

Solar-powered narrowboat: Tested on the tidal Thames

Electric-boat *Shine* caused quite a stir at the Crick Boat Show. But can it cruise the tidal Thames using only solar power? **Mark Langley** finds out...

FACT FILE



Length 57ft
Berths 2
Engine 10kW electric
Price £POA
mothershipmarine.com

Environmental and pollution concerns are widespread, yet most new narrowboats still use inefficient diesel engines, churning out harmful exhaust fumes and being quite noisy. Going electric is the obvious answer – moving the source of pollution to further afield, such as power stations. However,

plugging into charging points is not very convenient for those on the move. Diesel-electric hybrids, where there is a diesel engine with a parallel electric motor (which also acts as a generator), is a compromise solution.

However, to go one further, Tim Knox of Mothership Marine brought a narrowboat to the Crick Boat Show this year – 57ft semi-trad *Shine* – that is

predominantly powered by the sun. While we have reviewed solar-powered, self-sufficient boats before, these have been wide-beams, where there is generous room for lots of solar panels to power the inefficient hull shapes.

To show that a narrowboat can genuinely run from the sun, we joined *Shine* at Teddington, for a journey down the tidal Thames to Limehouse – a route that can



The boat's subtle paint scheme belies its technical innovation.



The good lines of the 57ft Tyler-Wilson shell.



Heading towards Tower Bridge at 7mph purely under battery and solar power.

tax the best of conventionally powered narrowboats, never mind one that is solar powered. We also had a good poke around its innovative interior, though it is the propulsion technology that is of prime interest here.

Shell and exterior

Shine's hull was built by Tyler-Wilson in Sheffield and follows the conventional norms of their craft, with very little additional detail needed for the propulsion system. There is a good-sized locker in the bow, with a deep cockpit behind, giving plenty of space for crew to relax underway. Aft there is a conventional short stern deck, with the unsinkable chute-like weedhatch that Tyler-Wilson is famed for. Within the cabin side is an enclosed cockpit with two seat lockers either side. None of the lockers take gas cylinders – this is a gas-free boat, which means there is a lot of storage for cruising gear around the boat.



Ten 180W solar panels are mounted on the roof.



The hatch in the forward cockpit is GRP, making it much lighter to open to access the generator. It is also warmer to stand on than steel.

centrally down steep steps into the cabin, with the electrics cupboard to starboard and a general storage and hanging locker to port. Immediately you notice that *Shine* is not your usual run-of-the-mill floating cottage. There are bright white-painted ceiling panels, combined with a huge amount of reclaimed wood – and, most unusually these days, wallpaper panelling on the cabin side.

The galley has a fairly conventional L-shape to port with a straight section opposite. However, the standard domestic units have been given a makeover with reclaimed timber – which is a much more costly approach than just buying virgin wood, and boosts the eco-credentials of the boat, as well as adding character. The cupboard doors are framed with angle iron, painted grey, which works exceptionally well with the enhanced grain of the wood.

There is a decent-sized 230V fridge integrated, as well as a two-'burner' induction hob on the port side, with a combination electric grill/oven to starboard. The circular sink is right aft on the port side, so there is a large amount of free worktop space along the rest of the unit, culminating in a two-person breakfast bar at the forward end of the galley. A side door to starboard gives more ventilation but there are also deep rectangular windows, which, combined with the extremely light interior, keep the cabin bright even in dull weather. With no cupboards under the breakfast bar, there is a clear, uninterrupted view through the

The cabin is finished in a very attractive muted grey paint scheme, combining darker panels with lighter framing, and with the black hull paint taken up to the gunwales. Cream-and-yellow tunnel bands at the stern, with matching decorative panels on the bow and cabin roof, add a splash of colour, but overall this is a very low-key exterior. On the roof are only two matt black mushroom vents plus the stove flue. However, most of the roof is covered in solar panels adhered to the deck.

Galley

A bright yellow sliding hatch and two doors give access



A combination 230V oven and grill is versatile and economical.



An electric hob on this gas-free boat, with a sizeable fridge underneath.



The retro TV and log store disguises a modern LCD screen.

boat from the aft deck, which makes it feel very large inside.

Saloon

There is no fixed furniture in the saloon – instead, there is a pair of chaise longues, which give good seating and could be pressed into service as two single berths. The way the cabin lining materials have been fitted gives added depth, with the panelling under the gunwales having a planked look. The waviness of the trim panels on the ceiling adds to the rustic Arts and Crafts feel that has more than a touch of William Morris about it.

