Wind vs. Solar

Evaluating alternative energy sources for marine use

By Ellen Massey Leonard

Whether setting out to cross an ocean or planning to spend a couple of weeks along a coast, every cruiser asks the question: How will we generate power? Many people solve the problem the old-fashioned, and often inefficient way, with the diesel engine's alternator. Others use separate fossil fuel generators, diesel or gasoline. But more and more cruisers today are opting for greener methods—wind generators and solar panels. My husband Seth and I tried both during our global circumnavigation aboard our 38-foot cutter *Heretic*, and ultimately decided hard solar panels were right for us.

When we departed Maine on Halloween 2006, we were equipped with two flexible solar panels that we could unroll on the cabin's coach roof. We were excited about them, but were quickly disillusioned. The panels produced at most half an amp, and by the time we reached the Bahamas in mid-December, they were starting to delaminate. Perhaps the technology for rollable panels was not yet fully developed in 2006, or perhaps we were unfortunate enough to have picked a substandard manufacturer, but we were soon left with only the engine to charge our batteries.

WIND GENERATORS

So we turned to wind. While in Panama City after transiting the Canal, we ordered an Air-X Marine wind generator. A friend of ours, an Englishman circumnavigating solo, had expounded the virtues of his, claiming that with its high output he could easily power a small refrigerator and use his laptop. *Heretic* was what many sailors would consider a primitive boat. Seth and I had no refrigeration, no chartplotter, no pressure water, no watermaker and certainly no air-conditioning. All we needed to run electrically was our tricolor, black-and-white GPS, and single sideband radio for weather files. The Air-X would provide plenty of power for that.

It did, for the next 7,500 nautical miles to New Zealand. But we also discovered the foremost problem with wind generators—they are inconsistent. Whenever we were at anchor facing into the wind, or on those rare occasions that we sailed to windward, Seth and I were pleased to find that the generator produced more power than we knew what to do with. But when sailing off the wind, heading with the trades across the Pacific, the apparent wind became so light that the Air-X only generated enough electricity to power our LED navigation lights and GPS. For many boats, this would be a problem, although for us it did manage to cover almost all of our needs. We were happy that the Air-X had made us independent from our engine, and we even installed a low-draw Engels fridge to take advantage

of the times when we had an excess of energy.

In New Zealand, however, we discovered a second issue with our Air-X when a very strong gust of wind damaged its circuit board. The 12-volt Air-X has an automatic shutoff feature so that when the voltage goes above about 15, it stops producing power. But the response lags the actual voltage of the system, allowing for the voltage spike that destroyed our circuit board. At first we thought this was an aberration that would only cause us the hassle of a day's work. The wind generator was still under warranty, so the new circuit board arrived free of charge. We disassembled the Air-X and installed the new circuit board, and whirred with the comforting sound of power generation once more.

Unfortunately, the problem was not an aberration. It happened three more times en route from New Zealand to Australia, and twice more we replaced the circuit board. The last time, however, the warranty had expired, so we finally faced up to the underlying problem. Our battery bank was too small. It did not provide resistance enough to keep the voltage from spiking in the lag between the arrival of a gust and the activation of the wind generator's self-shutoff function. We had three glass-mat house batteries totaling only 270 amp hours, and we estimated that 400 amp hours would be necessary to prevent the generator from damaging itself in strong puffs. Our English friend had a 400 amp hour house bank and had no problems with his Air-X in strong winds.

BACK TO SOLAR

Instead of installing new batteries we decided to switch back to solar, but this time to hard panels. In Australia, Seth and I purchased an 80-watt BP polycrystalline hard panel and two 20-watt hard panels, a Sunsei thin-film and a BP polycrystalline. We installed the 80-watt and the thin-film 20-watt on the stern pulpit, and the polycrystalline 20 watt atop the cabin roof. We found that the two polycrystalline panels were the most productive, but all three together generated plenty of power for our little Engels fridge, lights and electronics. Even on a cloudy day they produced some electricity, and now instead of anchoring in the windiest spots, we could luxuriate in the quiet calm of sheltered coves.

