

# SOLAR POWER

John Sootheran answers all the questions you've ever had about solar energy

Using a photovoltaic (PV) solar panel to create electricity to power your motorhome's facilities offers many advantages over simply plugging into the campsite's electric hook-up.

We quizzed a solar industry expert to shine a light on all of those essential things you need to consider when you are choosing, buying, fitting and using a solar panel for your 'van.

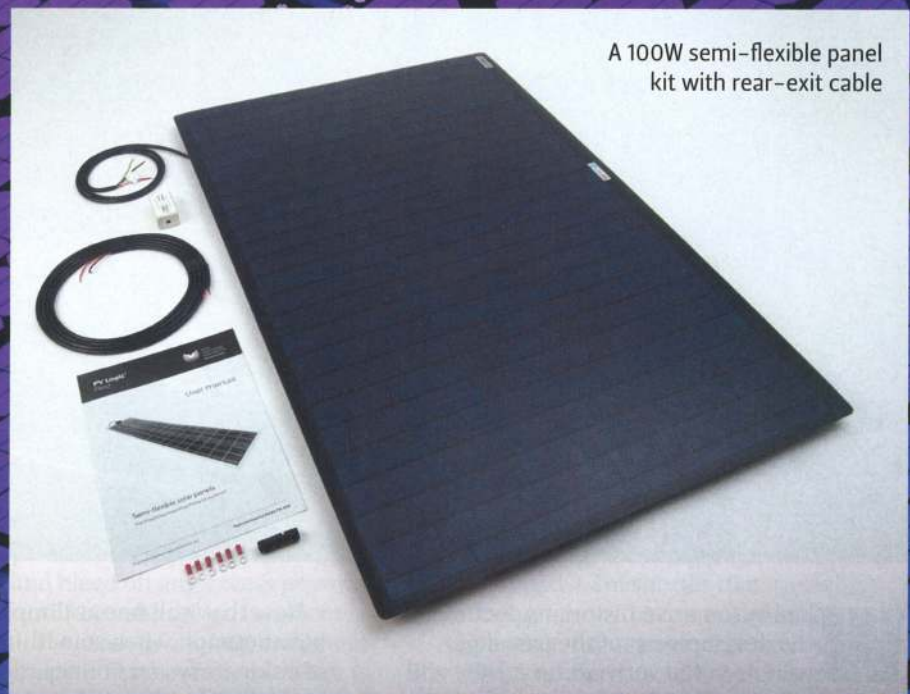
## Do you mean those water-heating solar panels from the 1970s?

**Caroline Rawlinson, Solar Technology International** "No, we're talking about PV solar panels, which contain silicon crystals that turn light into electricity. This electric charge then goes via cabling and a regulator into your leisure battery.

"The amount of electricity that the panel creates depends on its size, the quality and type of crystals, the amount of light striking it (this doesn't have to be direct sunlight, although that is best), and its angle to the sun."

## What are the benefits of using a solar panel in a motorhome?

**CR** "These days, most sites, including many basic ones, offer 230V hook-up, enabling you to take all your gadgets



A 100W semi-flexible panel kit with rear-exit cable

and devices away with you. But these little conveniences don't come cheap (especially as the cost of energy goes through the roof), and you can easily fork out £25-£40 a night on a standard pitch with hook-up.

"Canny motorhome owners have now realised that off-gridding without hook-up is a good way to save significant amounts on their pitch fees.

"The best way to do this is with a full gas bottle and a fully charged leisure battery, which is kept topped up using a solar panel.

"By not relying on hook-up, those pitch fees can drop to £10-£20 per night – and basic campsites are usually in the most beautiful locations."

## What are PV solar panels made of?

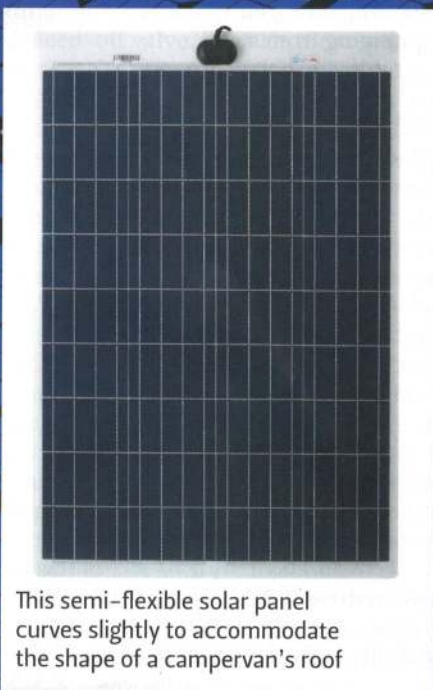
PV solar panels contain layers of silicon crystals. Typically, panels are available in three forms, with either monocrystalline, polycrystalline or thin-film amorphous silicon cells.

Monocrystalline cells consist of a single silicon crystal, while polycrystalline are made up of many fragments of silicon. Mono cells are marginally more efficient, because they allow electrons to move more freely, but they generally cost

a little more. In appearance, they are a single, smooth colour, while by contrast, polycrystalline cells are easily identified by their obvious grain and visible edges.

