

THE SOUND OF SILENCE





An electric auxiliary is becoming a viable alternative, writes
KEVIN GREEN

Multihulls, and catamarans especially, are spacious platforms for renewable energy sources. So, once you've upgraded the household systems, as detailed in my previous article (January 2022 issue), the next step could be replacing the donks with electric motors. This is a major step, so not to be taken lightly, given the relative complexities that can ensue. However, the growing choices of brands and the wider spread usage of electrical technologies means there is a lot of marine specific expertise to call on nowadays. For instance, there's plug&play installations allowing electrical inboards to fit exactly on the engine mounts of the old donk; or sail-drive transmissions that simply fit into the hull slot.

However, you generally get what you pay for, advises Steven Mullie from Eco Boats Australia: "People need to understand there is a big difference in quality in some of the cheap e-propulsion kits offered online and lithium cells from China and quality motors and marine grade lithium battery set-ups that companies like Eco Boats sell. The price tag is often hefty (like for a Tesla car for example) but that is because suppliers like Torqeedo, Bellmarine and others have spent many years testing and developing products that will work in a marine environment long-term. Naturally, people can cobble their own system together from an old forklift motor and for an able enthusiast that might well be the way to go (see Sailing Uma on YouTube) but that is not the area we operate in. We supply the best available brands of proven products that come with a warranty and that work properly even for a novice or not very technical end-user."

ELECTRIC BOAT BUILDERS

Many of the leading yacht brands – such as Hanse, Dufour, Arcona, Delphia, Elan, Beneteau Group and others – have released hybrid models. In particular, Beneteau's massive R&D resources has recently been demonstrated in one of its catamaran divisions – the Excess brand. A catamaran's generous deck space makes it particularly good for renewable energy sources such as solar panels and wind vanes to charge stored power.

Of course at this early stage there remain challenges. Battery costs and lack of mileage range are major limiting factors with electric. Yet as lithium-ion batteries prices fall, along with renewable sources such as solar panels, these challenges are reducing. Other advantages

The sound of silence, as found on the Silent Yachts 55 which is purely solar powered. Image Silent Yachts



TOP: The hybrid Excess 15 was a DAME award winner at METS 2021. This 48ft sailing catamaran has two Deep Blue Hybrid 50kw engines, a bank of lithium batteries and a backup generator. Renewable energy comes from the rotating propellers and solar panels. Cruising sailors would also fit a wind generator, to use all the natural elements. *Image Excess*

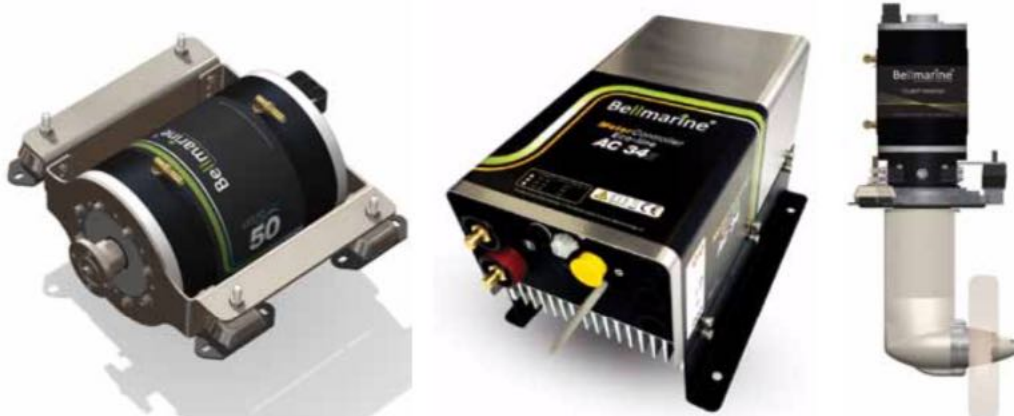
ABOVE L-R: The Torqeedo Deep Blue 40kWh BMW i3 battery. *Image Torqeedo*; This OceanVolt saildrive system was fitted to a 38ft race yacht in 2016. *Image Kevin Green*; The ePropulsion Spirit 6 outboard separates into several parts for easy stowage. *Image ePropulsion*

include simple solid state motors, very little service costs and the incredible charging capabilities of lithium batteries, compared to lead acid.

The significance of electric boats was illustrated at the 2021 Cannes Show by having an entire area of this prestigious event dedicated to them, in all their forms, which even included foiling powerboats. The world's largest recreational builder, Group Beneteau, is planning an electric range of its Delphia marque. Interestingly, I was asked a few years ago to use a Delphia canal boat in France for a week. The one downside I found that spoiled the tranquilly of the Canal Du Midi was the growl and stink of the diesel engine, so imagine how serene it would be to glide quietly along, then nudge the riverbank where a charging unit simply recharged as you slept?

