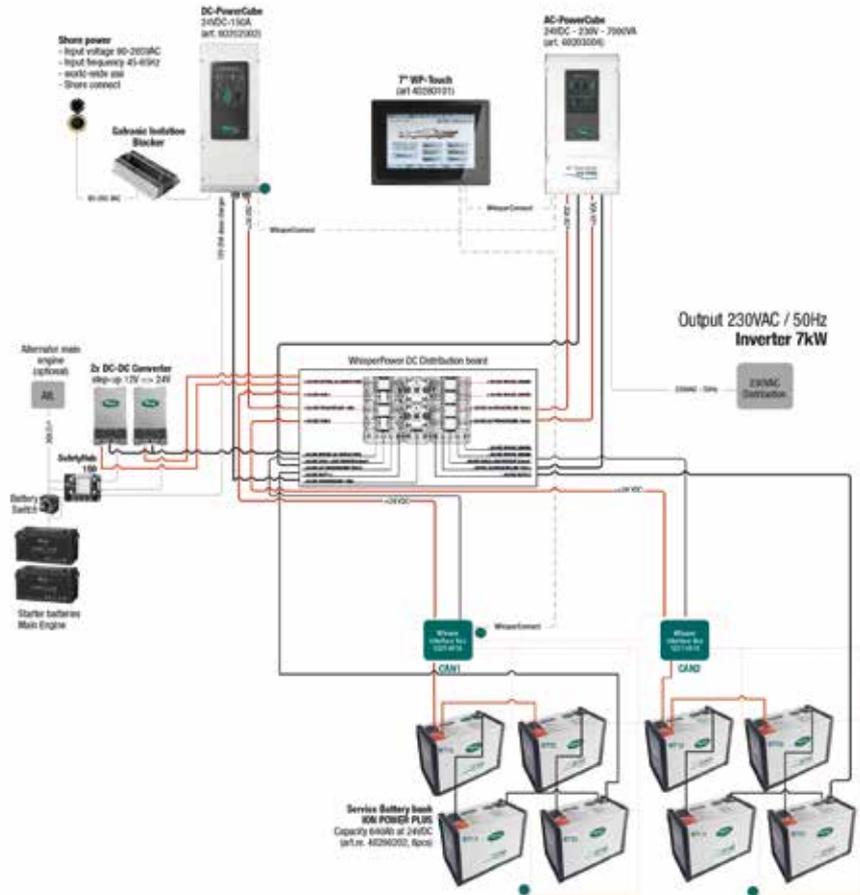
WITH THE MUCH greater storage capacity available from Lithium-ion technology, there is a move towards using an ‘energy bank’ in concert with a smaller generator. The idea is that the energy bank is recharged ‘off peak’ or when there is surplus energy, and then tapped into at times of peak demand to supplement – or even replace – the generator. One such system, called New School, has been developed by Dutch-based WhisperPower, and is reported to be enjoying considerable success following trials with Dickey Boats in Auckland, New Zealand.

The heart of the system is a large bank of Lithium-ion batteries, equivalent to the total peak load of the boat. A variable speed ‘Genverter’ would be able to recharge this bank in around six hours, and would run during the day when noise is less of an issue. Everything is managed via WhisperPower’s DC Powercube, including input from any renewables. When peak power is required, the boat will run entirely off the battery bank, which can be deep-cycled up to 5,000 times.

“Lithium-ion batteries aren’t cheap,” WhisperPower concedes, “so this system requires a considerably higher up-front investment that a conventional large generator with lead-acid batteries. But the fuel savings over the life of the system should pay for itself. In highly-regulated environments like Europe, the reduced emissions from such a system may be essential for a vessel to meet the necessary standards.”

“The development of intelligent power management systems has allowed the generator to be at the heart of a multi-input system”

## Featured system schematic



A large bank of Lithium-ion batteries are at the heart of WhisperPower’s New School system, and are equivalent to the peak load of the boat

### Global support

We mentioned the importance of a wide service network in our feature of diesel engines, but there is a growing trend for owners and some boatbuilders to specify equipment that they know is well supported throughout the world. The availability of service items such as belts and filters, or qualified agents in popular cruising areas, is a factor in the purchasing decision. In several cruising yachts, such as Oyster or Nordhaven, it is common to see the same brand of engine used for both

propulsion and the genset, to simplify spares and expertise.

### SYSTEM INTEGRATION

So, what do we do with all this power we’ve created? That’s where the clever bit begins, because the development of intelligent power management systems has allowed the generator to be at the heart of a multi-input system. These are some trends in how power is distributed around the boat. ➔





▲ Mastervolt offers a range of Lithium-ion batteries for on and off-grid power generation



▲ The EasyView 5 control screen from Mastervolt completes any MasterBus system. Its compact size makes it ideal for yachts

### Visual displays

Gone are the days when you would just fire up the generator and watch the lights brighten. Now advanced electronics allow you to monitor every aspect of the ebb and flow of power across a boat's entire system. Mastervolt pioneered this type of management system with MasterBus, where a single cable links all the components of a system together to allow communication between them, and the EasyView 5 control screen. Protocols are now available, usually through an interface, that allows the data to be displayed on navigation screens in the cockpit, or on a string of repeaters. Essentially, you can tell at a glance how your generator is performing, and how healthy your batteries are.

