

The marine wind generator remains one of the most effective methods of charging your batteries while you're away from the grid. Continuous refinement over the past couple of decades has improved them no end, particularly the introduction of permanent magnet, brushless alternators, CAD-designed aerodynamic rotor blades and smart, multi-stage charge controllers, all of which help to make the latest devices more powerful, quieter and much more efficient.

Three-bladed rotors have become increasingly popular. Although early models were quite noisy, smart CAD-designed blades have considerably reduced the thrumming and whistling sounds by removing the turbulence around the blade tips. Furthermore, the use of more efficient, low-cogging (less initial friction) permanent-magnet alternators has also allowed blade speeds to be reduced, further limiting ambient noise levels.

CHARGE CONTROL

It's all well and good decreasing start-up speeds and increasing alternator outputs, but if the power generated is not controlled wisely and efficiently then such improvements are all to no avail.

WIND POWER

After a flurry of recent technological developments, *Duncan Kent* compares the latest high-output wind turbines

Traditional regulatory systems divert any unwanted power to large, wire-wound 'dump' resistors, which dissipate the excess energy through heat. While this method works, it's fairly unsophisticated, wasteful and not suitable for hot climates. In a similar, but a more energy-efficient vein, you could at least divert this excess energy to a 12V water heating element.

However, the safest and most efficient form of regulation is to incorporate a modern smart 'charge controller'. These enable the wind generator to act rather like a modern shore power battery charger, taking the raw power from the alternator and extracting the best charge available. They are often multi-stage devices, employing a bulk/absorb/float regime to ensure your batteries are fully charged. Some even offer Maximum Power Point Tracking (MPPT) – a system that optimises output using clever software.

Though not cheap, models such as Marlec's HRDI and Silent Wind's latest charge controller also offer an informative LCD panel, which lets you know exactly what's going on in real time. The latter even offers Bluetooth connectivity for monitoring via a smartphone or tablet. Both allow the addition of solar panels and the HRDI has separate outputs for engine start and service battery banks.

BRAKING

At some point, either to prevent damage in an oncoming storm, or simply to carry out maintenance, you will want to stop the blades spinning. Manufacturers achieve this in different ways. Attaching a short lanyard to the tail fin will enable you to safely turn the turbine blades out of the wind to

RIGHT
Today's wind generators are quieter and much more efficient than their predecessors

stop them rotating. Better still, most can be electrically 'braked' by shorting across their output using a high-current, two-pole switch, slowing the rotation significantly and making it safe to tie the blades off. Unusually, the Superwind incorporates a 'kinetic' control, where the blades feather at wind speeds above a certain level.

ENERGY DERIVED

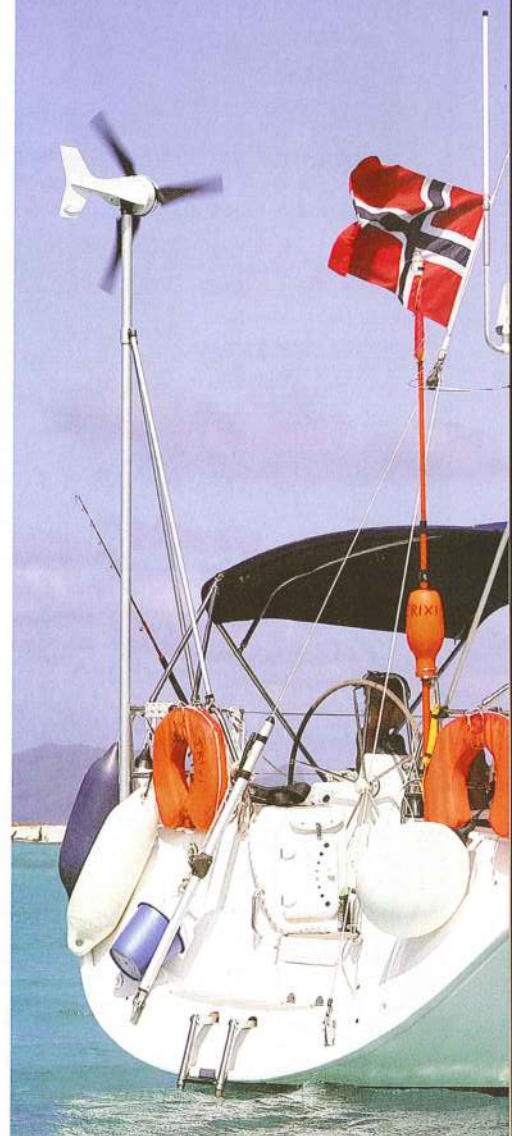
Manufacturers often confuse matters by quoting output figures in ambiguous ways. Some use watts and amps, others amp-hours or watt-hours. Some even quote 'expected' output over a period of time, as if they know the wind statistics where you'll be using it. Finally, many use figures obtained under laboratory conditions, often with no battery loads connected. Rarely do any of these equate to reality on board a cruising yacht.