Forward in the saloon are two most unusual items. The wood-burning stove to port is based on a cast-iron fishing net buoy, converted by Hotpod as a “Nautibuoy” model stove, which is amazingly simple and interesting as a standout design – this is the sole source of heat on the boat. The stove itself sits in a tile-lined hearth. Opposite it is a retro-style TV, which has been upgraded with



The breakfast bar at the end of the galley run provides dining space, and the absence of a cupboard underneath adds to the roomy feel of the saloon.



The walk-through bathroom has a sink to port.



Galley units are conventional carcasses, topped with reclaimed wood.



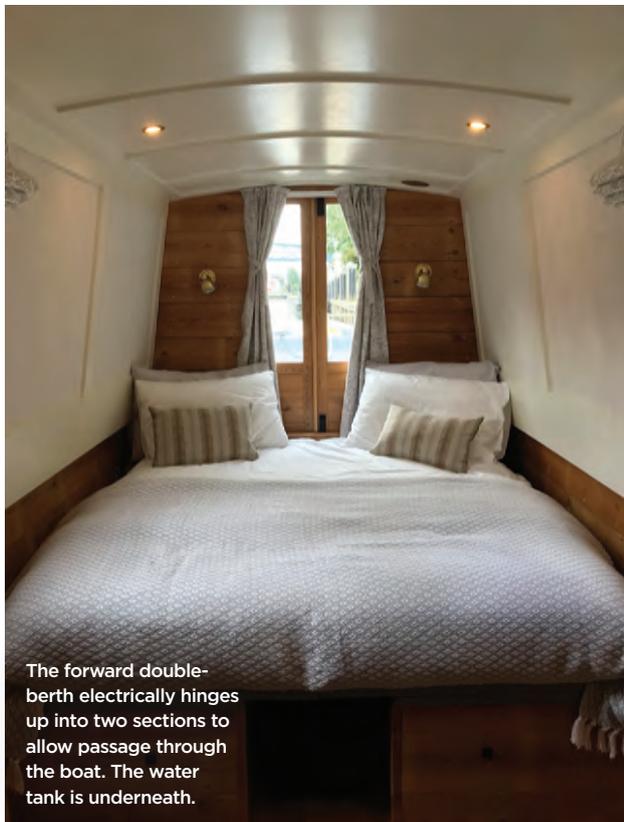
Two chaise longues provide good seating and are in keeping with the style of the interior.



This unique wood-burning stove is actually a converted fishing net buoy.



William Morris-inspired wallpaper, a white painted ceiling and the rustic, reclaimed wood give a very different interior to many current boats.



The forward double-berth electrically hinges up into two sections to allow passage through the boat. The water tank is underneath.



Two wardrobes in the spacious front cabin give good levels of storage.

an LCD interior, and the base unit is used as a wood store.

Bathroom

Unusually, the walk-through bathroom has a centre-corridor layout. This allows a clear view through the boat when the two doors are pinned back against the shower compartment on the starboard side. The shower is quite a decent size, with a rectangular shape, and although headroom is naturally more compromised by being against the lower part of the cabin roof, it is not significant. However, the clear glass in the porthole

in the shower does need to be frosted, so as not to give passing gongoozlers a potential shock!

There is a good-sized washbasin to port which has a mirror above and a big cupboard underneath. The electric macerator loo pumps to a vertical holding tank forward of the shower – which makes it very easy to fully empty, though could affect the lateral trim when full. The bathroom doors open out to give a big space for ablutions, with a bi-fold glazed door neatly containing the shower.

Bedroom

There is a full-width double berth in the cabin with the two sections rising electrically towards the cabin sides to create a passageway to the front doors. There is some storage under the berths, but much of the space is taken up by the water tanks. Further aft in the bedroom is a pair of wardrobes against the bulkhead, and there is open space aft of the berths that could be used to provide additional storage if required. As with the whole boat, LED lighting is used in a mixture of ceiling down lights and reading lamps. All the ample 230V sockets and 24V DC switches are in a matt stainless steel finish.

Services

At the heart of this boat is the exceptionally well thought-out electrical system, designed to power the boat with minimal operator intervention. Open up the hatch to the engine bay and in the immaculate bright space is a huge battery bank. There are 24 lead-carbon batteries, each with a nominal voltage of 2V, giving a battery bank of 600Ah at

48V. This equates to 28.8kWh of stored energy. To keep this filled up, there are three options: solar power, diesel generator and shoreline.