### Remote access

Taking the view screen a stage further, this information can be remotely communicated to your phone or home computer. "This is very important," explains Nicolas Fata of France-based

Dolphin Charger. "Today, owners want to be able to remotely monitor their boat in the same way they monitor their house. Battery charging is no different, especially as the chargers are permanently connected. We work closely with OEMs to ensure this is easy to achieve, because it is what customers are asking for."

Mastervolt has also developed its own remote monitoring system

NICOLAS FATA, OEM & EXPORT MANAGER  
DOLPHIN CHARGER

**Today, owners want to be able to remotely monitor their boat in the same way they monitor their house**

called Amperian, where electrical data is uploaded automatically from the boat to a secure server. A customised portal allows owners to not only check everything from battery charge to tank levels, but also access a logbook to trace system performance over time.

### Tapping renewables

Whilst generators are the heart of an AC system, there is a move now to reduce the size of generator needed and instead tap in to other sources of power as they become available. However, when wind generators or solar panels aren't effective, the genset comes in, sometimes automatically, to fill the void. The effective harnessing of varying degrees of renewable power in concert with a generator requires 'intelligent' battery chargers to not only charge batteries of all types, including the relatively new Lithium-ion variety, but also to know which power source to prioritise. This trend for a complete system, rather than just a generator, is gaining popularity. ➔



### The rise of diesel electric

**THE LEISURE INDUSTRY'S** flirtation with electric propulsion is now gaining momentum, largely thanks to technological advances in the commercial sector, the rise of the hybrid electric vehicle, and owners wishing to enjoy silent cruising. Austrian pioneers such as Steyr Motors, with its clever electric motor/generator/starter sandwiched between engine and gearbox, and Torqeedo with its lightweight Lithium-powered outboards and pod drives, have already set the stage with proven products.

The ability to run electric propulsion via a large bank of deep-cycle/fast recharge Lithium-ion batteries, itself recharged via a highly efficient generator, is now becoming widely accepted in the commercial shipping industry. At the recent Electric & Hybrid Marine World Expo in Amsterdam (6-9 June 2017), the industry gave achievement awards to companies such as Corvus Energy, ABB propulsion and BB Green for their advances in commercial battery banks and drive systems. This technology is now being adopted by companies with a specialised leisure sector, such as Dutch-based HyPS Hybrid Power Systems, which took a stand at the show. "We were showing our new 85kW variable speed prototype generator, designed for hybrid applications," says HyPS's Rudolf van Heek. "It is around 40% smaller and lighter than a conventional set, and it received a great deal of interest."

HyPS customises generator and battery technology to increase a vessel's speed and range, broaden the electrical platform and allow for emission and noise-free cruising and anchoring. HyPS's team members' experience goes back to the pioneering work on the 'greenest ever' 60m superyacht *Ethereal*, which carries 400kWh of Lithium-ion batteries. "A lot of innovation is happening within the automotive sector, rather than shipping, as they have the largest budgets for R&D," van Heek explains. "When the Germans develop a new technology – for example, hydrogen-powered cars – it is quickly adopted by the rest of the industry."

#### THE IMPACT OF EMISSIONS

"Tightening emission regulations will have an impact on installation and maintenance," says Greg Klompenhouwer, senior product

manager at Kohler Marine. "Tier III changes affecting our products coming up in the future require SCR after-treatment systems to reduce NOx levels, and these systems are going to require more maintenance. These systems can be quite large, and boatbuilders are preparing now to accommodate those changes, both on the genset and on the propulsion engines. IMO Tier III came into effect last year on commercial vessels, and is coming to yachts in 2021. Engines have grown increasingly complicated, both operationally and on the emissions control side, and this will just add another level of complexity and maintenance."

#### THE FUTURE

OEMs continue to strive for smaller and quieter generators with a high power density, but the future does seem to be in the more efficient management of the power they create, and a greater use of Lithium battery banks as a deep cycle/fast charge energy reserve. At the same time, the generator, especially on smaller yachts, is being used to supplement other sources, particularly from renewables, rather than being a stand-alone unit.

