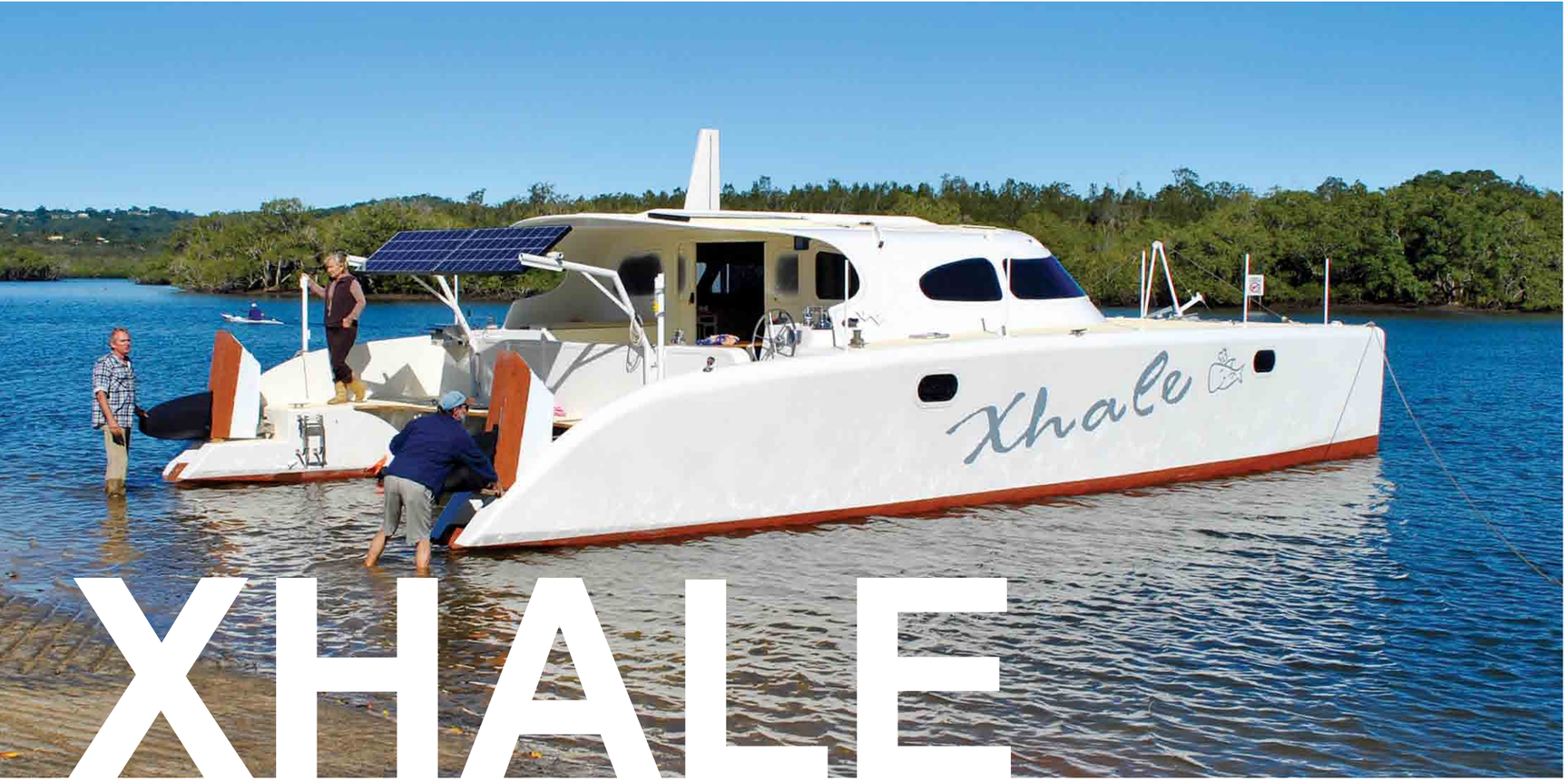


XHALE

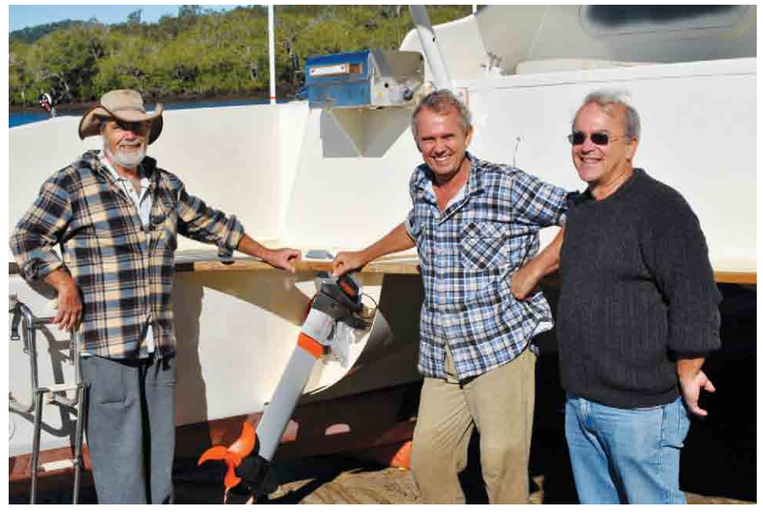
the green alternative

by Greg Smith and Neil Bochow

An advance towards green power for catamarans has quietly taken shape in a rural shed on the Sunshine Coast over the past 20 months. With the launching of *Xhale* by Neil Bochow of Cool Cats on May 31, 2010 diesel electric power may have moved significantly closer to becoming a realistic option for those looking for an environmentally friendly motoring option.

XHALE IS THE LATEST Oram 44C built by Neil and has been constructed specifically for diesel electric auxiliary power. The Oram 44C constructed out of Duflex panels pre-cut by ATL Composites has proven to be a light, strong platform with excellent sailing characteristics. The light weight, approx 3.8 tonnes dry launch weight, for a 13.2m catamaran with efficient wet surface design is a sound starting base for the use of alternative power.