Crystalline panels are available in rigid and semi-flexible forms. The latter allows them to be curved slightly when they are fixed to a 'van roof. Typically, these cells are going to be around 15-20% efficient.

A different technology is exploited in thin-film panels, which is expected to pretty much revolutionise the solar



This semi-flexible solar panel curves slightly to accommodate the shape of a campervan's roof



This PV Logic monocrystalline high-density solar panel shows how few options there are for mounting among the 'van's numerous rooflights





An MPPT Pro solar charge controller unit will charge two batteries and can be monitored by smartphone app



A 155W rigid monocrystalline high-density solar panel kit with mounts

industry in years to come. Currently, these thin-film panels are less efficient than their counterparts (except in low light and shady conditions), only offering about 10-15% efficiency.

Although under laboratory conditions, scientists have seen conversion rates as high as 23.4%, these panels are not yet commercially available.

In addition, thin-film solar panels are cheaper to manufacture, so they may well take over the market in future.

**How do they work?**

Basically, a PV solar panel is made up of dual layers of mineral silicon. As light hits the panel, it gives up its photon energy, causing electrons to flow between the two layers. As one layer is positively charged and the other negative, an electrical current is created, which is 'siphoned off' to your leisure battery.

**Does panel size refer to physical size, or the size of the electrical output?**

Generally, these two things are related, because to achieve a greater output from your set-up, you need a bigger panel that

contains more crystals. Of course, the size of the panel you choose might be dictated by the space available on your motorhome roof, especially if you have additional accessories such as air-con units or satellite dishes fitted.

Solar panels are now available in a wide range of sizes and outputs, typically from 5W (for charging your digital devices) to 200W (for the hardcore off-gridder!).

**How long is a PV solar panel going to last in my motorhome?**

**CR** "A good-quality PV panel should last for at least 20 years, which means that buying a solar power system can be a really sound investment.

"Just make sure you buy a reputable brand from a respected retailer, because many low-cost, cheaply made panels will have neither the charging capacity nor the build quality to make them a good long-term investment."

**How do I choose a panel for my 'van?**

**CR** "The first question is how much energy your leisure battery (or batteries) can store. Many serious off-gridders fit

more than one leisure battery in their vehicle, to ensure they can stay out in the wild for longer. Both batteries can be kept charged using solar panels.

"Now you can select a solar panel that will replenish the charge in the battery in line with your pattern of use.

"Your battery capacity is measured in ampere hours (Ah), and a typical leisure battery may be 100Ah. You then convert this to Watt hours (Wh) by multiplying the Ah by the battery voltage - typically 12V. So in theory for a 100Ah, 12V battery, the Wh will be 1200.

"This means the battery can supply 1200W for one hour, 600W for two hours or 120W for 10 hours. Basically, the more energy draw you take, the faster the battery will be discharging.

"At least that's the theory, but in the real world, you are never able to take all of the power from the battery, because once the voltage drops below the equipment's requirements, it will no longer be able to power it.

"For example, lead-acid batteries will typically give you around 50% of their rated power - also referred to as depth of discharge. So a 100Ah lead-acid battery actually has 50Ah of usable power.

"The latest-generation leisure batteries feature lithium iron phosphate (LiFePO4) ☑



Who knew solar panels could also look beautiful?

**'A PV solar panel is made up of dual layers of mineral silicon. As light hits the panel, it gives up its photon energy'**



technology, such as those available in the Lifos Go range. These will output 90% of their rated power, so the Lifos Go 105Ah battery gives about 95Ah of usable power.

"That can make a big difference, and these batteries are also smaller and much lighter than their lead-acid equivalents."

### How much electricity will I need to generate for my motorhome?

**CR** "To calculate this, you need to know how much energy your appliance(s) will consume and how long you are intending to use them for.

"The power requirement for appliances is generally given in Watts. For example, your portable 12V TV might have a rating of 20W (this information can be found on the appliance's data sticker or panel). To calculate its total energy consumption, you simply multiply power consumption by hours of intended use.

"If the 20W TV is on for two hours, it will use 40Wh. Repeat this calculation for LED lighting and any other equipment run by your leisure battery, and this will give you a total for the amount of Wh you will typically use in a day.

"The final calculation needed to size up your renewable energy system is the power generation rating of your panels (given in Watts) multiplied by the hours exposed to sunshine. However, because the quality of the light varies during the day and throughout the year, we always recommend that customers should apply the following rule.

"A typical UK winter day might only give you one hour of effective sunshine, whereas an average UK summer day will give you around six hours.

"So in winter, a 100W panel will provide 100Wh of energy for your leisure battery, but on a summer day, that could be multiplied six times, to 600Wh."