On the roof are ten custom-designed 180W panels, giving 1.8kW of output via a MPPT (maximum power point tracking) charge controller. These fit perfectly between the traditional-style handrails and are both robust enough to walk on and have a low-reflective coating, to maximise power output on overcast days, not just direct sunshine.

Under the forward cockpit, hiding beneath a GRP rather than steel hatch (much lighter to open and warmer on the feet!) is a 6kVA diesel generator, which can recharge the batteries if required, and also heat the hot water in the calorifier (though this can also be heated by a 1kW immersion heater). The cocooned generator has its own diesel tank in the forepeak, as well as a large attenuation silencer and skin-cooling tank, plus its own starter battery. Altogether this gives a very quiet installation, almost inaudible at the helm and not liable to disturb fellow boaters. There is also a bow-thruster lurking at this end, so the thruster batteries are sensibly located here as well.

Lastly the batteries can be charged by a large Victron Quattro combi inverter-charger, which when connected to shore power gives up to 70 amps at 48V, and when away cruising can supply up to 5kW of 230V power from the batteries.

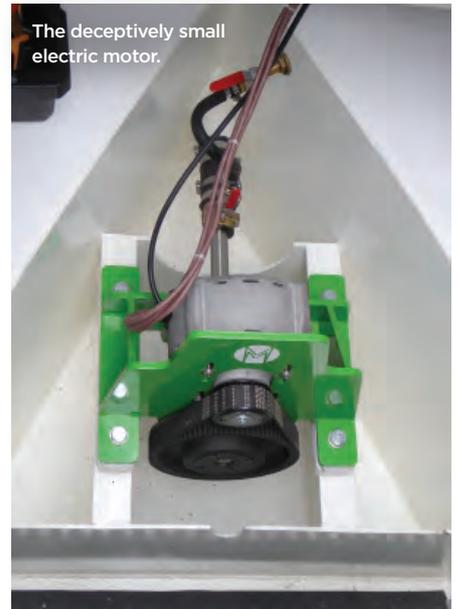
To ensure a 24V DC supply to the cabin, there is a converter which gives an isolated supply



The 6kVA diesel generator under the foredeck provides reserve power and hot water heating.



The electrical installation is substantial and well engineered.



The deceptively small electric motor.

from the 48V battery bank to a constant 24V system, up to 380W (16A) of power, which is more than enough for all the domestic systems such as lighting and pumps. In the electrical cupboard are all the busbars, connections and isolation switches, in a very neat installation. There is even a proper isolation transformer on the 230V shoreline input, which completely isolates the line (live), neutral and earth electrically from the shore supply, which can help with power spikes and avoids any continuity with other boats' earthing. This gives complete protection against stray currents, which can cause significant corrosion issues, unlike galvanic isolators which only give limited protection.

To monitor all this, there is a Victron touchscreen, which gives the relative power flows from the different devices in the system, thus providing owners with a great deal of useful information.

Engine

A deceptively small electric motor is used to power *Shine*. Mothership Marine has become the sole distributor of the Ashwood electric motor in the marine market. The 48V DC unit has a stepless controller with a single lever control that will be familiar to anyone who has helmed a modern diesel-powered boat. The motor itself drives the prop shaft via a sturdy belt, which both enables the ratios to be tweaked, as well as acting as a shock absorber, should the prop strike an object or pick up debris. The shaft passes out through the hull with a water-lubricated gland, as many