Meanwhile, there seems to be no let up in

the global appetite for on board AC power generation, with most OEMs reporting strong sales in the Far East. "Typically, the US market is high production gas (petrol) and small to mid-range diesels. South America is smaller diesel units, mainly for sailboats," says Kohler's Greg Klompenhouwer. "Europe is primarily mid-to-large diesel units, and not very much gas at all. For us, Asia is a focus. In Singapore there's so much yachting going on. China is still a developing country from a boating perspective, but it's becoming more like the US and European economies in that they have a growing middle class, they're building marinas and there are more and more private yachts."

Whilst the markets may be strong in the Mediterranean and Far East, the future of the technology is moving inexorably towards smaller, high-output variable speed generators feeding banks of Lithium-ion batteries.

"There is a new market that is rising in Italy and Europe – hybrid propulsion," concludes Mase's vice chairman, Dino Salvemini. "We produce generators for electric or diesel-electric propulsion systems, and if a customer asks for a generator that doesn't yet exist, we make it."



▲ HyPS's 85kW variable speed prototype generator is said to be 40% smaller than a conventional set





▲ Generators should be easy to install and easy to service. Here, a Caterpillar unit is being installed by Pure Refit in Spain

### THE ENGINEER'S VIEW

The real test of a product is the passage of time. We asked experienced engineer Keith Harris of Golden Arrow Marine what tends to go wrong with generator sets.

"Initially, poor installation can cause the biggest problems, which isn't the generator manufacturers fault," Harris explains. As a veteran marine engineer he has worked in both the commercial and leisure sectors for over 40 years. "We had one set that had been put in the wrong way round, so all the service items were hard against the hull, and unreachable. This had been done to ease the exhaust run, but simply made the set unserviceable."

Exhaust runs are a major issue with any installation, and can lead to some maintenance issues if not properly addressed. "The generators on smaller boats tend to have a small bore exhaust, but often with a long run, and if there is no water separator fitted, you can have problems with both exhaust back pressure, and water getting back into the engine,

with catastrophic results," Harris says.

"Another issue is lack of maintenance. We had an American boat in our UK marina for several months, and using the generator all the time as the boat was incompatible with shore power. There was no down time for maintenance, and when it did finally need urgent attention, we found the oil was so thick we had trouble getting it out of the sump."

Owners are keen to service their main engines at regular intervals, Harris suggests, but the generator sets often get sidelined, even when the engineer is on board, and happy to do the job.

Another failure point seen is the support bearing at the end of the alternator. "On most conventional sets, the alternator is supported at one end by the engine itself, and at the other by a set of bearings," Harris says. "These are almost never changed, whereas they should be swapped out periodically. The result is that the alternator sags in its bearing, and the rotor can hit the stator and damage the

windings. The alternator is written off, and because it is listed as a spare part, and is very expensive to replace, it is often more cost-effective to replace the entire genset."

Light running also leads to problems, where large generators are only supplying small loads for extended periods.

"This can glaze up the bores and lead to excessive smoke," Harris says. He advises owners with large generators to give them a full blow-out now and again, loading the electrical system to peak capacity to drive the engine hard enough to clear out the cylinders.

### THE INSTALLER'S VIEW

Whether fitting a new generator or upgrading an old one, what helps a generator installer to provide a reliable installation?

"Customers usually come to us with a brand in mind," says Mike Underwood, a specialist at UK-based Solent Refit. The yard conducts full refits mainly on superyachts, where power generation ➔





▲ A Westerbeke genset inside a Hallberg-Rassy 62. Note the extensive soundproofing of the engine bay



▲ CEO Magnus Rassy surveys the engine room. “Noise reduction is important, but exactly how we achieve that is a trade secret,” he says.

is a key issue. “It’s usually the captains that decide what they want, rather than owners, and it’s often based on previous experience. They will often be specifying greater capacity, but we usually advise the parallel route, because we have seen so many over-sized generators written off by excessive running on light loads. They need to work hard.”

Although OEMs are making their gensets as small as possible, this can give some headaches for the installers. “Small isn’t necessarily good as it can make servicing tricky if things are too close together, and there isn’t much room to manoeuvre,” Underwood suggests. “An issue we have with some boats is that we have to place the genset in a different area, such as a lazarette or locker. If the boat is for charter, this can raise some issues for the owner as the area is now a designated engine space, with its own set of rules.”

Another specialist, this time for mid-range yachts and commercial vessels, is UK-based Seapower Marine, a dealer for the Cummins Onan brand.

“We settled on this brand because of the long warranty, which is five years or 2,000 hours, and a good distribution network,” says Seapower Marine’s Jules Wright. “We’re typically selling between 7kw-9.5kW for leisure use, and 19kW and above for commercial use. In the latter sector, the generators do some remarkable hours. We have one that has just passed 27,000 hours. We have very few issues with installation, except where the boats may have an isolated electrical system. This is common on aluminium boats, but some GRP boats, especially from France, may have a positive earth, rather than a negative. It’s important that installers know about this peculiarity.”

