27 Solar Panels

How much power for your pound?

Increasingly conscious of the impact we have on the environment – and because most of us are fitting ever more electrical equipment on board – we decided it was time to review the benefits of solar power. **James Turner** reports.

As a boat owner myself, I began with a list of obvious questions. How much do solar panels charge? How do they fare when a shadow is cast? What about when the panel isn't pointing directly at the sun? There were so many considerations that needed to be addressed that testing solar panels was never going to be easy. We rounded up 27 examples from six suppliers. It could have been a hundred, but rather than test every single one, we tested a varied selection, then listed the full range of outputs available for each model we tried.

HOW WE TESTED THEM

As ever we do our best to test equipment in a practical – rather than laboratory – way, to better replicate real life.

Outside the *Sailing Today* office at Swanwick Marina we set up a level board with parallel lines and 45° lines – a sun dial – to make sure the panel was perpendicular to the sun and an electrical test rig comprising ammeter, voltmeter, half-charged 12V battery and a fan.

The test day was hot with a completely clear sky. First, with the panel base lined up direct to the sun and wired into the test rig, the panel was angled progressively back till the absolute maximum charging current was measured. Next, the panel base was turned through 45° and again the absolute maximum charging current was measured.

After these first two tests were completed, with the sun high in the sky around noon, we then moved on to the flat tests. Here, the panel was laid flat and the current was measured.

After that, we partly covered the panel with one hand laid on the panel surface, then raised the hand to a fixed height above the panel to cast a shadow. We expected these last tests to affect small panels more than large ones, because a greater percentage of the panel was being covered or shadowed.

THE PRODUCTS

GB SOL £189-£336

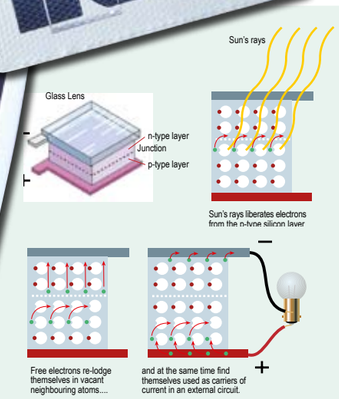
We tested the 18W and 70W semi-flexible panels, plus the 60W rigid panel, which is housed in a stout aluminium frame. GB SOL also manufactures 115W and 120W models, though most boats will struggle to find space to fit panels of that size. The semi-flexible panels are made to be walked on with a low profile IP67 waterproof junction box, which is bolted through the panel. The rigid panel has a waterproof IP67 junction box on the back, recessed into the frame. Strangely, the 60W panel produced a bit more power than the 70W panel in the first part of our tests, which we can't explain, but the difference was minor, both panels producing nearly 4A charge.

The warranty covers one year materials and workmanship, and two years for 80 per cent power.

SUNSEI £25-£173

Sunsei panels are rigid and mounted in a white plastic frame. They come with plug-and-play wiring and an accessory pack that includes a cigar plug to connect to the batteries you want to charge, plus a cigar socket in case you want to run something direct from the panel. The SE150 isn't weatherproof, but the bigger panels are waterproof to IP67. We found the plug-and-play very easy to use and suitable for quick assembly/stowable installations, though they appeared a bit flimsy. The SE150, putting out 0.14A at best, will do little more than keep a charged battery from depleting itself over time. We found they stood up well to partial cover. Sunsei also manufactures a range of polychrystaline panels in aluminium frames, available in 65W, 100W and 130W sizes.

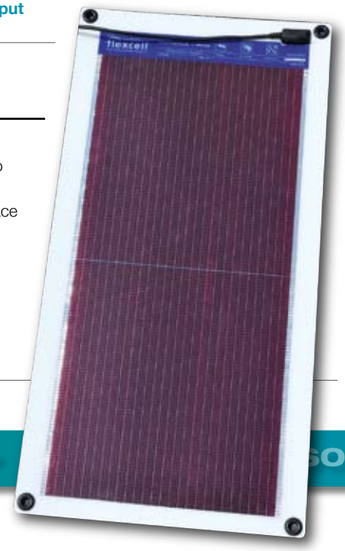
Mechanical warranty is two years and power output at 75 per cent is for 10 years.



