A buyer's guide to solar electricity panels

solar home
CONNECT

Energy from the sun

The sun provides an abundant, free source of clean energy in the form of natural light and warmth. It is possible to capture some of this free energy directly to convert sunlight into electricity using solar photovoltaic (PV) panels. If you're thinking about installing solar PV to generate electricity - this guide is for you.

How does solar PV work?

Solar PV systems convert light into electrical power using a thin layer of semi-conducting material, usually silicon, encased between a sheet of glass and a polymer resin. They range in size from a few square centimetres, for example on calculators and watches to systems of hundreds of square metres made from interconnected modules that form an array. When exposed to daylight electrons in the semi-conducting material become energised. These electrons are then able to flow through the material generating a direct current (DC). The DC is carried through wiring to an inverter which converts the current to 240V alternating current (AC) so it can be connected to your home's main electricity supply.

Effortless integration

Solar PV can be easily incorporated into most houses. The most common option is to use standard solar PV modules in a frame fixed to an existing pitched roof or a tilted frame on a flat roof. In this arrangement the panels will slightly protrude from the roof tiles but are still in keeping with the shape of the house. If you are replacing your roof you can now buy solar PV integrated roof tiles and slates that can form part of the weatherproof membrane or structure.

Versatility

As solar PV is made up of modules, typically around 1m x 1.5m, an array (the full solar PV installation) can be designed to accommodate virtually any size and shape of roof. Solar PV can also be mounted vertically and horizontally allowing the system to form part of the wall and roof structures in new properties although performance will be reduced with these tilts.

What does kWp and kWh mean?

Solar electricity systems are given a rating in kilowatts peak (kWp). This is essentially the rate at which it generates energy at peak performance for example at noon on a sunny day. The kWp of a domestic system will vary depending on how much a customer wants to spend and the roof area available to accommodate the panels.

The total amount of electricity the system actually generates in a year is measured in kilowatt hours (kWh). This will depend on the system's orientation, shading and how sunny your site is, as well as the size of the system (in kWp) that you have installed.

A typical domestic system is between 1.5 to 3kWp. Each kWp should generate around 800 to 850kWh per year if unshaded and perfectly south facing with a tilt of around 30-50°. A solar roof array would typically generate 1200 to 2400kWh per year depending on size.

By contrast an average home uses 4000kWh of electricity per year on lights and appliances. However, an energy efficient home using A rated appliances and lighting could conceivably use half this value.

TILT degrees	West										South								East
											-	-	-	-	-	-	-	-	-
	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90
0	87	88	90	91	92	92	93	93	93	93	93	93	92	92	91	90	89	87	86
10	84	87	90	92	94	95	95	96	96	97	97	96	95	94	93	91	89	87	84
20	82	85	90	93	94	96	97	98	99	99	98	97	96	95	93	91	88	84	81
30	78	83	87	91	93	96	97	98	99	100	98	97	96	95	93	89	85	81	78
40	75	79	84	87	92	94	95	96	96	96	96	95	94	92	90	86	82	77	72
50	70	74	79	83	87	90	91	93	94	94	94	93	91	88	83	80	76	73	70
60	65	69	73	77	80	83	86	87	87	87	88	87	85	82	78	74	71	67	63
70	59	63	76	70	72	75	78	79	79	79	79	79	78	75	72	68	64	61	56
80	50	56	60	64	76	68	69	70	71	72	72	71	70	67	66	60	57	54	50
90	41	49	44	58	80	61	60	61	63	65	65	63	62	59	60	52	50	47	44

This table shows the percentage variance in performance when orientation and tilt are adjusted away from the optimum (100%).

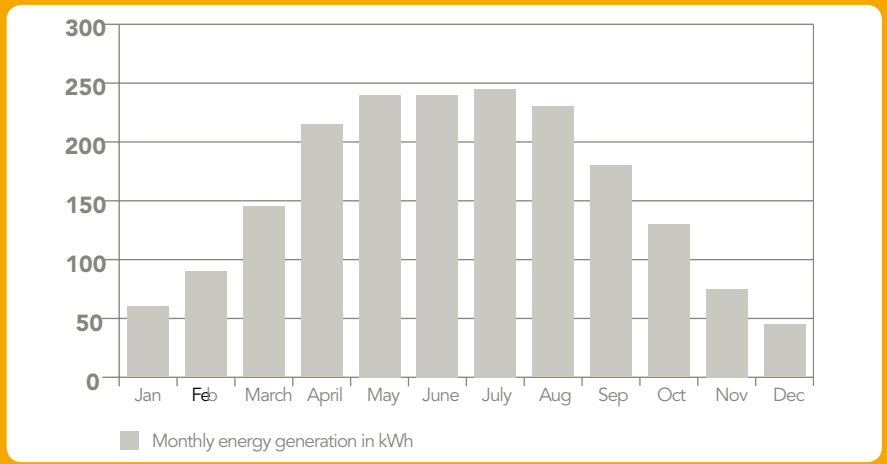
Orientation and tilt

Your roof should ideally face due south at a pitched angle of between 30° and 50° from the horizontal to give the best overall annual performance. Installations facing anywhere to the south of due east and due west are feasible, although output will be reduced. Installation is not recommended on roofs facing north.