Diesel electric propulsion for boats is not new but the offerings until recently have not proven to be as effective, efficient or reliable as we would like. Advances in electric motor, battery and generating technology in recent times have set a new benchmark. The technology being used by Neil is so new that he has had the opportunity to become involved in some of the development necessary to make the system both effective and reliable.



Floating easily on her lines. (left)

Greg Smith and Neil Bochow with Claude Desjardins, Torqeedo Importer – from left. (above)

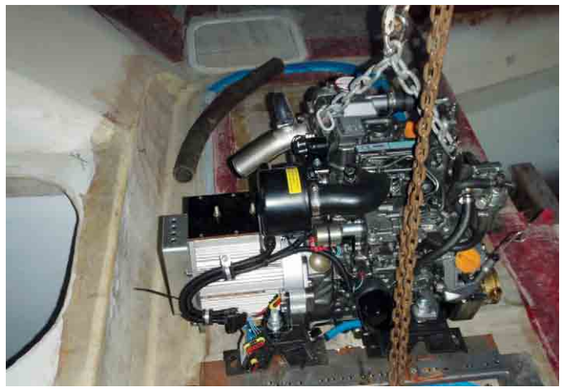
The Torqeedo range of electric motors came on the market in Australia about the time that Neil commenced *Xhale*. Initial research indicated that they may have been just what were needed for the *Xhale* concept. The Oram 44C was originally designed for outboard propulsion in order to provide a clean bottom profile for more efficient sailing as well as to provide shallow draft.