Most produce a 'charge graph' of sorts, but it's best to take most of these with a pinch of salt, particularly at the lower end (<10kt) of the scale, where outputs are generally pretty feeble. Myriad factors come into play when trying to calculate the collective energy supplied by one of these – start-up speed for instance. While the blades might start spinning in four knots of wind, the alternator will probably not start supplying an effective charge until the wind is blowing 8-10 knots. So, on a day when the wind rarely blows above a Force 2, it'll actually supply very little useful energy.

Tests carried out in wind tunnels do not reflect reality. While there might be a steady 15 knot breeze where your masthead anemometer is mounted, the blades of the wind 'genny' mounted just above the deck are unlikely to be getting such clean air.

* We have quoted actual figures obtained from tests over the past few years, where possible. For the Superwind, which we haven't yet tested, we have inserted the manufacturer's figures

MOST 'GENNIES' PRODUCE A CHARGE GRAPH OF SORTS, BUT TAKE THESE WITH A PINCH OF SALT...



MODEL DETAILS			PRICES		OUTPUT				OTHER		
Make	Model	Power	Turbine	Control	Start	12kt	18kt	24kt	Blades	Wgt	Regulator
Eclectic Energy	D400	600W	£1,350.00	£227.00	5kt	4.9A	9.9A	19.2A	5	17.0kg	Resistive
Leading Edge	LE-300	300W	£649.95	£189.95	6kt	2.1A	5.7A	11.6A	3	6.0kg	Resistive
Leading Edge	LE-450	450W	£899.95	£189.95	6kt	4.6A	10.4A	19.1A	5	8.0kg	Resistive
Primus	Air Breeze	300W	£1,169.50	Incl	6kt	5.1A	9.9A	13.7A	3	5.9kg	Braked
Rutland	914i	450W	£649.96	£78.50	5kt	2.2A	4.6A	10.6A	6	11.5kg	Braked
Rutland	1200	480W	£1,195.00	£155.95	4.8kt	5.8A	16.6A	31.2A	3	7.8kg	Braked
Silentwind	400	420W	£1,291.33	£410.42	5.4kt	4.2A	8.5A	19.7A	3	6.8kg	Braked
Superwind	350	350W	£1,528.75	£384.00	6.8kt	3.2A*	9.7A*	22.3A*	3	11.5kg	Resistive



AIRBREEZE
£1,169.50

This 12/24V, three-blade, self-regulating model is well-made and stylish. Its cast aluminium housing has an LED on the bottom that indicates the mode it's in. Permanently on means it's charging, but this changes to a steady flash when its electrical braking system cuts in and slows the blades down to a mere tick-over. The regulator not only activates when the wind speed is above 45kt to prevent overcharging, but it also monitors the battery voltage and applies the brake when a pre-programmed voltage (default 13.6V, but user-adjustable) is attained.

The Airbreeze is easy to assemble as everything is contained within the casing, requiring only a quick blade assembly before being ready to mount. It's not the most powerful and can be a little noisy in high winds, but it's very good value as you don't need to spend money and time installing an external charge controller.

Verdict: Easy to assemble, mount and operate, but noisier and less powerful than some

● ecopowershop.com



ECLECTIC ENERGY
D400 £1,350

Available in 12V, 24V, 48V and 72V versions, this five-bladed genny is very heavy and will need sturdy mountings. It incorporates a high-efficiency, 12-pole, three-phase alternator with twin stators for high output. Its regulator (£227) utilises a resistive load to dump unwanted power and it can also be braked using an optional park switch, enabling it to be tied off safely in a storm.

Although it's fairly straightforward to assemble, it's not made any easier by the sheer weight of the generator.

During previous trials it proved to be one of the quietest on test, started quickly and outputting an increasingly progressive rate of charge. It is also less prone to yaw from side to side than some, keeping head into wind to ensure a more stable output.

Provided its mounting can handle the loads, its sturdy build allows it to continue operating in very high winds, producing a staggering 50A+.

Verdict: Solidly engineered, very powerful and quiet. The flip side is it's heavy and needs dump resistors

● eclectic-energy.co.uk



LEADING EDGE
LE-300 £649.95

The fully-marinated, British-built LE-300 is available in 12V, 24V and 48V versions and is remarkably light, making it ideal for sailing yacht installations. It's also competitively priced, particularly if judged on a £ per watt basis.

The device is easy to assemble and light enough to carry in one hand. An integral rectifier produces a two-wire DC output and its efficiency has recently been improved with the fitting of stainless steel counterweights to offset the effects of pitching and yawing common on a yacht.

