

Shaft generators: problem or solution?

When making ocean passages, a yacht should never have to run an engine or generator to charge its batteries. Ideally, use a big modern wind generator when the wind is forward of abeam, and a shaft generator when the wind is aft of abeam.

Our family yacht, the engineless *lolaire* built in 1905, went through a number of ways to generate power for lights and instruments. In 1975 we tried a small wind generator developed by Hugh Merewether, mounted on the mizzen masthead. It was too small to provide all our light, but did provide most of it. Hugh developed what became the Ampair wind generator. With wind forward of the beam these put out large quantities of electricity... although some brands also produce an insufferable noise level.

Later, I attached an outboard prop to a 3ft iron rod, attached to 50ft of ½in braided line, attached this to a cannibalised wind generator and hung the whole lot off the stern pulpit, and so a towed generator was created, evolving into the Aquair. *lolaire* did five transatlantic passages with all electricity provided by Ampair wind and water generators.

Recently two water-powered, transom-mounted generators have come on the market: Watt & Sea, and Sail-Gen. Both put out massive amounts of electricity from a small propeller. But they are expensive, easily damaged, and difficult to fix. In contrast if a towed generator hits something or picks up a net, the break link will break, you lose the prop and 50/60ft of line, but with a spare prop and line you are quickly back in business.

A towed prop using a Watt & Sea-style generating unit could produce enough amps for even the most hungry electrical system. It could be easily repaired at sea by replacing the towed prop and line if fouled and lost.

An alternative for boats with engines

Generator	Typical output at 12v	Possible cost (exc. regulators)
Wind	up to 25 amps	£1000
Towed	6-7 amps at 6kt	£1100
Transom water	10-40 amps at 5-8kt	£3000 (Watt & Sea)
Shaft	30 amps at 5kt	Feathering prop (up to £2k) plus alternator, parts & time

is a shaft generator. *Lang Zyne*, a 36ft ketch, sailed around the world in 1948/49 with all electricity provided by a generator belted off the freewheeling shaft. This generator ran the lights, autopilot and refrigerator! Other installations came along over the years. Most worked well and cut down or removed the need to run a generator on passage. At certain speeds some props might cavitate and create a lot of noise, and when batteries are fully charged, if the shaft is locked, the prop then drags. This could be overcome with a direct drive to a feathering prop.

At this time shaft-driven alternators are strictly a DIY project.

You need to get a hand-held tachometer (about £40), put a dot on the shaft and **measure the shaft speed** when you are sailing at a normal passage speed. As a rough rule of thumb, a trailed prop spins at 50% of the rpm needed to drive the boat at the same speed in calm water and no wind. On *Lone Star*, a 56ft ketch with a 23in Hunestadt variable pitch propellor, the figures were:

6.3kt	301 rpm
7.6kt	366 rpm
8kt	390 rpm

Find an **alternator that cuts in at low rpm**. Check the cut-in rpm of the alternator, your shaft speed at passage speed, and figure the pulley sizes for the shaft and alternator. Two automotive alternators, an original and replacement, may be cheaper than one marinised one!

For **drive belts**, we have found the best are the green ones with holes. Cut the belt to length and join with two metal plates and two screws.

When the prop is freewheeling the blades are flipped into reverse and it is pulling the shaft aft. Check with your gearbox manufacturer. **Will the gearbox accept this reverse pull** over a long period of time? Or should a thrust bearing be installed on the shaft to absorb the reverse thrust?

Use a **feathering prop** that when put in reverse will lock in reverse. Start the engine, put it in reverse, then neutral, prop will freewheel driving the alternator,



This installation ran successfully on a 42ft catamaran with twin 34hp Yanmar engines. Unfortunately sideways pull on the propshaft disturbed the engine mounts, so it is now being rebuilt with a strut from the engine to the alternator. See lifepart2.info/equipment/prop-shaft-driven-alternator

shut engine down. Once batteries are charged, put the engine in gear, in ahead, then hit the starter, prop blades will flip to drive ahead but since the engine did not start, and it is in gear, the blades will feather.

Currently shaft generators are rare and problems have not been ironed out. If the Clipper Race or Volvo Ocean Race mandated water generation, or the World Cruising Club endorsed them, the evolution would be rapid and effective.



Donald J Street

We asked the members of RATS for their comments on Don's proposal. A selection of thoughts are below. All agreed that towed generators work well and rigidly-mounted versions are effective but expensive. If you have comments or experience, please write to us at Cruising.

There are serious practical objections relating to: space available; gearbox suitability; the high number of revs to excite the alternator; friction etc. Even with proof of a viable set-up, at best it might only be practical on a limited number of craft.

The pitch of the prop would be wrong. Noise and wear on bearings and gearbox would be considerable. It wouldn't work on a folding prop, valuable to avoid flotsam at sea. And do we want mods where there really isn't space, or electrical stuff in the bilge?

However, a generator using the flow of water past the boat is a very fine device, and Don is a pioneer to whom we owe a debt of gratitude.