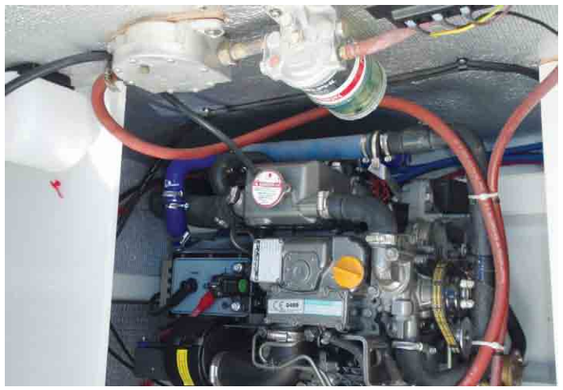
Before committing to using Torqeedo's, a trial was arranged using the then available 'Cruise 2' (roughly equivalent of 6hp 4-stroke petrol outboard) on *Outahia*, the first Oram 44C which happened to be in Tin Can Bay. Claude Desjardins, Torqeedo importer and Neil travelled to Tin Can Bay where one of *Outahia's* Yamaha 9.9 4-stroke outboards was removed and the Cruise 2 installed. The motor was light, compact and fitted exactly as a normal outboard so the transition was easy.

It was always expected that the Cruise 2 would be too small for the job but it was hoped that the trial would show sufficient promise to progress. A new range, the 'Cruise 4' (10hp equivalent), was just coming onto the market and it was these that Neil hoped to use.

The trial was sufficient to show that there was real potential in this alternative. In calm, still waters the single 'Cruise 2' moved *Outahia* (encumbered with a not so clean bottom and loaded for live aboard cruising) at three knots average.

Phase 2 was finding a suitable 48 volt DC generating plant. This set some challenges. Extensive online research and looking at alternatives at the Sanctuary Cove Boat Show established that there was not a lot about and those that



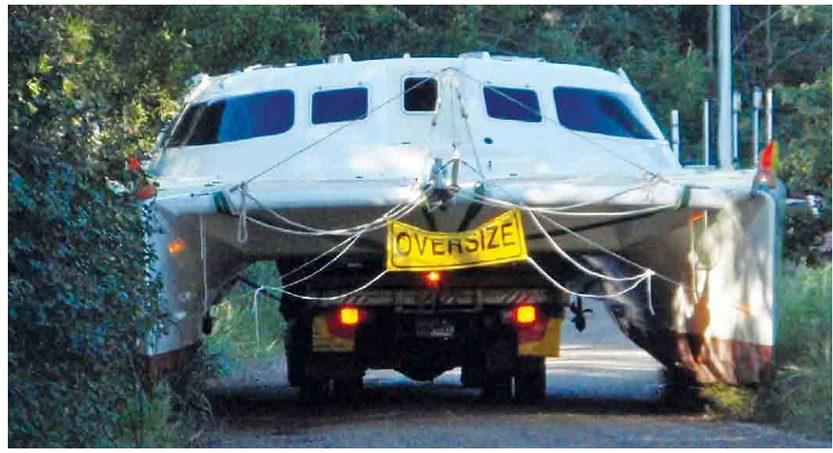


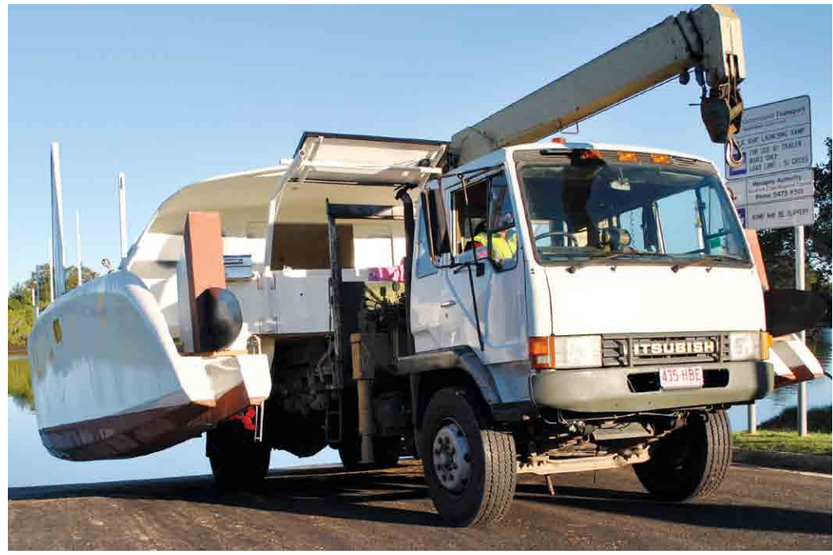
Diesel generator being lowered into position. (above left)
Diesel generator in situ. (above right)