The only failure point, common to all marine diesels, is the impeller, but Seapower has developed a special grid to catch any fragments before they can get into the heat exchanger. “We think the Onan brand is the Rolls Royce of marine gensets,” Wright says. “Spares aren’t cheap, but the brand has a solid reputation, and is well supported globally.”

### THE BOATBUILDER’S VIEW

Hallberg-Rassy is based in Sweden and is well known for building high-quality production sailing yachts that are regularly cruised to some of the remotest places on earth. As a result, each yacht is very highly specified, and generators are common across the size range.

“To start with, we need to have an engine room with lots of space,” says CEO Magnus Rassy. “This allows for the installation of a big generator, yet offering availability for servicing and good ventilation. We’re seeing Lithium-ion batteries gaining a greater market share, and that in turn opens up for larger gensets and greater charging ability, as those batteries hardly have any resistance and can be charged much faster. Luckily, modern generators are getting more and more compact, allowing more kW in the same space than just a few years ago. Noise reduction is also important, but exactly how we achieve that is a trade secret.” **IBI**



OUR THANKS TO

# Movers and shakers in the generator world and their support systems

## GENERATORS

### Cummins Onan

Provider of marine generator solutions for recreational and commercial boats and yachts  
Tel: +1 (763) 574-5000  
<http://power.cummins.com/marine>

### Fischer Panda

German producer of diesel generators, hybrid and drive systems for mobile marine and vehicle applications  
Tel: +49 (0)5254 9202-0  
[www.fischerpanda.de](http://www.fischerpanda.de)

### Perkins

UK-based supplier of auxiliary power generators for leisure and commercial applications  
Tel: +44 (0)1733 583000  
[www.perkins.com](http://www.perkins.com)

### Beta Marine

Producer of generator sets based on Kubota, Scania and John Deere blocks, with a specialisation in hybrid installations  
Tel: +44 (0)1452 723 492  
[www.betamarine.co.uk](http://www.betamarine.co.uk)

### WhisperPower

Dutch producer of generators for both recreational and commercial markets, offering high, low and programmable RPM options  
T: +31 (0) 512 571 550  
[www.whisperpower.com](http://www.whisperpower.com)

### Volpi Tecno Energia

Italian manufacturer of gen sets for the marine industry since 1933  
Tel: +39 040 231715  
[www.volpitemco.com](http://www.volpitemco.com)

### Kohler

US-based producer of marine diesel generators and small gasoline generators  
Tel: +1 800 544 2444  
[www.kohlerpower.com](http://www.kohlerpower.com)

### Mase Generators

Italian manufacturer of power systems offering a



▲ Generators are a necessity when sailing to remote regions. Above is the Hallberg-Rassy 48 at anchor

range of generators from 1Kw to 1600KVA  
Tel: +39 0547 354311  
[www.masegenerators.com](http://www.masegenerators.com)

### MAN

Manufacturer of marine, emergency and auxiliary/harbour gensets between 100kVA and 750kVA  
Tel: +45-3385-1100  
[www.marine.man.eu](http://www.marine.man.eu)

## HYBRID SYSTEMS

### HYPs (Hybrid Power Systems)

Dutch specialist in the design, development and delivery of marine hybrid power and propulsion systems  
Tel: +31 345 576 664  
[www.hyps.nl](http://www.hyps.nl)

### Steyr Motors

Austrian diesel engine specialist that offers of a range of accessories including the Integrated Flywheel Generator (IFG) electric power system  
Tel: +43 7252 222-0  
[www.steyr-motors.com](http://www.steyr-motors.com)

## POWER MANAGEMENT

### Dolphin Charger

French designer and manufacturer of advanced-technology battery chargers for the recreational and commercial marine markets  
Tel: +33 (0) 450 272 030  
[www.dolphin-charger.com](http://www.dolphin-charger.com)

### Mastervolt

Dutch manufacturer of power management systems, inverters and Lithium-ion batteries in support of on and off-grid power generation  
[www.mastervolt.com](http://www.mastervolt.com)

## INSTALLERS AND OTHER SUPPORT

### Solent Refit

UK-based superyacht refit and repair facility  
Tel: +44 (0)2380 84 1188  
[www.solentrefit.com](http://www.solentrefit.com)

### Golden Arrow Marine

Supplier and installer of marine generators with three branches on Britain's south coast  
Tel: +44 (0)23 92201171  
[www.goldenarrow.co.uk](http://www.goldenarrow.co.uk)

### Electric & Hybrid Marine World Expo

Latest electric and hybrid marine propulsion technologies, components and solutions  
Tel: +44 (0)1306 743744  
[www.electriconhybridmarineworldexpo.com](http://www.electriconhybridmarineworldexpo.com)

### Seapower Marine

Authorised dealer and installation specialist for the Cummins Onan brand in the UK  
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### Hallberg-Rassy

Swedish producer of blue-water sailing yachts  
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