RISING ELECTRIC TIDE

Momentum away from ICE (internal combustion engine) vehicles is gathering pace, as seen in leading industries such as car production. For example, major marine electric engine builder Torqeedo's Deep Blue



ABOVE L-R: The Bellmarine Ultimate Ultimate shaft drive motor comes in a power range of 16kw-35 kw. *Image Bellmarine*

The Bellmarine Controller manages the system and converts DC/DC. *Image Bellmarine*

Bets Marine in Queensland is fitting Bellmarine 15kw Sailmaster drives to this Leopard 42. *Image Kevin Green*

model is very nearly the same as that found in the BMW Series 315i3. Engineers describe the potential of a vehicle by measuring its 'energy density', which is the maximum mileage available from its on-board energy sources.

So, for instance in car terms my Subaru Outback can run for about 750km on one tank of petrol, while the Smart car model EQ can only go about 80km on one charge. Electric systems and their batteries are fairly heavy in relation to hydrocarbons and do not store energy nearly as efficiently per unit of mass.

Having said that, comparing like-for-like is not really fair on these different energy sources, so when considering replacing that dying diesel with an equivalent electric motor there are several factors to take into account. For instance, sails remain your main propulsion, so the retro-fitted electrical motors are strictly auxiliary power. They will never have the range of a diesel, so have to be used differently. Some basic principles apply of course, such as the ability to power the vessel to about 60% of its hull speed. To do this, rough estimates advise 3hp per ton but of course vary with the efficiency/drag potential of the vessel. So, a lightweight carbon catamaran or trimaran will arguably require much less power than a heavy GRP flybridge cruising cat that also creates lots of windage.

RECHARGING AND STORING

Energy for recharging the electrical motor is a key part of the equation. For dayboaters the choices are easy: fast charging stations, such as the European

JARGON

Power-to-weight ratio – an important consideration for engine replacement.

Displacement speed – ideally reaching 60% for an e-solution

Energy density – the stored power of a vehicle

ICE – (internal combustion engine) vehicles

Kilowatt-hour – Energy expended in one hour by one kilowatt of power

Parallel hybrid drive – a secondary e-power supply (for harbour use) to main diesel engine

Regeneration – ability to recharge on the move

Level 1 Charging (slow) AC – Charging of 110-120V of alternating current (AC).

Level 2 Charging (fast) AC – Charging at 240 AC

Plug&play motor – simple e-replacement installation for diesel

Serial-hybrid drive – when a generator can run along with e-power

Transmission – a critical component in the efficiency of any electric motor system

Water or air cooling – the choice for electrical motors



TOP LEFT: This was an early electrical motor used on the Silent Yachts catamaran I steered in the Mediterranean. *Image Kevin Green*

TOP RIGHT: ePropulsion CEO Danny Tao claims his company to be one of the largest e-outboard suppliers and received millions dollars of investment in 2020. *Image ePropulsion*

ABOVE: This Arcana yacht uses an Oceanvolt motor with solar panels on its sails. *Image Oceanvolt*

Aqua Super Power company who plans to roll-out to major cities in Australia. For bluewater sailors, this is not a reliable option (yet) so renewable energy is required. Typically in the form of hydro power, wind generators and solar but hydrogen is another source being evaluated. Taken together, and in ideal conditions they can propel a vessel in perpetuity. Of course we don't always have ideal conditions, so hybrid power, like the newly launched Excess 15 hybrid catamaran is an option. This 48 footer uses a diesel generator to supplement the other charging methods when necessary.

Voyaging sailors and racers in global events like the Vendee Globe and Mini Transat use hydro power extensively because the turning of the auxiliary propeller shaft, or a separate unit like the popular Watt&Sea, gives a reasonable ampage at 6kts

and above. Leading provider Oceanvolt was a DAME Design Award winner at METS Trade (the global marine industry gear show in Amsterdam) for its ServoProp hydro-generating variable pitch saildrive. The ability to recharge at sea is available on inboards and saildrives by Torqeedo, Bellmarine and several others. METS 2021 showcased electric solutions for boats of every size. Ranging from lightweight and waterproof electric outboards to high voltage and low voltage inboard units.

The final part of the e-equation is storing the power in batteries. Lead acid batteries are cheap and reliable. And if used properly do 600-700 charge-and-discharge cycles with about seven years usage. Alternatively, lithium batteries are generally 50% lighter, can offer up to 3,000 charge cycles; and current estimates give them a lifespan of about 10 years or more. Car manufactures nowadays typically give their batteries eight year warranties.