SUNSLICK £83-£167

These dedicated marine panels are highly flexible. We tested the 7W and 14W models. A 27W model is also available. Sunslick panels are very thin and can be mounted on curved surfaces or tied or screwed in place using the pre-cut corner eyes. The wiring connection box is screwed through from the back. As well as the 3m wire, there's a 3m extension and IP67 waterproof connector supplied as standard.

The warranty is for three years on current charge and two years on defects in material and workmanship.



How do they work?

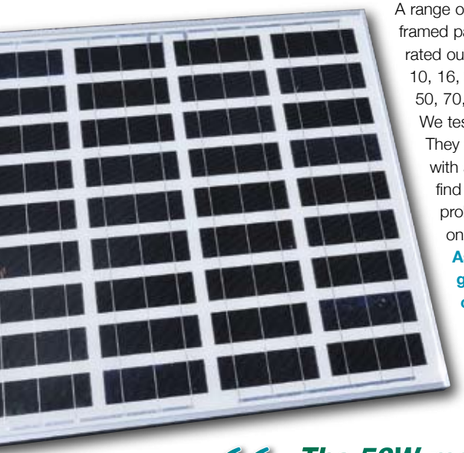
Solar panels rely on the photovoltaic effect through which light energy in the form of photons is converted into electrical energy. It was discovered in 1839, when Edmund Becquerel found that certain materials produced small amounts of electric current when exposed to light. Photons contain different amounts of energy according to the particular wavelength, which is transferred to a semiconductor and becomes part of the electrical current.

SUNBOARD £74-£208

Made by the same company as Sunslick, the Sunboards are a little less flexible, but nonetheless still pretty bendy. It's a trade-off between flexibility and price, because they cost a little less. They come in the same 7W, 14W and 27W sizes and we tested all three. Both the Sunslicks and Sunboards were consistently good performers with part of the panel covered or in shadow. They can be walked on, though we wouldn't recommend placing any solar panel in a main thoroughfare.

The warranty is three years on current charge, two years on defects in material and workmanship.

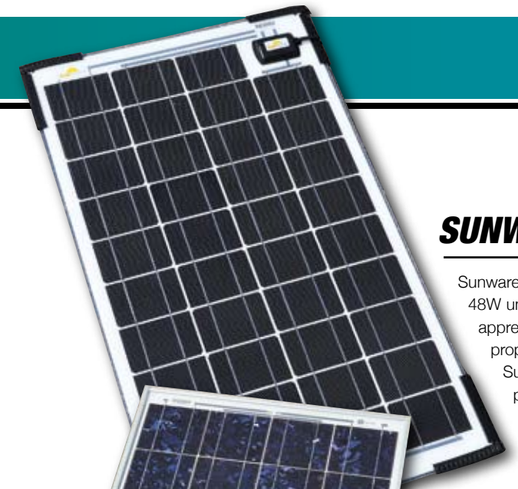
KYOCERA £65-£276



A range of aluminium-framed panels with rated outputs of 5, 10, 16, 20, 21, 32, 50, 70, 85, 95 and 135W. We tested the 5W, 21W and 50W models. They appear extremely robust and well engineered with a solid aluminium frame. However, some might find the sharp corners on this type of panel a problem. The 50W performed well, but the smaller ones were significantly affected by partial covering.

As to the warranty, power output is guaranteed to be not less than 90 per cent of minimum rated power for 10 years and not less than 80 per cent of minimum rated power for 20 years. There's a one year limited warranty on material and workmanship.

> *"The 50W model performed well, but the smaller ones were significantly affected by partial covering"*



SUNWARE £559

Sunware semi-flexible panels are available in 24, 36, 48, 69 and 70W. We tested the 48W unit. The junction box is screwed through from the back, which we liked. We also appreciated the U-section rubber strips at the corners, which make the panel easy to prop up without falling over. There were no pre-made holes for permanent installation. Sunware claims its panels run cooler than other brands and therefore deliver better performance, especially in summer months and in hotter climates, though we weren't able to test this.

Warranty is two years.

