PHOTOS: DUNCAN KENT

MARINE HYDRO GENERATORS

COULD A HYDRO-GENERATOR BE THE ANSWER TO KEEPING YOUR BATTERIES CHARGED AT SEA? DUNCAN KENT TRIED OUT SOME OF THE LATEST MODELS TO SEE HOW THEY PERFORMED

If you're planning to go long-distance cruising you'll most likely be looking to fit one or more forms of power generation to avoid running your propulsion engine. You could just fit a dedicated diesel generator, but unless you require extra power for air-conditioning, say, it's a good idea to try to make the most of the many natural energy resources available first.

Eco-friendly power generation offers you three sources – solar, wind or water. Solar, being pollution- and maintenance-free, always makes a good backup, despite only working in daylight hours. Wind generation can be very productive when anchored somewhere that has constant winds such as the Trades, but it is not very effective when sailing downwind.

Thanks to modern alternator designs that offer increased power at lower rpm, hydro-generators are becoming a worthwhile investment for yachtsmen who regularly sail long passages. Yes, they do create a slight drag on the yacht under way, but only around 0.25kt or so, which is unlikely to worry most long-distance cruisers.

How do they work?

A hydro-generator has an impeller (reverse prop) that rotates when towed behind a yacht. That rotation is applied to an alternator, which produces AC power that is rectified to produce a DC charge for your batteries, in a similar way to a shore-powered battery charger.

Early models towed an impeller on a long line behind the boat, which was attached to an alternator on board. But their trailing impellers were often bitten off by large fish and they frequently tangled up when fouled or if not retrieved correctly. Current devices have an impeller attached to a submersible leg – not unlike an outboard motor.

Modern, brushless alternators with magnets have reduced turning resistance and increased efficiency, enabling them to produce more power at lower revs. A hydro-generator is an effective way to provide constant electrical charge over a long distance. On a 40ft yacht one of these can produce around 200Ah of charge every 24 hours at 6kt, which is enough to run most electrical items on board.

They also require little maintenance, other than weed clearance and periodic checking of the electrical connections.

ABOVE Hearty gearing allows the generator head of the French designed Save Marine H240 to be folded up out of the water

BELOW Charge current supplied at 1kt intervals into a 110aH deep-cycle battery kept 50% charge

HYDRO GENERATOR	3KT	4KT	5KT	6KT	7KT	8KT	DRAG
Watt & Sea Cruising 600	0.3A	2.9A	5.2A	8.0A	16.0A*	20.0A*	0.25kt
Eclectic Energy Duogen	1.3A	2.5A	5.0A	6.6A	11.0A*	15.0A*	0.30kt
Eclectic Energy Sailgen	1.2A	3.1A	6.3A	8.2A	14.5A*	22.5A*	0.30kt
Swi-Tec Hydrocharger	1.2A	4.1A	6.8A	11.0A*	17.0A*	20.5A*	0.50kt
Save Marine H240	2.2A	6.5A	9.8A	14.5A	21.6A*	30.0A*	0.25kt

** Manufacturers' data*

Swi-Tec Hydrocharger

On unpacking this generator I was surprised at the industrial engineering that goes into its construction. Whereas the Watt & Sea my colleague was assembling was lightweight and simple to put together singlehanded, I needed help just to lift the various components out of the box! The pivoting mount bracket alone weighs nearly 3kg, being fabricated entirely from 5mm-thick 316 stainless steel plate.

We liked the mounting bracket keyholes, which allow you to simply drop the pivot head into the slots and lock it together with a single pin. The head also has 11 angle adjustment holes to ensure the generator leg can be mounted vertically. It wasn't clear from the appalling instructions and grainy photos just how the lifting mechanism should be connected and either way it looked wrong as the lever arm is way too short for easy lifting. A cantilever locks the leg firmly down, but requires a third line for releasing it in order to lift the leg.

The impeller attaches like an outboard propeller, aligning a drive pin with the slot at the back before tightening a lock nut. The leg is secured by a locking bolt.

The Swi-Tec comes with a charge controller that has water/wind generator and solar panel inputs. It has a single line LCD and a menu system for setting the required parameters such as alarms, charge voltage etc.

Verdict 6/10

At first this HG produced a high current flow, although not stable as it fluctuated considerably between readings. Hence the charge levels in our results table are derived from a mean between lowest and highest reading for each speed. The control box is liable to overheating, as the fan appears to be prone to failure. Our test team felt the box was more complicated than necessary.

- **Swi-Tec: +49 (0)7444 9541920, swi-tec.com**

Watt & Sea

This device started as a generator for fast racing boats that needed a minimal amount of power with the least possible drag. It proved successful and was highly rated among the long-distance yacht racing fraternity. The company then designed these new models for cruising yachts with up to twice the output of the original.