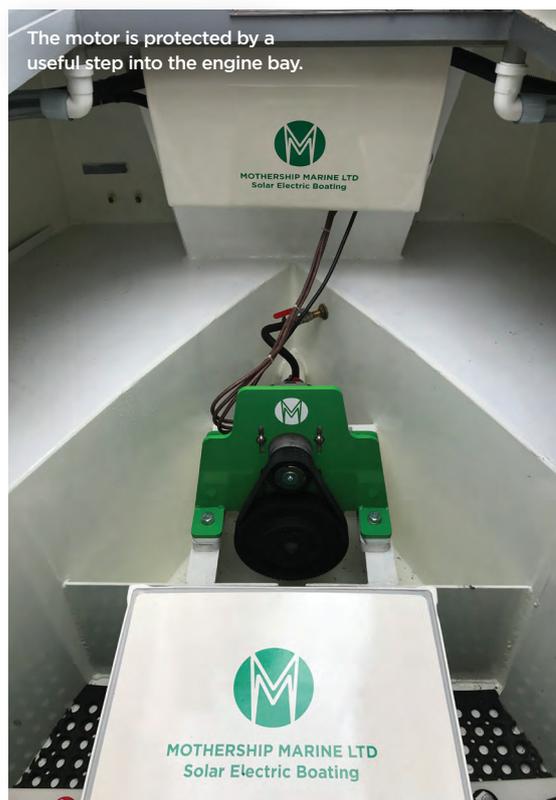


A large battery bank of lead-carbon 2V cells gives a massive power reserve.

modern diesels do. Tim Knox is also considering boxing-in the motor in the future. There is a comprehensive LCD panel that displays crucial motor functions, including RPM, temperature and power being drawn in kW.

Underway

We had the opportunity to have an extended on-water test, which took us from the moorings above Teddington Lock, down onto the tidal Thames, through London and back onto sheltered waters at Limehouse. The route presents a challenge to narrowboats as they are not particularly well suited to the busy tidal river,



The motor is protected by a useful step into the engine bay.



With no diesel engine under the aft deck, there is useable storage in this space.

where large craft can generate substantial wash, and often continued high-speed running is required to safely make headway.

On leaving the moorings at Teddington, the battery bank level was showing as 95% charged. For normal canal cruising (and slow river cruising), the engine was drawing around 1kW in power. This equates to about 0.7 horsepower! This is one indication as to why electric power is likely to be the way forward – it is so much more economical than a diesel engine, where the inherent losses are huge.

The boat itself has good steering, with only the slightest of vibration through the tiller at certain engine speeds. It also maintained a good course on the deep water of the river, while the torque of the 10kW motor means that a blast of reverse really does bring the boat to a standstill very quickly.

Once we left Teddington Skiff Lock (the smaller of the two locks) we punched the last 90 minutes of flood tide, drawing around 2.2kW of power on the engine. However, even though it was around 1pm in summer, with overcast skies, the solar array was putting 1.3kW into the system, so only around 900W was being taken from the battery bank.

Once the tide had turned, as we passed the Grand Union entrance at Brentford, we picked up pace and also opened up the throttle a little, so that we would comfortably make the tidal window for Limehouse Lock. Drawing around 2.8kW, the boat moved with the tide at around 7mph and we soon entered the busier waterways of central London. The large passenger vessels, and especially the Clippers running at displacement speed, generate substantial wash that is bounced between the hard banks of the narrow and fast river as it heads through the capital. The boat plunged well through the deep troughs of the wash, with only minimal ventilation of the prop in the more extreme cases. As the afternoon sunshine started to fade, the solar panels were still putting out around 700W of power.

We had to increase the boat speed to ensure we kept up with other traffic and could deal effectively with the eddies that swirl around the bridge piers, as well as the even more challenging waves as more and more vessels moved around us. Running with a draw of



Shine heading off from Teddington.

“Shine demonstrates the viability of sunshine-powered cruising”

around 4kW at times, the motor temperature ran into the 90°C region, but never approached the upper limits of the motor. However, Tim is considering adding a temperature-controlled

air cooling fan to reduce the chance of overheating.

Around 5.30pm, we reached Limehouse, having run the engine quite hard for the previous hour, and as we passed into the

duckweed-covered water of the basin, we took stock of the power situation. The battery bank stood at 55% of capacity and the panels were still giving over 300W of power back to the batteries.

WW'S VERDICT

We had taken *Shine* down one of the most challenging tidal stretches that any narrowboat will do, entirely on electric power, without having to resort to starting the generator. Interestingly, having cruised extensively since the Crick Boat Show, the boat has only used 20 litres of diesel for the generator. When underway on canals, drawing around 1kW or so, the system is

entirely self-sufficient. The generator is only used on the duller of days, when long periods of cruising are undertaken – and even then, the system is much more efficient than a diesel propulsion engine.

Shine demonstrates the viability of sunshine-powered cruising. The lead-carbon batteries, while not cheap, can withstand thousands of discharge

cycles – and are more cost-effective than lithium battery packs. Tim Knox is developing the technology package so that other boat-builders can effectively buy and fit the system off-the-peg, which should make it more widely adopted.

Shine is an excellent boat, with its superb propulsion and power system pointing the way to the future of inland cruising.