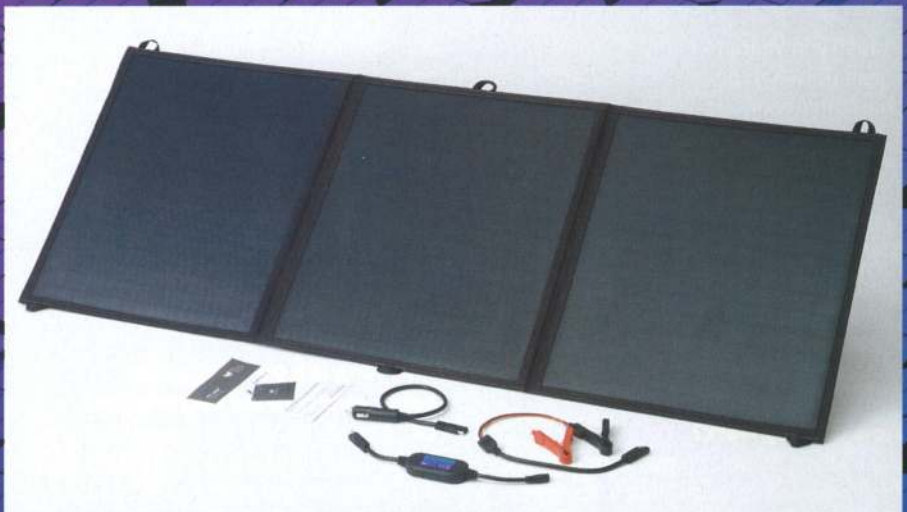
### Do solar panels work in winter?

Yes, they do: PV panels just need light, not direct sunlight. However, generally, they will be less effective, and of course, you are going to be using more power, with lights and so on being kept on for longer periods than in other seasons.

In theory, you are going to need a much bigger solar panel, so motorhome owners who tour in winter should always factor that into their choice of panel.

On a sunny summer day in Britain, the typical 'van installation with a 100W panel could deliver up to 50Ah to your battery. That's enough to keep all of the electrical equipment in the average vehicle running smoothly. However, in winter, with its less intense light and shorter days, it will charge your battery at a lower rate, so you might need more than one panel.

A 120W portable solar array can be connected directly to the leisure battery



Roof-mounted solar panel installed on a motorhome

### If I install a solar panel in my 'van, do I also need to fit a regulator?

Solar panels create a potential difference of 17-18V, but your leisure battery is 12V, so you'll need a controller between it and the panel to regulate the voltage to 12V, ensuring the battery is not overcharged.

This will also prevent any reverse feed from the leisure battery.

Controller devices deliver the panel charge in different ways. The most popular regulators employ pulse width modulation. These are sophisticated devices, which will not only convert the



**'On a sunny summer day in Britain, the typical installation with a 100W panel could deliver up to 50Ah to the battery'**

voltage from the solar panel, but also monitor the battery and its charge levels, delivering peak charge and efficiency.

Maximum power point tracking (MPPT) regulators are even more complicated, and can flow much more energy into the leisure battery.

Caroline Rawlinson of Solar Technology International explains: "The MPPT artificially modifies the voltage from a solar panel system to actively match any battery's requirements.

"This means that whatever the weather conditions, your solar panels will deliver maximum power with minimum electrical loss. Our 15Ah MPPT charge controller also has a Bluetooth app, so you can monitor the performance of your panels and the state of charge in your leisure battery from your smartphone.

"MPPTs are more efficient, too, but their charging advantage depends on the conditions. However, you can expect an increase of around 20%."

"As you'd expect, this extra efficiency isn't going to come for free, so you should be prepared to pay a bit more for an MPPT unit.

**Which will be best in my motorhome, fixed mountings or portable units?**

Solar panels are at their most efficient when sunlight strikes them directly at a 90° angle. With panels mounted flat on the roof of your tourer, this might only occur for about an hour a day.

Some motorcaravanners therefore believe that freestanding portable panels, which can be moved to face the sun throughout the day, are their best bet.

Of course, they are correct, but only if you're prepared to constantly swivel your panels around throughout the day.

For most people, that's not realistic, so the charging gains of a freestanding



Visit any of the motorhome shows and you'll find a wide range of solar panels, but always make sure to do your research



For us, a fixed roof panel offers the best combination of convenience, security and charging potential, and will also create enough current to keep essential devices such as a tracker powered over the winter.

These are available either in rigid form, in a metal frame that screws to the roof, or a slimmer, lightweight, flexible 'mat' design that can be bonded to the roof.

**Will I be able to install a solar panel myself, or is this a job for the pros?**


Any keen DIYer (with a good selection of tools) can fit a solar panel.

Always aim to minimise the number of holes you drill through the 'van's roof or walls, by bonding panels where possible. Modern adhesives are incredibly strong and long-lasting, which means the only hole you should need to drill is for the power cable to enter the vehicle.

Note that you should always take all necessary safety precautions before starting work on fitting a solar panel.

panel are somewhat nullified. You should also consider the security of any external solar panels, which will have cost you several hundred pounds.

With these freestanding panels, don't forget to face the panel eastwards before you go to bed – that way, in summer, you should get three or four hours of effective charging before you've even woken up!

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