INBOARDS

The first electrical boat I ever steered was powered by a forklift truck motor. It was one of the Austrian designed Silent Yachts which used only solar energy and a diesel generator to top-up the battery bank on dull days. Relatively heavy and not an ideal bluewater



The Italian built Magnos e-550 powerboat uses a 30kw/h customised Torqeedo motor powered by a 23kw battery to reach maximum speed of 22kts (or 12 hours running at 5kts). Ex-factory price is €68,960. *Image Magonis*

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TOP: Aqua Super Power chargers are installed in Europe and have plans for Australia. Image Aqua Super Power



ABOVE: A tiny ePropulsion motor on this paddle board. Image ePropulsion

CASE STUDY 2 ECO BOATS DAY SAILER

This is an example of relatively easy e-conversion. It's a four ton traditional wooden sailing boat, kept at a marina and used for day-sailing on sheltered waters. We replace its diesel engine with a Bellmarine Drivemaster Ultimate. It is probably more sensible to use lead-acid batteries. The weight of the new set-up, with small and light electric inboard and medium size lead-acid bank, is about the same as that of the heavy old diesel engine along with its fuel tank and lead ballast from the bow that was used to counterbalance the weight of the motor aft. For a lightweight racing yacht or multihull, where space and weight is a crucial factor, one might be more inclined to install a large lithium battery bank if the budget allows for it. www.ecoboats.com.au

boat because sailors like us require sails, yet it proved a point in the sunny Mediterranean, and could also do so in sunny Australia. The good news is the company now offers a kite-wing, to fly off the bow, so may pique the interest of sailors as well.

Recently, Silent Yachts has been boosted by the involvement of German car giant Volkswagen who announced a cooperative agreement with it. Strong synergies are obvious between the two, given the massive investment in electric power vehicles at VW and Silent's proven boats, the 55 and best-selling 60 models. The Silent 60 yacht is equipped with 42 solar panels resulting in 17kWp solar energy production. Four 60's are now under construction at Silent-Yachts production facility in Thailand and others at its base in Europe.

Car companies are investing heavily in research and development into electrical and hybrid power and this has a trickle-down effect elsewhere. Manufacturers are now flocking to the electrical motor market to join pioneering brands such as Oceanvolt, Torqeedo, Bellmarine, ePropulsion and others. For instance, traditional

generator maker Fischer-Panda now offers a range of inboard electric and hybrid systems; as well as sailpods. The technology behind these varies with the usage of brushless motors, variable voltages, water and air cooling.

Some of these leading marine e-brands – Oceanvolt, Torqeedo and Bellmarine – offer various auxiliary power solutions. A few use saildrives from marine companies such as Yanmar, allowing easy re-powering. Yanmar, Volvo Penta and others are of course also working steadily to grab market share while continuing to supply diesels. Volvo has just partnered with commercial electrical manufacturer Danfoss Editron. Danfoss is a maker of hybrid powertrain systems for heavy-duty and commercial vehicles and machines. The division's Marine Business Unit focuses on delivering electric systems to ferries, workboats, and superyachts in the marine sector, so an ideal partner for Volvo.

OUTBOARDS

An electric outboard is the easiest refit for any type of boat and again, the range of possibilities here is increasing rapidly. For example, in the past year two companies – Evoy of Norway and Vision Marine Technologies of Canada – have introduced electric outboards with more than 150hp and at least one more is on the way from Denmark's EP Technologies.

Leading outboard brand Mercury Marine is also planning to launch five electric outboard models by 2023.

Established Chinese builder ePropulsion manufactures sailpods and outboards while Torqeedo, Holland based Bellmarine and others offer products across the full spectrum. Torqeedo even offer a bolt-on water cooled sail-drive style box. CEO Danny Tao of ePropulsion says his company is the world's second-largest maker of electric outboard motors for small boats, shipping more than 6,000 units in 2020. In quarter three 2021 the company received 'tens of millions of US dollars' in investment, to further develop its range. Their products are available in Australia from Queensland dealership Betts Marine and ePropulsion Australia.

Elsewhere, a French manufacturer has created the Temo 450. It looks like a broomstick with a propeller on the end. The French maker claims 12kg of thrust from its 450W brushless motor's triple bladed propeller, which is about half the power of market leader Torqeedo's base product. Stored power comes

RIGHT: A Torqeedo saildrive unit - often can be retro-fitted into a diesel sail drive slot. Image Kevin Green



Islander 12 powercat ... progress report



Wayne Barrett Multihull Designs

Work is progressing well on the Islander 12 powercat, the photo shows the bottom shoe fitted to the hull.