Watt & Sea offer a choice of two alternators (300W or 600W output, 12/24V) and three impeller diameters (200, 240, 280mm) depending on the amount of charge you require and the average speed of your yacht. It can also be supplied with a 61cm- or 97cm-long leg, to cover a variety of transom mounting possibilities, and a choice of fixed or quick-release mounting brackets – the latter enabling you to remove it entirely very quickly, even at sea.

Even with the 600W alternator fitted (the 300W and 600W alternators are easily interchangeable), being constructed mainly from aluminium it is very lightweight compared to all the others we tested.

Output from the single cable is high voltage AC current, but it is supplied with a simple regulator box with just sockets for the generator, solar panel and battery inputs. There are no user-adjustable features or parameters, but there are LEDs that change colour to indicate charge levels or which flash when there's a problem.

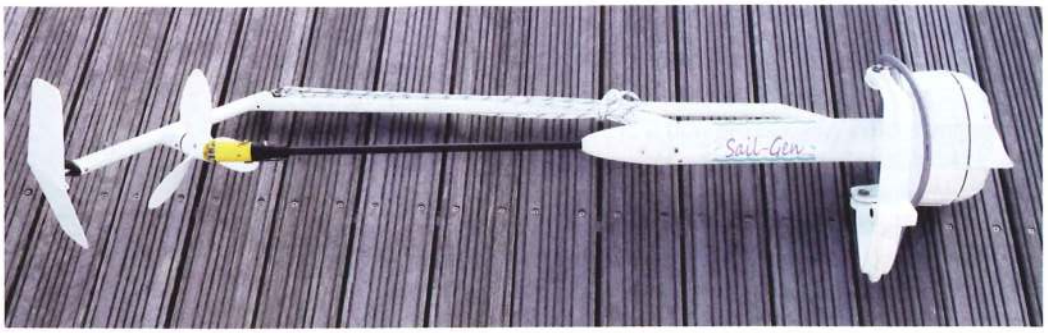
Verdict 7/10

We tried the 600W model with the mid-range impeller as that was more compatible with the others on test. Although not as powerful as the Save Marine and Swi-TEC HGs at the lowest and highest speeds, at a typical cruising speed of between 5-6kt the output is strong and, importantly, stable.

We liked the ease of installation and straightforward operation, including the simple 'plug-and-play' charge controller.

- **Technical Marine Supplies: +44 (0)1752 600454, technicalmarinesupplies.co.uk**

SailGen



Eclectic Energy supplies both the SailGen and DuoGen-3, which share the same technology. The SailGen alternator mounts 50cm above sea level with a choice of pole or bracket fixings. The construction is different from the other devices on test in that it is designed to run at an angle to the water, relying on an adjustable, submerged dive plane to keep the impeller at the right depth. This overcomes the problem of the fixed leg generators where the impeller depth changes depending on the angle of heel and sea state.

The SailGen is solidly engineered and its permanent-magnet alternator robust and waterproof, but it's also very heavy (14kg) so requires a very sturdy mounting on the boat. Its AC output is rectified inside the casing (much safer) so it outputs DC volts without requiring an external rectifier. For this reason no control box is supplied, but like all solar, wind and hydro-generators it ideally needs a regulator to prevent overcharging.

Whereas most tow-gens use a freewheeling or braking system to disconnect the charger when a pre-set battery voltage is attained, Eclectic supplies a black box switch that diverts any unwanted charge to a pair of large resistors. These dissipate the unwanted energy inside the boat as heat, which is not ideal in the tropics and seems somewhat rudimentary in this day and age, but you can still install a simple switch or even another type/make of regulator, so long as it can handle 40A maximum current.

● **ABOVE**
The business end of this unit is light and easy to raise and lower

Verdict 8/10

The SailGen is easy to mount and, having the heavy alternator at the boat end, is light and easy to deploy and lift. The dive plane idea works well and, though its real-time output is less than others, being always kept at the correct depth means its charge level is far more consistent.

● **Eclectic Energy: +44 (0)1623 835400**
eclectic-energy.co.uk

DuoGen

We last tested this excellent generator in our June 2008 [ST134] issue and, apart from a few physical design revamps, little has changed in its design or performance since we gave it a well-deserved ST Premium Product award.

The DuoGen utilises the same dive plane, impeller, alternator and swivelling mount as the SailGen, so the charge capabilities are very similar. However, due to the need for it to be easily converted into a wind generator, the design of the structure differs somewhat. The alternator remains in the same place, which keeps the heaviest weight close to the boat, but it has a longer/taller pole designed to be lifted to a height above which it presents no danger to the crew when operating as a wind turbine. It is also designed to be mounted at toe-rail height, either on a pole or an existing stern rail upright.