Seasonal performance

The chart above shows a typical seasonal spread of energy generation for an average system of 2.2kWp facing south. The winter months generate significantly less electricity compared to the summer months.

Energy generation by month – 2.2kWp system



Site location

The amount of electricity generated by a solar PV system can also vary depending on where you live in the UK. Northern areas receive slightly less energy from the sun over the year. For example a 1kWp system will generate less electricity in Northern Scotland than it would in Cornwall. However solar electricity is still worth while in the northern parts of the UK as the differences aren't substantial.

Shape of roof area

Solar PV arrays are made up of modules of about 1.5m2 which allows most available roof shapes to be accommodated. Typical UK installations are around 14m2 or 15m2. For example a 2.2kWp system could comprise of 12 panels taking up an area of 15m2 and will generate roughly 1800kWh per annum.

Shading

Any shading on a single module will affect the performance of the whole array as all the modules are connected. A system can tolerate some shading early or late in the day without much reduction of overall output but it should not be shaded between 10am and 4pm. Nearby trees, chimneys, TV aerials and vent pipes are all common causes of shading and should be accounted for before any installation.

Solar electricity doesn't necessarily require direct sunlight and can still generate electricity on cloudy days. You will generate approximately 1/3 of the energy on a cloudy day as on a sunny day at the same time of year.

Solar PV cell types

There are several different types of solar PV with different characteristics, costs and benefits. The main options for domestic use in the UK are:

Crystalline cells

These are the most commonly manufactured type. There are performance variations depending on whether you opt for a 'monocrystalline' cell (often the more efficient of the two) or a mix of crystals or 'polycrystalline' cells which have a marble-like appearance. Polycrystalline cells can be cheaper to produce.

Hybrid cells

These combine crystalline cells with another cell type, thin film to give the best overall performance and do not cost much more to produce than conventional crystalline cells.

Comparison summary of different technologies

Hybrid panels often cost more to buy than the other types. However, there are many other factors that also affect the total installed cost of a system. A typical 2.2kWp system will cost around £12,500.

Cell type	Efficiencies*	Approximate area per kW(m^2)
Monocrystalline	13-17%	6-8
Polycrystalline	11-15%	7-9
Hybrid	17%+	5-6

* The efficiency of a solar cell gives an indication of how much of the sun's energy is actually used by the system per unit area. The higher the efficiency, the better the cell is at converting the sun's energy.

Connecting to the grid

The vast majority of systems are installed in properties with an existing mains electricity supply. The solar PV supply feeds into your existing system and the electricity generated is either used in your house or is exported to the grid, depending on how much you are using at the time. Connection to the local grid is not as complicated as you might expect and your installer should be able to deal with this for you by informing the electricity District Network Operator (DNO).

For isolated installations where there is no grid connection, solar PV panels can be used independently by using batteries to ensure supply when there is not enough daylight to generate electricity or when you need more energy than the system is able to generate.

Connection equipment

A basic grid-connected solar PV system requires no batteries. If the grid fails however for example in a severe storm - grid-connected inverters automatically switch off to protect any engineers working on the lines to repair them. If grid related power cuts are common in your house you might consider some form of back-up storage. Consult your installer for further details.

Permissions

In England, Wales, Scotland and Northern Ireland changes to permitted development rights for domestic renewable technologies mean that most solar electricity installations don't generally require planning permission, as long as they respect certain criteria. A key criterion is that the panels should protrude more than 200mm when installed. Particular exceptions apply for installations flat roofs, listed buildings and buildings conservation areas, world heritage sites designated landscape areas. You may need obtain approval from Building Control. We recommend you always check this with planning department in advance of installation.

Make sure you inform your building company of your installation as they to note it as a material fact on your policy shouldn't increase your premiums but first with your insurance company.

Governments Feed-in Tariffs (FITs) and exporting electricity

With the UK Government's Feed-in Tariffs (FITs) scheme, you can get paid for the electricity you generate with your solar PV array. The scheme guarantees a minimum payment for all electricity generated by the system (generation tariff), as well as an additional payment for the electricity exported to the grid (export tariff). These payments are in addition to the bill savings made by using the electricity generated on-site. The payments you are eligible to receive vary depending on system size and when it is installed. The payments are index linked and guaranteed for 25 years.