BP SOLAR £379

These aluminium-framed panels are available in 5, 10, 20, 30, 40, 50, 65, 80 and 125W. We tested the 65W. This powerful panel lends itself well to being mounted across davits, where it will be clear of obstructions. It worked well when horizontal, but less well with partial cover or shadow. As with all glass panels in aluminium frames, it's more prone to damage from falling winch handles than flexible and semi-flexible panels and it has sharp corners.

The warranty is five years on materials and workmanship. The performance warranty is 12 years for 90 per cent power and 25 years for 80 per cent power. Warranty may vary on smaller panels.

SPECTRALITE £149

This smooth surfaced panel is available in 5, 10 and 20W versions, we looked at the 20W. The junction box is bonded, not screwed or bolted, to the panel. We talked to the people at Marlec, the importers. They said that whilst they had sold over 3,000 of this model in the last three years, they had not had any panels returned with a loose or broken junction box as a result of inadvertent kicking. In common with most of the panels of this size it was quite badly affected by partial covering.

The warranty is for two years.

> *"Glass panels in alloy frames are more prone to damage from falling winch handles"*

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SOLAR TRADER FLEXI PANEL £85-£300

Flexible and lightweight, Flexi Panels appear to be practically unbreakable, they float (though it isn't recommended) and are suitable for temporary or permanent installation. We decided to test each of the 5, 10 and 20W models, because we suspected we would find them really useful on a yacht. Flexi Panels can be lashed across the sprayhood, along the boom or to side dodgers. They really are extremely flexible. In our tests the 32W unit was one of the most efficient when calculating Amps per square metre.

The warranty lasts for one year on material/manufacture and five years for 80 per cent of maximum power.

INPROSOLAR £130-£320

The almost rigid, frameless construction can be curved slightly – but not much – to mount on a coachroof or cabin top.

In addition to the 11, 22 and 32W models tested, there's also one generating 15W. The junction box is screwed through from behind. These panels do not have a built-in blocking diode, so must be used with a regulator that incorporates one, otherwise the panel will discharge battery power at night. We liked the fixing holes in the four corners, which are lined with stainless steel grommets.

Their warranty lasts five years for materials and 10 years for 80 per cent power output.

SOLARA £230-£401

These semi-flexible panels are available in 12, 18, 23, 34, 45 and 68W variants. We tested the 12, 23 and 34W. They have a good solid feel to them, but they are not as flexible as some – see table on pages 58-59. The backing plate is pre-drilled in the corners for bolting down, then in-filled with the top cover of resin, so if you plan to make a permanent installation these holes will need careful drilling out to maintain the watertight integrity.

There's a two-year manufacturer's warranty.

FLEXCELL SUNPACK ION £142.50

This roll-away solar panel incorporates a battery and is supplied in a tidy case with a multi-adaptor pack for charging phones, computers, etc. We couldn't include this panel with the main test, because the built-in battery would distort any test measurements. Whilst primarily aimed at the hiking market, we think it could be a useful piece of emergency equipment on a yacht. However, the importers asked us to stress that the battery compartment isn't waterproof, so care would need to be taken.

IS IT WORTH BUYING A SOLAR PANEL?

Without a doubt. Free energy from the sun is a sensible way of reducing your carbon footprint. For a sailing boat, which spends most of its passage time with the engine turned off, it seems sensible to fit as many solar panels as the space and budget will allow. However, you should pick your locations carefully, because we found in our practical tests that shadows do indeed make a difference to the charge output.

USING A REGULATOR?

The rule of thumb is that if you're going to charge your battery (or bank of batteries) with more than 10 per cent of their capacity per day – and not take any power out – you need to fit a regulator. For example, a yacht with a single 100Ah battery, left unattended, can accept 10A of charging per day without a regulator. If in doubt, fit a regulator. Most can be used to charge gel, sealed or conventional wet, lead-acid batteries. An LED display showing how much the panel is charging and the charge level in the battery is a particularly desirable feature.

Two from Barden

The first regulator is a basic, low cost option for small systems, the other is of higher quality and will give better performance and, as you might expect, should also last longer.