seemed to be available, weren't, or did not match the hype. Sometimes strange coincidences happen in life and as it happened Neil's wife Carol mentioned their dilemma to a hairdressing client who said that his wife's employer was involved in building small generators on the Sunshine Coast.

Don Pulver, from Watts2C, who has had a long association with independent power generation, felt a simple solution could be found. Using his experience in the design and manufacture of generators, he started work on developing a 48V DC generator. To ensure reliability, Don built the system around the Yanmar 14hp 2YM15 marine diesel engine – an engine that had proved it self in marine applications. This was coupled with Don's purpose designed, fully sealed water cooled alternator.

Proud owners, Neil and Carol Bochow. (below left)
Green start to the journey! (below right)
***Xhale* on truck at ramp on fisherman's Road, Maroochydore.** (bottom)





Foremost in mind was that the gen-set had to be light, quiet and fuel efficient. The development was not without its challenges, but a successful prototype was built and installed. Christened the PowerMaker Cruise, it is a 5600Watt 48Volt diesel generator with full digital instrumentation, weighing in at 145kg.

The engine automatically adjusts the speed – from 1800rpm to 2600rpm – producing power requirements in the most efficient way possible. This provides a number of benefits including less noise (65dBA @ 7m), improved fuel economy and an extended engine life.

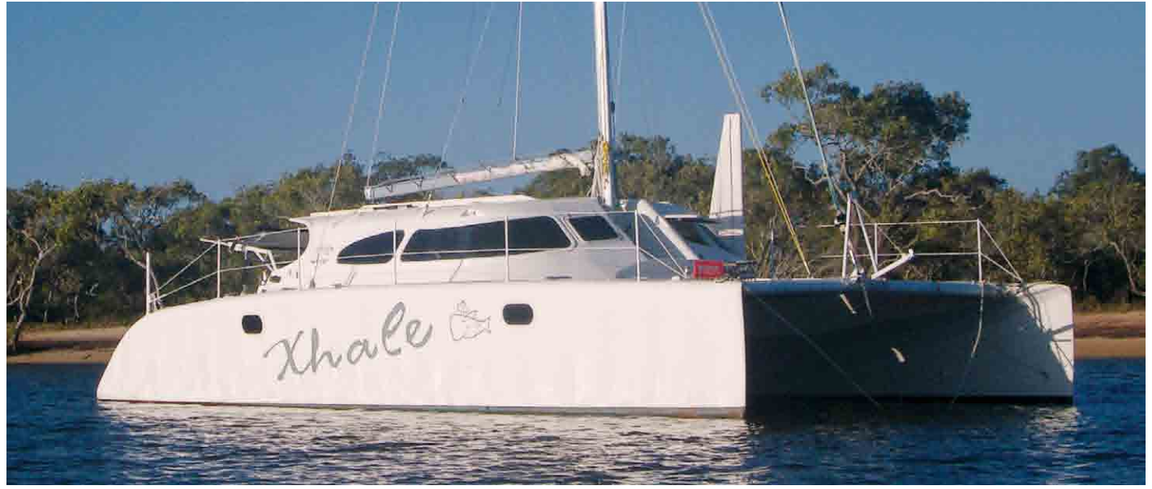
With a remote start and stop facility to automatically maintain the batteries, the PowerMaker Cruise is simple to use and extremely reliable. All service points are accessible from one side, making maintenance easy.

