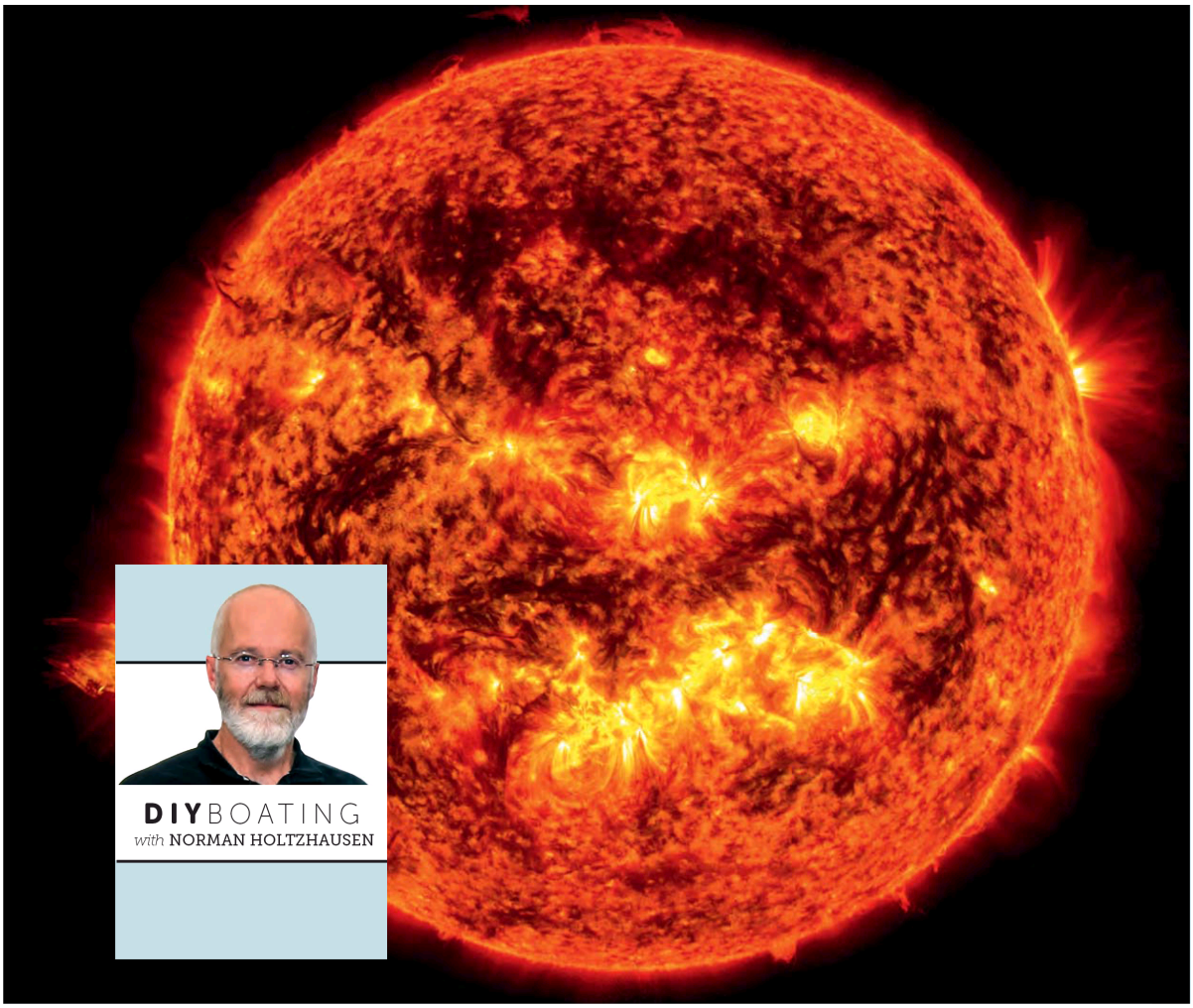
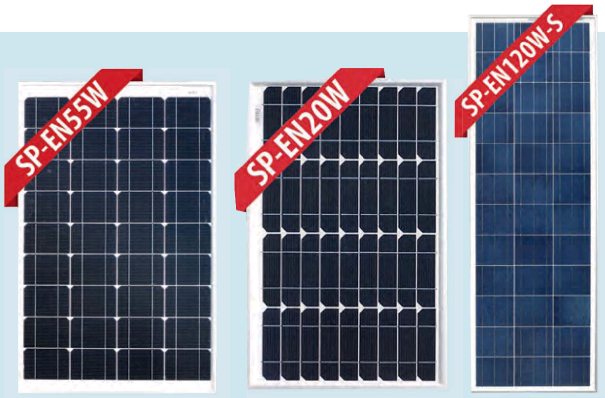


The sun as a friend

Sod's Law says the condition of your boat's battery is inversely proportional to weather conditions. Cold, miserable rain = great charge. Brilliant sunshine? Click.