A run/stop switch is supplied that brakes the turbine by shorting its output. It can also be supplied with a dump load style regulator to prevent overcharging (£189.95).

The LE-300 is probably the quietest of all the three-blade models available, but it's also one of the least powerful.

Verdict: Light and great value, but with a lower output than many of the others

● leturbines.com



LEADING EDGE
LE-450 £899.95

Available with 12V, 24V and 48V DC outputs, the LE-450 is the most powerful turbine produced by Leading Edge that is small and light enough to fit to a yacht. Optimised for typical marine conditions and built from salt-resistant aluminium and stainless steel, it has been designed to perform especially well at normal, everyday wind speeds of between 8-15kt, yet is robust enough to withstand much stronger winds up to 35kt.

The alternator uses rare earth fixed magnets and has zero 'cogging', allowing the turbine to start quickly and to spin in the lightest of breezes. Furthermore, having five blades of advanced design allows the swing radius to be kept to a minimum and reduces wind noise noticeably, while its light weight allows it to be safely mounted on a mizzen mast or possibly even a stout spreader.

Verdict: Well designed, lightweight and good value, but needs manual tethering in over 35kt of wind

● leturbines.com



RUTLAND 914i
£649.96

Like its predecessor the 913, the six-blade 914i is used widely on both leisure craft and in commercial applications such as light buoys and beacons. Featuring Maximum Power Point Tracking (MPPT) – a system that makes the most of its generating power by optimising its output – this model offers 30 per cent more power than the 913.

An optional multi-stage charge regulator is available, which has an on/off switch and LED charge status indicators. It can also accept and integrate solar panels up to 160W.

The surprisingly cheap HRSI regulator (£78.50) works electronically to gradually slow the turbine in high winds or near full charge situations, rather than using resistive dump loads.

The 914 is quiet in operation and quick to start generating in light winds. Well made, its heavy metal hub acts as a flywheel, giving it enough momentum to smooth out the pauses during brief lulls in the wind.

Verdict: Quiet and inexpensive, with a smart controller. Relatively low output

● marlec.co.uk



RUTLAND 1200
£1,195.00

The recently-launched, three-bladed R1200 has been purpose-built for the marine environment and, when combined with the intelligent HRDi charge controller, looks to be one of the most powerful and efficient wind generators on the market. Thanks to a unique blade design this model also boasts a very low start-up speed and is very quiet, even at high wind speeds.

High rotation speeds and efficient alternator design results in plenty of raw power. Marlec's latest smart HRDi charge controller (£155.95) continuously alters the rotation speed of the generator, slowing it down as the batteries become more charged. It also incorporates the latest Maximum Power Point Tracking (MPPT) technology to optimise all the available energy produced and Pulse Width Modulation (PWM), which enables multi-stage charging to keep the batteries topped up. Other features include dual-battery bank control, an input for up to 250W of solar panels and an optional remote digital display.

Verdict: Powerful, well-made and with smart regulation. Has a wide rotation diameter

● marlec.co.uk



SILENTWIND 400
£1,291.33

A sleek and powerful three-bladed model with integral tail fin and hand laminated, UV-resistant carbon composite blades, wind tunnel tested to 65 knots for optimum performance. This model is well made using durable materials, so maintenance should be minimal.

The Silentwind is heavier than it first looks, mainly due to its high output, permanent magnet 420W alternator. Recent (2016) upgrades include a boost feature in the generator and a lower start speed thanks to its 'low cogging' design.

Available in 12V, 24V and 48V versions, its three-wire AC output connects directly to a recently upgraded smart charge controller with solar inputs, an LCD display, integral brake switch and Bluetooth connectivity so the user can monitor their battery status and charge from a mobile device or laptop. Furthermore, the new controller (£410.42) now consumes only 20mA itself, rather than the 100mA of the old model.

Verdict: High power output and a nifty Bluetooth smart controller, but all at a price

● technicalmarinesupplies.co.uk



SUPERWIND 350
£1,528.75

Available in 12V or 24V versions, the blades on this device are steeply pitched towards the hub to facilitate low wind speed starting and tiny fins along the blade length are said to make them quiet at high rotation speeds. The rotor blades also incorporate a kinetic control system designed to allow them to feather in very high winds. When hooked up to a suitable charge controller this self-regulating turbine can be left spinning in all weathers.

The SCR Marine charge controller option (£384) has two independent outputs, for start and service banks, although it does rely on the rather crude method of dumping any excess loads to two large resistors, which can get very hot if the device is left running in a gale.

Despite having a slightly lower output alternator than some, in field tests this device gave a very respectable performance in wind up to 15 knots, and provided serious amps in higher winds up to 28 knots.

Verdict: Light, well made, quiet and powerful, but expensive and reliant on dump load regulation

● mactramarine.co.uk