Second half of the hulls will commence during the following week after which the two halves will be bonded together then rolled upright.

Materials are all foam and epoxy, the bottom shoe is from H130 high density foam with generous overlaps of glass at the spray rails.

More to follow in the next issue ...

- 12m power cat
- 10m sailing cat
- 6-9m trimarans

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TOP: This Whisper-Yachts 50 footer that launches in 2023 uses the Deep Blue system from Torqeedo. Image Whisper Yachts

ABOVE: The Bellmarine Sailmaster saildrives have been fitted to a Leopard 42. Image Kevin Green

from a 290W lithium battery and the stick weighs only 4.9kg so is easily carried to dinghies. Run time is 80 minutes at half speed. It sells for Euro 1,450.

For more information:
www.temofrance.com

LOCAL MARKET

An assortment of Australian companies have been offering electrical solutions for several years, including dealerships for the larger international brands already mentioned. Locally, there are projects such as the McConaghy built Frers designed Shearwater 57 which uses a 15kw Oceanvolt SD15 saildrive. It generates its own hydro power and weighs only 46.5kg.

In Queensland BB Electric Boat (www.bbelectricboat.com) is busy with several projects, boss Mal Betts told me. One includes re-powering a Leopard 42 sailing catamaran with two Bellmarine 15kW sail drives in a system that will also run house functions, such as cooking. The Bellmarine SailMaster is based on the same type of motor as the shaft-drive inboard range, coupled with a Yanmar SD25 saildrive leg with a 2:1 reduction and stainless steel motor supports. Many of these brands are designed to slot into the hull gap for regular saildrives, allowing relatively simple re-powering.

In NSW, Eclassboats (www.eclassoutboards.com.au) are building electric outboards from the chassis of proven leading brands such as Yamaha and Tohatsu. The chassis are purchased without the combustion engine. A simple idea yet ingenious in that it reduces building costs while creating powerful lithium battery powered outboards. The Kiama company is a collaboration between automotive engineer and experienced boater Ron Kelly and business woman Lynelle Johnson who allowed me to use their product at the Sanctuary Cove Boat Show.



The Oceanvolt SD15 has two versions: the standard Saildrive or ServoProp version – the latter uses hydro generation (200W at 6kts).
Image OceanVolt

"After 10 years in development we have launched a range of powerful, portable electric outboards made in Kiama. Although electric trolling (low power) pod motors have gained wide acceptance. Ours are a world-first for a true affordable replacement of polluting 2-stroke and 4-stroke outboards up to 15hp," said Johnson.

The batteries are in a separate box, about the size of typical petrol container, so can be up-sized according to power requirements. "We suggest a battery for a minimum of 30 minutes at wide open throttle. Which is about 90 minutes at mixed speeds as an entry-level package. But you can buy whatever battery combination you need."

The cost is \$5900 for a 10hp equivalent electric outboard, which the company say is an affordable option over the life of the motor, when fuel costs and service of a typical combustion engine is considered. Eclassboats also will consider trade-ins possible for an old outboard which can be converted to electric.

So, the bottom line is that there are plenty options out there to at least consider in the electric marine market.

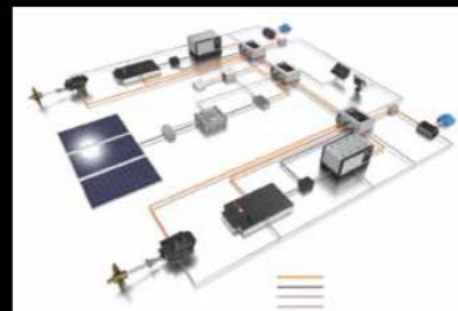
CASE STUDY 1 SPECIFICATIONS OF THE TORQUEEDO DEEP BLUE 50KW MOTOR AS USED ON THE EXCESS 15 CATAMARAN:

Model: DB50i 1400
Power: 50kw
Torque: 343nm
Transmission: Shaft Drive
RPM Max: 1,400
Weight: 80kg
Power generation: hydro
Cooling: Sea water

Battery- Torqeedo BMWi3
Voltage: 360
Performance: 55kw
Capacity: 40kw/h
Weight: 278 kg
Dimensions: 1660 x 964 x 174mm

Generator - 25kw Deep Blue Diesel
Power: 25kw
RPM max: 2200
Weight: 480kg
Dimensions: 1107 x 748 x 704mm

www.torqeedo.com/us/en-us/products/hybrid-drives



Torqeedo Deep Blue Hybrid 50kw motor (with BMWi3 battery) is the first fully integrated system that combines a hybrid drive system with the entire on-board energy management. Image Torqeedo/Excess