The solution is a solar panel – keeping batteries topped up and ready to go. This is a relatively simple solution and has become increasingly affordable. Not only will a solar solution ensure the engine always kicks into life, it can even save you money in the long run: a battery's life is considerably shortened if left in a discharged state.

Two elements are required for a solar charging solution: the **solar panels** and a **controller/regulator**. Output from a solar panel varies widely depending on the amount of sun falling on it, while a battery needs to be charged at a very specific voltage. A regulator is rated to the maximum output of the panels and the appropriate voltage of your batteries.



Solar panels are available in various shapes, sizes and forms. Choice is typically dictated by budget and available space, but the flexible models offer a bit more, well, flexibility in terms of mounting options.

Not only will a solar solution ensure the engine always kicks into life, it can even save you money in the long run.

WHICH PANEL?

The choice used to be easy: rigid panels (in an aluminium frame with a glass cover) were by far the most efficient, while flexible panels suffered from considerably lower efficiency and shorter life spans.

But rigid panels require mounting brackets and are harder to install, more susceptible to breakage, heavier than their flexible counterparts and stand up to 5cm off the surface. They are also best installed at a slight angle so water can disperse, which may limit installation options.

Happily, the latest Juice 'Black Series' of high efficiency flexible solar panels from Auckland-based Enertec Marine & RV (www.enertec.net.nz), remove

LEFT AND BELOW
Mounting a flexible solar panel is very simple. It's bonded to the cabin top with double-side tape – and only requires a thorough cleaning of the substrate.

BOTTOM
The Votronic regulator can handle dual battery banks.

the main negative aspects of earlier flexible technology.

Using high-quality cells with over 22 percent efficiency, coupled with a new high-tech polymer top layer (expected life of more than 10 years), these offer all the advantages of rigid panels – and more.

These flexible units can be walked on and their stippled surface provides grip when wet. They can be fitted to curved surfaces and are easy to install. They can be fitted to cabin tops and even decks with minimal effort. The low profile means zero windage.

Regulators have also evolved considerably. The latest MPPT technology (Mean Power Point Tracking) delivers over 25 percent more power than the older PWM gear. Select a regulator that provides at least a three-stage cycle for efficient battery charging.

It should also include a temperature sensor and, ideally, a battery status display at the helm. Lastly, a voltage auto-sensing capacity allows a 24V panel to charge a 12V battery bank.

MULTIPLE PANELS

Connecting multiple solar panels can be confusing. There are two options – configuring them in **series** or **parallel**. In series, a positive terminal is connected to the next panel's negative terminal. In parallel configurations, the positive terminal is connected to the next panel's positive terminal.

The series option has a cable-size advantage – the size can be minimized, so running cables is easier and less expensive. Connecting in series increases the output voltage to the regulator, with a lower current.

For example, if two 100W panels are connected in series, the maximum output voltage would be 35.6V (2 x 17.8V) and the current from the two panels remains at 5.45A.

The disadvantage of a series set-up is that if either panel is affected by shading, the total output of the solar array is reduced. The location of the shadow is as important as the size of the shadow. A small shadow in the wrong place on the panel can have a significant impact on the amount of the energy the panel provides.

If your installation is to be affected by shading, it's best to use the parallel option. The two 100W panels would have a maximum output voltage of 17.8V and a total maximum current of 10.9A (2 x 5.45A). The lower voltage/higher current requires larger cables than a series connection, but will be less affected by shading on one of the panels.

Most MPPT regulators cater for both series and parallel installations, and while they will allow input voltage of a solar array up to 100-150V, they will charge your batteries at the required nominal 12V or 24V.

MORE THAN ONE BATTERY BANK?

Many boats have multiple sets of batteries, and the Votronic MPP Duo range of controllers from AA Solar (www.aasolar.co.nz) can charge two different banks from the same solar panels.

This is perfect for a set-up where you have a house battery and a starting battery, isolated

SOLAR PANEL TIMELINE

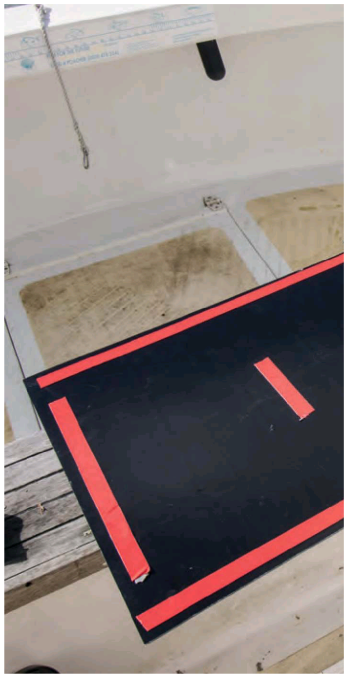
1950s
Bell Labs produce solar cells for space activities.