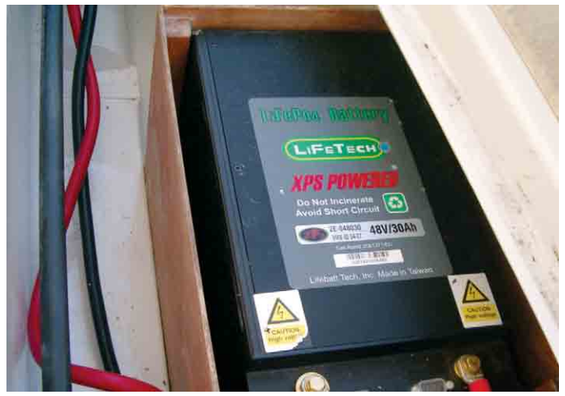
Battery type was the next decision. Alternatives seemed to point towards AGM technology but word was out that other alternatives were coming onto the market. Again online research and networking with others lead Neil to Armin Pauza from Lithium Batteries Australia who had begun importing Lithium Ion batteries.

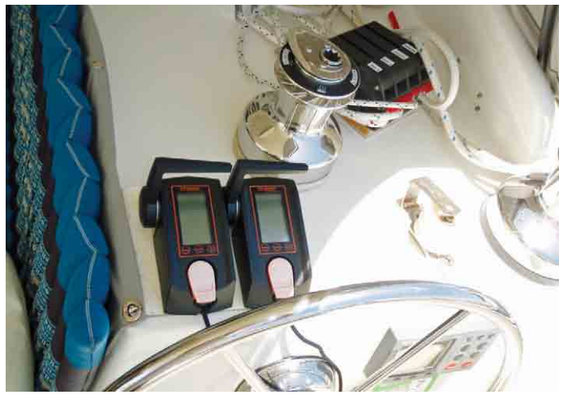
Whilst this technology had been on the market for a while there were limitations to charging rates/times. Fortunately again recent developments had overcome these issues and a new range of batteries had become available. Neil now had 48volt batteries rated at 30Ah per battery at a miserable weight of 19kgs per battery.

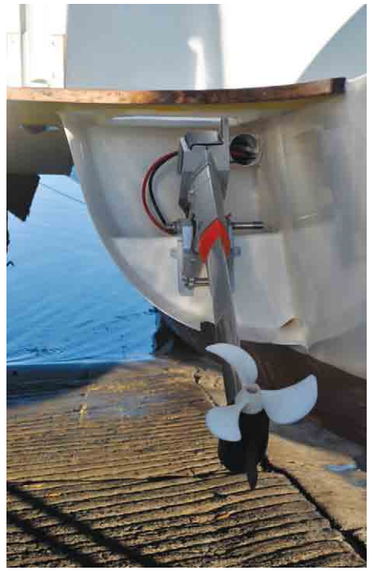
The lithium iron phosphate (LiFePO4) propulsion batteries from LiFeTech Energy are perfectly suited for boating applications due to their light weight, very high charging efficiency of minimum 95% (of particular advantage when charging by solar panels) and the fact they are very safe to use ie, they are totally maintenance free for life and do not produce any explosive hydrogen gas so can be fitted in any location in a boat without any requirement for venting.

Unlike lead acid/AGM batteries which should not be discharged greater than 50% of their capacity to ensure a long working life there is no such restriction with the LiFeTech LiFePO4 batteries. They can be deeply discharged without suffering any damage and can also be fast charged with









Xhale off Frazer Island. (top)
Lithium batteries in situ. (above left)
Toqeedo motor controls. (above right)
Torqeedo electric motor – transom mounted. (above)

a high power charger from a completely discharged state to greater than 90% fully charged capacity in only 15 minutes.

Software is available for the LiFeTech batteries that allow the user to plug a computer into the battery to see the internal battery cell voltages, total number of accumulated charge cycles and a log of any errors for over charge, over discharge and over temperature which are stored in the memory of the battery. The warranty on the LiFeTech lithium batteries is a very re-assuring three years / 3000 cycles (which ever comes first).