So, wind or solar? Wind generators often produce lots of energy. In locations where there is a consistent, strong breeze, such as the Tuamotu Archipelago in the South Pacific, a wind generator will provide significantly more amp hours over the course of a day than a solar panel. A solar panel, by its nature, can only generate while the sun is out, whereas a wind generator can run for 24 hours continuously.

Let's assume you have a good quality, polycrystalline 120-watt solar panel and an Air Breeze (the successor to the Air-X, which operates more quietly and features a lifetime warranty). The sun shines all day and the wind is blowing at a consistent 17 knots. If it is clean and has a good angle to the sun, the solar panel will probably average six amps from 8 a.m. to 4 p.m., eight hours. Therefore, it provides 48 amp hours over the course of the day. The Air Breeze, however, puts out 12 amps in a wind speed of 17 knots. Since it can run through the night, the wind generator provides 288 amp hours that day. Even if the wind were only blowing at 12 knots all day, the wind generator would still produce 3.3 amps for 24 hours, providing 79.2 amp hours. Under ideal conditions a wind generator is an excellent way to produce energy, but to prevent the voltage spike problem we encountered, it is best to couple it with a large battery bank.

Due to the inconsistency of the wind, many cruisers have solar panels in addition to their wind generators. Or, like us, they have exclusively solar panels. There is a whole range of solar panels on the market, and it is useful to know which are most effective. Flexible roll-up panels such as we originally had are generally not worth the money. In 2010, we met a couple with similar panels who, after their engine died, were so unable to charge their batteries with their rollable panels that they couldn't power up their GPS or even operate the propane solenoid for cooking.

There are semi-flexible panels on the market, however, that do have decent output. They are quite robust, more so than hard solar panels, since they are often manufactured to withstand a person's weight. Their primary drawback is that they take up a large amount of space on your boat for the energy they produce. Thin-film hard solar panels, while cheaper than polycrystalline, have the same disadvantage. Our 20-watt Sunsei thin-film panel was only slightly smaller than our 80-watt BP polycrystalline panel. In terms of space required on deck, wind generators are the most efficient, having only the footprint of their mounting pole. For solar modules, polycrystalline panels are the best in terms of output and space per watt, but they are also the most expensive.

PRICE POINTS

That said, energy produced by hard polycrystalline solar panels is in fact cheaper per amp than that produced by the Air Breeze wind generator. You can find a good 120-watt panel for $260. Southwest Windpower, who manufactures the Air Breeze, sells it for $1,195. The polycrystalline panel produces about six amps while the sun shines, leaving us with a price

per amp of $43.33. The Air Breeze produces about 12 amps at a 17 knot wind speed, which equates to a price per amp of $99.58. If we apply this to amp hours per day, the price is instead marginally cheaper for the Air Breeze: at 17 knots we get 288 amp hours for a price of $4.15 per daily amp hour, while for eight hours of sunlight we get 48 amp hours for $5.42 per daily amp hour. This of course assumes there is a steady wind.

The other advantages Seth and I found with hard solar panels are more subjective. We found them more consistent and were grateful not to worry about power on light, downwind passages. With fewer moving parts, the panels were less liable to break and they did not pose a danger to birds. On our final passage with our Air-X, from Vanuatu to Cairns, Australia, the fast-moving blades had broken the wing of a curious juvenile booby, a terrible experience for me since the wildlife I see offshore is one of my greatest delights in sailing. Once we made the switch to solar, many birds landed on the panels for a rest instead: a tiny plover off Darwin and a noddy off South Africa. Finally, although both Seth and I had grown used to the whirring of the Air-X, the new-found silence of the solar panels was a pleasant dividend. BWS

Ellen Massey Leonard recently completed a four-year 32,000-mile circumnavigation with her husband Seth aboard Heretic*, their 38-foot semi-custom cutter. Their voyage took them westabout on the Milk Run Route via Panama and the Cape of Good Hope. Now based in landlocked Switzerland, Ellen is working on a book about their circumnavigation.*

To determine price results: Price/Amps= $ per amp (e.g. for solar panel: $260/6=$43.33; for wind at 17 knots: $1195/12=$99.58). Price/Amp hours=$ per daily amp hour (e.g. for solar panel: $260/48=$5.42; for wind at 17 knots: $1195/288=$4.15).