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From Windbugger to Air Breeze

Cruising boats are almost always short of electrical power. We learned this the hard way on our first extended cruise from Louisiana, in the USA, through the West Indies to Venezuela and back. In six months I killed two heavy battery banks and decided there had to be a better way of doing things. The resulting research culminated in the first edition of my *Boatowner's Mechanical and Electrical Manual*. Since then, we've always had powerful, and effective, electrical systems on our boats.

Given our predilection to sail in the Trade Wind belt, a wind generator has been a key component of our electrical systems. The first one was a 'Windbugger', built by a fellow known as 'Bugger Bob'. It swung a 6ft-diameter blade. In a 15-knot Trade Wind, it supplied all the power we needed but had no voltage regulator. In strong winds it wound itself up to speeds at which the blades could fly off from centrifugal force, and fried the batteries in the process. You had to climb up to it, turn it out of the wind to stall it, and muzzle the blades with a piece of line.

On one occasion, we hiked inland from Lago Isabel in Guatemala to bathe in a beautiful pool, into which a scalding hot volcanic waterfall cascades. While we were ashore, a violent wind came down off the mountains. Unfortunately, I hadn't tied off the Windbugger. I raced back to the beach, leaving my wife Terrie to follow with our two small children.

The boat was a mile or so out in the lake, dragging her anchor through the soft bottom in nasty, short, steep seas. I hitched a ride from a couple of fellows in a dugout canoe. As soon as I stepped aboard, I could smell the acid from the boiling batteries. It was a life-threatening exercise to climb up and muzzle the wildly gyrating generator. Subsequent disassembly revealed it had melted its internal brushes as well as cooking the batteries.

I replaced the Windbugger with a first-generation Air Marine from Southwest Windpower. This not only had an internal voltage regulator, but also had blades designed to flex and stall if the wind speed exceeded 25 knots. The first time we were able to test this feature was anchored off Fort Jefferson in the Marquesas. A sudden squall hit the anchorage. A noise like a howling banshee brought both of us flying out of the cabin, hearts pounding. The wind generator had reached its stall speed. Even in the squall, you could hear it clear across the anchorage.

Subsequent generations of the Air Marine were refined to make them less noisy, but nevertheless these wind generators have always had a significant noise issue. Many cruisers, myself included, have been willing to live with this because the output relative to the size and weight of the generators has

been impressive, and the voltage regulation feature has been really valuable. You have always been able to shut these generators down from inside the boat by throwing a switch.

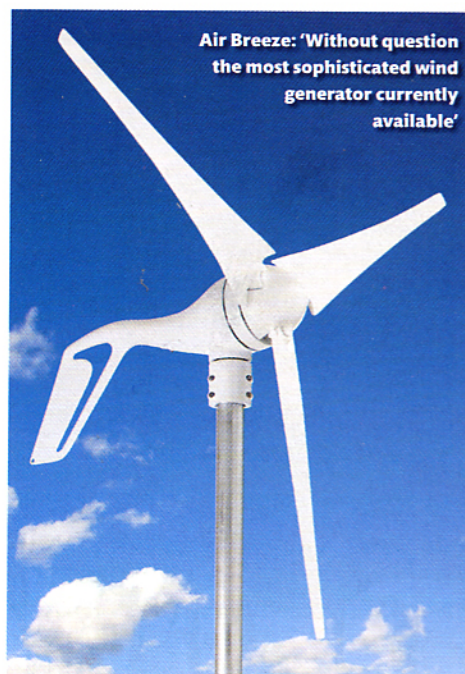
In the time it took the Air Marine to evolve through three generations, the solar panel world spent a lot of resources developing sophisticated voltage regulators that optimise the output of a solar panel. The technology is known as 'maximum power point tracking' (MPPT). In essence, a panel is disconnected from its batteries and allowed to reach a voltage that maximises its output in any given set of conditions. This voltage will be different to the voltage of the batteries that are being charged. A DC-to-DC converter is used to apply the panel's output to the batteries in a manner that maintains the panel at its optimum voltage.

Wind generators can benefit from similar technology. Unless a wind generator has variable-pitch blades – and marine ones don't – the camber of the blades can only be optimised for one blade speed. To maximise the wind generator's output, the blades must be allowed to reach optimum blade speed regardless of the wind speed, and then kept at this speed. The way to do this is to disconnect the wind generator from the batteries it is charging,

let it run up to speed, and then apply whatever load will hold it at this speed. In light winds, only a small amount of energy will be extracted from the wind generator but in strong winds, considerably more. A DC-to-DC converter is used to apply the wind generator's output to the batteries in a manner that maintains the wind generator at this optimum speed.

The latest wind generator from Southwest Windpower, the 'Air Breeze', has voltage regulation with similar properties to MPPT. It also has redesigned blades that are much quieter than those of the previous generations. It is, without question, the most sophisticated wind generator currently available for boat owners. As I type these words on my laptop, anchored off Georgetown in the Bahamas, an Air Breeze is quietly humming away in the background, powering the boat's electrical system.

Wind generator technology has come a long way since the days of Bugger Bob and our Windbugger. ▲



'I could smell the acid from the boiling batteries'