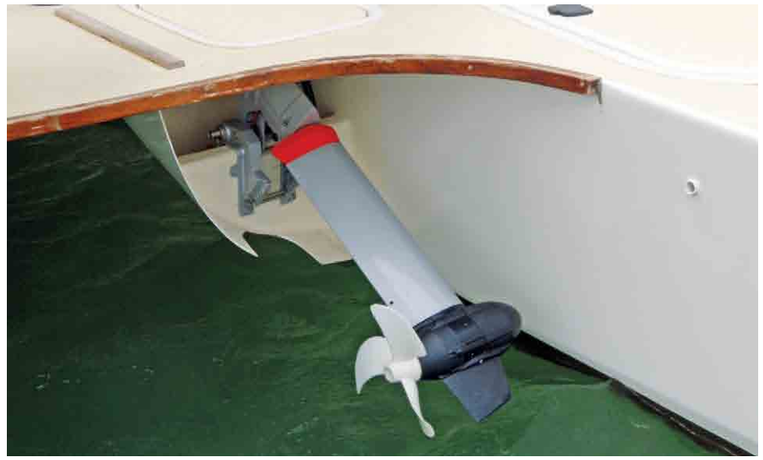
Phase three involved initial trials on *Xhale* by Neil and Carol. First of all *Xhale* had to negotiate a breaking Maroochy River bar. The motors proved to have more than enough torque/power to shoulder aside a couple of significant 'greenies' that popped up unexpectedly.

After final provisioning and some final fitout it was time to make the passage from Mooloolaba to Hervey Bay. Unfortunately the weather as it often does turned contrary so a lot of motoring was necessary to get to the Wide Bay Bar to make a safe crossing.

Motors, batteries and genset performed faultlessly all the way. Running both motors on battery alone at 1500 watts each until the battery voltage dropped from a top of 58.4 volts to 48 volts (about one hour) gave a cruising speed of about 4.5kts with plenty of power in reserve. As automatic start on low battery voltage had not yet been installed the genset was manually started putting out 100 to 115amps at 48 volts until the batteries were charged at the same time continuing to allow motoring at 4.5kts.

When the batteries were fully charged, the genset cuts back to supply motors at about 70amps and was happy to do this all day. The system enables the genset to be shutdown and run on batteries alone again for a full 95% of their charge. Without the 'Torqeedos' running, the batteries are fully charged in about 20 minutes.

Another nice feature of the system, particularly for catamarans because of weight sensitivity, is that the overall weight of the various components is very reasonable and can be located with weight distribution in mind. The



Torqeedo electric motor profile.

Torqeedo motors weigh 17kg per motor, motor batteries 19kg each, 48 volt genset 145kgs and house battery 20kgs. *Xhale* carries the motors just behind the back beam, batteries in the back beam with the genset and house battery located forward of the mast beam. Fuel for the genset is also centrally located giving good weight distribution to help keep those transoms clear.

The net effect is that *Xhale* can run for approximately 50% of her motoring time on battery power alone with subsequent savings in fuel and reduced noise. Of course *Xhale* is a very effective sailing boat so it is hoped that much of the time will be spent sailing not motoring but it is nice to think that the motoring that needs to happen will be quiet and green.

FACTS BOX

Design	Bob Oram 44C
Builder	Cool Cats
Hull Materials	ATL kit - Duflex
Motors	2 x 10hp Cruise 4 Torqeedo
Generator	Watts 2C14hp 2YM15 Yanmar 48 volt DC generator
Motor Batteries	2 x LiFeTech Energy 48V 30Ah LiFePO4 (XPS2E-048045)
House Battery	1x 75amp spiral wound AGM
Rigging	Allyacht
Deck Gear	Anderson
Sails	Ullmann fibre path mainsail (more coming)
Refrigeration	Trailblazer
Internal Layout	Twin queen size cabin - four persons – comfortable
Launch	Ken Hilton Truck hire with PVC pipes at local boat ramp