1953
Gerald Pearson begins research into lithium-silicon photovoltaic cells.

1954
On April 25, 1954, Bell Labs announces the invention of the first practical silicon solar cell.

LEFT
The DC2DC regulator is installed between the engine alternator and battery bank, with the solar panel connected to the MPPT input.

RIGHT
Using double-sided tape for mounting the panel leaves a small gap which reduces the risk of water being trapped.



from each other but charged from the same source. Votronic controllers also come with a neat LCD display panel to monitor the solar panels and battery state.

Another option is the ePower DC-to-DC battery charger with MPPT, available from Trident Marine (www.tridentmarine.co.nz). This is installed between the engine alternator and the battery, with the solar panel coming in on the MPPT input.

Apart from simplifying the wiring, this unit has the added advantage of providing an optimised battery charging regime both from the engine output and the solar panel, maximising the batteries' service life.

Our project boat, sitting on a pole mooring in Auckland's Tamaki River, is typical of many. Used extensively in the summer, it can go for

Used extensively in the summer, it can go for months through winter without the engines being run.

BUYING A SOLAR PANEL

Not all panels are created equal, and they vary in efficiency, robustness and reliability. This all relates to the quality of the cells used, the materials they are made from and the manufacturing processes. The things to compare are:

- Top panels have a 22 percent (or better) energy efficiency. Many budget panels, and especially the cheaper flexible ones, have considerably lower values
- Most flexible solar panels have a design life of around five years, but the latest models have a design life in excess of 10 years
- Uncoated aluminium frames can corrode swiftly, especially if mounted with stainless screws. Make sure they are marine-rated. Check every item in the framing, and ensure it's waterproof.

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- Easy to install – no screws or frame required
- Can be integrated into biminis and dodgers
- Thousands sold locally over 4 years

JUICE AGM, GEL, LI-ION BATTERIES
- Suitable for deep cycle or cranking
- Designed for the vibration associated with marine applications
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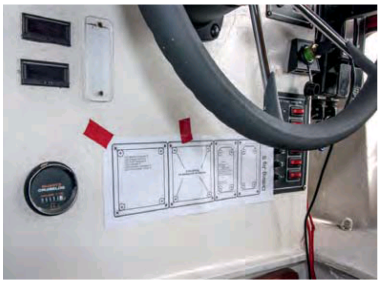

ABOVE AND LEFT
The LCD display comes with a useful template to help with installation. Mounting the display unit was the most demanding part of the job.

months through winter without the engines being run. Its large house battery is separate from the starting batteries, and it always seems to be semi-flat. Time for a solar panel!

INSTALLATION

The cabin rooftop is the ideal place for a solar panel, and because there is no 'shadow risk' we opted for a single panel. But the surface is curved and almost horizontal, so a flexible panel is easier to install and allows water to run off better than a rigid panel. We chose one of the Juice Black Series panels.

Panel size is usually based on budget and available space, rather than the required charge rate. But lead-acid batteries won't accept a charge faster than about 25-30 percent of their rated capacity. In our case the batteries have a total capacity of 120 ampere hours, so a single panel will be well below the 30 amps maximum.

Double-sided tape is the mounting system regularly used by Jeremy Peacock, director of Enertec Marine & RV. "Some DIYers," he says, "try to completely bond the flexible panel to the surface. But water will inevitably get under the panel, and it's better to have a small gap to allow airflow and water to find its way out again. This prevents more serious problems later."

So we cleaned the cabintop where the panel would go and used the double-side tape to hold it in place.

We fitted a waterproof gland at the point where the cable would go through the cabin roof, big enough for the industry-standard IP67-rated MC4 solar connector to pass through. Inside the cabin we plugged the panel into an MC4 cable extension, and ran this under a bulkhead down to under the helm where the regulator would be located.

Because we have a dual-battery configuration we selected a Votronic MPP250 Duo controller. This is rated to 15 amps, which gives us capacity for the future, and supports dual battery banks.

We connected the output to the start and house batteries, then ran the supplied cable up to the helm where we installed the neat LCD monitor. Last step was to connect the panels to the controller. For safety reasons the batteries are always connected first, with the panels plugged in last.

JOB DONE

The LCD display not only indicated of how much sun was falling on the panel, but also the power output (in watts) and the state of the batteries. It also shows whether or not they were currently being charged, and we can switch the display to show either battery.

Total cost was $419 for the Juice JSP-100W-12 solar panel, $219 for the Votronic Duo regulator and $99 for the LCD monitor. Installation time was about two hours, with the job of cutting the hole at the helm for the LCD display taking the most time. BNZ

THINKING OF GOING SOLAR?
Contact any of the companies mentioned in this article will be able to provide a customised solution.

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