For every unit of electricity generated you will receive the generation tariff for solar PV currently set at:

Technology Scale	Current tariff level (p/kWh)	Tariff lifetime (years)
≤4kW (on existing building)	43.3	25
≤4kW (new build home)	37.8	25

You will also be paid 3p/kWh for every unit of electricity you export and you will save around 12.5p/kWh on your electricity bill for every generated unit that you use in your home.

The amount of energy generated will be measured by an approved generation meter, supplied by your installer as part of the package.

Until Smart Meters are rolled out across the country any export payments through the FITs will be 'deemed' at 50%. This means you will get paid for exporting 50% of the electricity you generate regardless of how much you do actually export.

To be eligible for the full Feed-in Tariffs payments the system must be installed on or after 15 July 2009 using new equipment, and both the system and the installer must be registered under the Microgeneration Certification Scheme (see How to find an installer).

Where possible it is recommended you use any appliances during the day when the solar PV modules are generating the electricity. This avoids the full cost of taking electricity from the local grid and makes maximum use of your own investment in your solar PV system. Obviously you shouldn't use additional electricity just to make use of the solar PV output.

Costs and savings

On average (across cell types), solar PV costs £5,800 per kWp installed. When comparing quotes from installers do not simply focus on the suggested system capacity as this is probably not the best way to compare performance or cost effectiveness. When comparing prices ask the installer what is included. Some things are often excluded from an initial estimate including:

- Scaffolding (if required).
- Removal of the existing roof and other roofing works.
- Any internal work to install wiring.
- Connection agreement with the Distribution Network Operator (DNO).
- Allowance for lightning protection.
- Electrical connection work (this requires a fully qualified electrician).
- A generation meter.
- Other display meters if required (i.e. handheld display meter).

Most of the above services will be required, so if they are excluded from your installer's quote, you will need to obtain separate estimates or make your own arrangements. It is important to bear this in mind when comparing quotations. Most domestic solar PV arrays are between 1.5kWp and 3kWp. A typical 2.2kWp system will cost around £12,500.

Here is an example of what a typical domestic solar electricity system with an installation size of 2.2kWp could earn and save you each year through the Feed-in Tariffs:

	£ per year
Generation Tariff	£807
Export Tariff	£30
Reduction in current electricity bills	£120
Total savings and income generated	£957

Based on a tariff rate of 43.3p/kWp, export rate of 3p/ kWh and electricity price of 12.5p/kWh. The Feed-in Tariffs are not currently available in Northern Ireland.

This assumes 50% of the electricity generated is exported. The Feed-in Tariffs rates are index linked, so this income will hold its value over the entire life of the system.

Maintenance

Very little maintenance is required if a well designed solar PV system is installed properly. Modules that are tilted at 15° or more have the additional benefit of being cleaned by rainfall to ensure optimal performance.

You can expect them to operate for 25 years or more before they need replacing, although the inverter may need replacing over the lifetime of the panels. Once fitted, your installer should leave written details of any maintenance checks that you should carry out from time to time to ensure everything is working properly. This should include details of the main inverter fault signals and key trouble-shooting guidance. Ideally your installer should demonstrate this to you at the point of handover. In areas that experience high levels of dust and grime such as city or industrial locations your solar PV array may need additional cleaning from time to time as rainfall may not be sufficient. Consult with your installer for exact maintenance requirements before you commit to installing a solar PV system.

By choosing Solar Home Connect to provide your environmentally friendly and money saving solar energy.

Your are joining thousands of users reaping the benefits of FREE solar energy. Your investment will not only save you money, but also helps in the fight to reduce emissions and provide a cleaner, greener environment for future generations.

Solar Home Connect specialise in the supply and installation of the very latest Solar Photovoltaic Electricity and Solar Hot Water Heating Systems, maximising the return on your investment.

We aim to provide you with first class customer service, assisting you through every step of the process, and our installers are MSC accredited - giving you total peace of mind.

solar home
CONNECT

Environmentally friendly energy for a brighter future.

T: 0845 260 9150
F: 0845 260 9333
E: info@solarhomeconnect.com

Solar Home Connect LLP,
4 Emmanuel Court, Reddicroft,
Sutton Coldfield, West Midlands B73 6AZ

www.solarhomeconnect.com

MCS

Installed and commissioned by MCS approved installers.

All information in this booklet was obtained from the Energy Saving Trust - A Buyer's Guide To Solar Electricity Panels.

Designed and produced by The Marketing People - www.marketing-people.co.uk