Switching between water and wind modes is easy and quick. Hauling the longer device out is harder than with the SailGen, but after that it simply involves a change of impeller blades and locking into the upright position – neither of which requires tools. From previous *ST* tests on the DuoGen we can confirm it compares very favourably with other pure wind generators in terms of output levels.

● **ABOVE**
Both made by Eclectic Energy, there are lots of design similarities between the SailGen and the DuoGen

Verdict 8/10

The output is a bit lower than SailGen's, which itself is middle of the range in comparison with all the others, but having the 2-in-1 option of a wind generator could be a real bonus for those planning to make long passages then coastal cruise in windy areas such as the Trades.

● **Eclectic Energy: +44 (0)1623 835400**
eclectic-energy.co.uk →

Save Marine H240

Being so new to the market, we were unable to get one of these for our own boat, but instead we trialled an existing installation on a 30ft cruiser/racer in France.

This is an unusual looking hydro-generator in that it utilises an 11-blade turbine rather than the more common propeller-shaped impeller. The turbine spins within a cowl, which is faired to create a Venturi effect that speeds up the flow of water through it. A total of 72 permanent magnets moulded into the tips of each blade interact with wired coils in the cowl, turning the whole arrangement into a water-cooled alternator. As an alternator works more efficiently the cooler it is, designs in which it is permanently submersed will undoubtedly perform better than those that don't, although it clearly needs to be completely waterproof.

The device is lightweight and easy to deploy/lift below 4kt, thanks to a control arm that houses the control lines, 8:1 tackle and jammers. The turbine leg lock has an emergency release mode should it be hit by floating debris and the leg angle can be adjusted through 30° to compensate for sloping transoms, ensuring it is always vertical.

It is designed to work at boat speeds between 3-10kt, above which the charge controller automatically shuts off and the turbine freewheels. A black-box regulator is provided with no switches or indicators, but automatically controls the charge and allows you to monitor its output and the battery state remotely via an inbuilt wi-fi transceiver by simply connecting a tablet or smartphone to its own wi-fi hotspot and opening up a browser page.

Verdict 8/10

We liked the lightness and ease of deployment of the Save device, especially the arm that kept the lines tidy and secure. We also thought the turbine design to be innovative, quiet and very efficient. Finally, we loved the idea of the remote monitoring on a smart device, especially as the charge controller is fully automatic so there are no switches to be flicked or audible alarms to listen out for.

- **Save Marine: +33 (0)6 33 02 29 36, save-marine.com**

CONCLUSION

Any one of these hydro-generators would be a boon to the bluewater cruiser undertaking long passages. With a little judicious power saving any could supply all your electrical needs.

Lightly-built models are easier to install, mount, handle and deploy, although sometimes sheer engineering beef is needed to prevent damage in rough seas. That said most are intended to be lifted out to prevent physical damage – ideally while still under way.

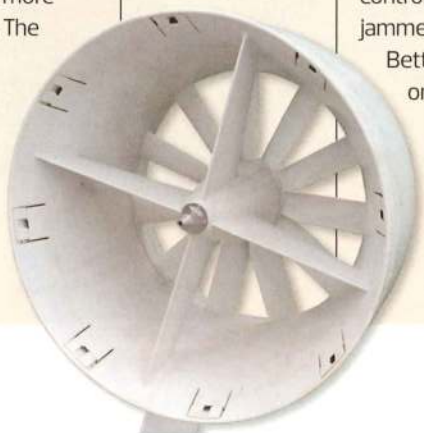
Fixed-leg models produce a higher and more stable charge the deeper their impellers are immersed. So, though they need to be offset from the centreline to avoid turbulence from the propeller and rudder, further than 50cm can mean they're too shallow when they're on the high side. For this reason we particularly liked the SailGen/DuoGen's free swinging arm and dive plane design to keep the impeller immersed. None produced useful charge below 3kt, but all produced 5A+ at 5kt.

With charge controllers, the more automatic they are the better. The Watt & Sea and Save Marine black boxes have no display or switches; instead they just work from the outset using the factory-set parameters. The Swi-Tec controller has a host of possible settings, however, many of which will be unnecessary for the average bluewater sailor, who will likely just want it to work unsupervised.

Hydro-generators can be tricky to lift out of the water while under way, so you need to slow right down first. That makes sense, but having three control lines like the Swi-Tec can be confusing and untidy. Save Marine's control arm allows the lines, blocks and jammers to be kept neatly in one place.

Better still, the SailGen and DuoGen only have a single control line.

The tester's final 'top choice' was the SailGen (or the DuoGen for those needing wind power on arrival); however Save Marine's innovative H240 was a very close runner up.



BELOW
Save Marine says its bulkier impeller head actually reduces drag