The Morningstar Sunsaver 10, 10A regulator, costs £76.06; the Solara SR60UL 4A is £23.44. Both units can be bought direct from the manufacturers. Details: Barden Energy Solutions 01489 570770 www.barden-uk.com.

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PERFORMANCE

When turned 45° from the sun and when laid flat, all the panels tested worked well, so aiming directly at the sun is less important than having an unobstructed view. Where things went less well in the tests was with partial coverage or when casting a shadow.

We covered the same area on each panel – after all, if you leave an oar on deck and it covers part of the panel, you wouldn't be using a smaller oar just because you own a smaller solar panel. This caused three of the smaller panels to register no output at all, so if you only have space for a small panel, it's doubly important that it gets an unobstructed view of the sun.

CONTACTS

Sunsea/Sunslick/ Sunboard/ Flexcell Sunpack ion
Meridian Zero
www.meridianzero.co.uk
01268 493200

Solara
Barden
www.barden-uk.com
01489 570770

Kyocera
Dulas
www.dulas.org.uk
01654 705000

Solar Trader/ Inprosolar
Select Solar
www.selectsolar.co.uk
01793 752562

BP Solar/Sunware/ SpectraLite
Marlec
www.marlec.co.uk
01536 201588

GB SOL
GB SOL
www.gb-sol.co.uk
0292 0820910

WHICH PANEL IS BEST?

Metal-framed panels, aimed primarily at the domestic housing and commercial markets, lend themselves well to mounting across dinghy davits, so they can get a clear sky view, in a place where their sharp edges don't matter. In this position they are also much less susceptible to damage from things like winch handles. That's important, because they are relatively fragile.

Semi-flexible panels are more suited to permanent deck mounting. They are designed to be walked on, though the less you do so the smaller the chance of damaging the panel with small stones embedded in your shoes – which won't lead to a warranty replacement. We mounted a 36W semi-flexible panel on the coachroof of our Bruce Roberts 36 back in the 1980s and as far as I know it was still working well 10 years later.

Flexi panels are best for non-permanent installation, because they can be so easily moved and stored. Surprisingly, the largest one we tested was as good a performer all round as any of the other panels.

However, logic dictates that this kind of panel, subject to a lot of movement, isn't going to have the lifespan of a fixed panel.

Prices

As usual, we've quoted RRP including VAT throughout this article. We've found it's worth asking for discounts, though. The worst response will be "No".

32W FLEXI PANEL

Model	Price inc VAT	Type	Degree of flexibility 0 = rigid 6 = highly flexible	Length mm	Width mm	Max Amps – direct at sun	Max Amps – turned 45°	Amps when flat – noon		Amps with hand on panel	Amps with hand above panel – casting shadow	Efficiency at 45° – compared to direct alignment	Efficiency when horizontal	Efficiency – horizontal with hand on panel	Efficiency – horizontal with hand casting shadow	Efficiency – Amps per m² (max)	Efficiency – Amps per m² (casting shadow)	Value £ per Amp max
GBS Flexi 18W	£189.75	Semi flexible	3	340	655	1.22	1.13	0.90		0.04	0.09	93.26%	74.0%	3.3%	7.4%	0.271	0.007	156.04
GBS60BL 60W	£238.05	Rigid frame	0	338	1398	3.97	3.70	3.29		0.32	0.60	93.20%	82.9%	8.1%	15.1%	1.876	0.038	59.96
GBS Flexi 70W	£336.95	Semi flexible	3	700	800	3.88	3.57	3.52		0.51	1.55	92.01%	90.7%	13.1%	39.9%	2.173	0.074	86.84
Sunsei SE150 2.25W	£25.80	Rigid frame	0	127	394	0.14	0.12	0.10		0.00	0.01	86.19%	72.7%	0.0%	7.3%	0.007	0.000	187.50
Sunsei SE500 7.75W	£69.35	Rigid frame	0	360	375	0.43	0.38	0.36		0.16	0.17	88.34%	83.9%	37.3%	39.6%	0.058	0.050	161.66
Sunsei SE1500 22.5W	£173.98	Rigid frame	0	350	1000	1.30	1.14	1.05		0.90	0.91	87.34%	80.6%	69.1%	69.8%	0.456	0.242	133.52
Sunslick 7W	£83.07	Very flexible	5	350	695	0.60	0.56	0.40		0.34	0.34	92.67%	66.7%	56.7%	56.7%	0.146	0.138	138.45
Sunslick 14W	£167.00	Very flexible	5	350	1305	1.22	1.13	0.90		0.80	0.85	92.55%	73.7%	65.5%	69.6%	0.558	0.299	136.77
Sunboard 7W	£74.69	Semi flexible	4	350	695	0.58	0.55	0.43		0.35	0.36	94.13%	74.3%	60.4%	62.2%	0.141	0.147	129.00
Sunboard 14W	£125.03	Semi flexible	4	350	1305	1.17	1.08	0.89		0.82	0.83	91.97%	76.1%	70.1%	70.9%	0.534	0.320	106.86
Sunboard 27W	£208.95	Semi flexible	4	642	1305	2.42	2.25	1.67		1.60	1.60	92.97%	69.1%	66.2%	66.2%	2.026	0.554	86.41
Kyocera 5W	£65.55	Rigid frame	0	205	351	0.34	0.31	0.26		0.00	0.03	91.69%	77.2%	0.0%	8.9%	0.024	0.000	194.51
Kyocera 21W	£138.00	Rigid frame	0	367	512	1.37	1.26	1.16		0.05	0.20	91.77%	84.5%	3.6%	14.6%	0.258	0.007	100.51
Kyocera 50W	£276.00	Rigid frame	0	706	749	3.16	2.88	2.94		1.02	1.31	91.04%	93.1%	32.3%	41.5%	1.670	0.171	87.37
Sunware 48W	£559.95	Semi flexible	3	460	780	2.36	2.09	1.95		0.20	0.60	88.70%	82.8%	8.5%	25.5%	0.845	0.030	237.77
BP Solar 65W	£379.95	Rigid frame	0	502	1111	4.31	4.11	3.70		1.07	1.37	95.36%	85.8%	24.8%	31.8%	2.404	0.138	88.16
SpectraLite 20	£149.95	Semi flexible	3	508	622	1.25	1.12	1.04		0.06	0.46	89.66%	83.4%	4.8%	36.9%	0.394	0.015	120.25
Solar Trader 5W Flexi	£85.00	Very flexible	6	248	542	0.45	0.42	0.30		0.08	0.12	92.68%	66.5%	17.7%	26.6%	0.061	0.024	188.47
Solar Trader 10W Flexi	£140.00	Very flexible	6	426	538	0.80	0.71	0.55		0.32	0.34	88.88%	68.8%	40.0%	42.5%	0.183	0.092	175.00
Solar Trader 32W Flexi	£300.00	Very flexible	6	425	1430	2.89	2.60	2.03		1.80	1.85	89.87%	70.2%	62.3%	64.0%	1.757	0.378	103.77
Inprosolar 11W	£130.00	Rigid frameless	1	270	450	0.65	0.58	0.53		0.05	0.09	89.15%	82.2%	7.8%	14.0%	0.078	0.009	201.55
Inprosolar 22W	£230.00	Rigid frameless	1	430	450	1.25	0.77	1.03		0.05	0.17	61.70%	82.5%	4.0%	13.6%	0.241	0.008	184.29
Inprosolar 32W	£320.00	Rigid frameless	1	450	590	1.96	1.69	1.61		0.46	0.34	86.36%	82.3%	23.5%	17.4%	0.520	0.062	163.52
Solara SM40 12W	£230.24	Semi flexible	2	267	445	0.58	0.52	0.53		0.00	0.09	89.83%	91.4%	0.0%	15.5%	0.069	0.000	396.97
Solara SM80 23W	£331.57	Semi flexible	2	440	460	1.25	1.12	0.93		0.05	0.18	89.27%	74.5%	4.0%	14.4%	0.253	0.008	265.47
Solara SM120 34W	£401.17	Semi flexible	2	460	590	1.73	1.53	1.09		0.07	0.24	88.77%	63.1%	4.1%	13.9%	0.469	0.011	232.29

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