



green energy doctor

Energy advice that doesn't cost the Earth

SOLAR PHOTOVOLTAIC

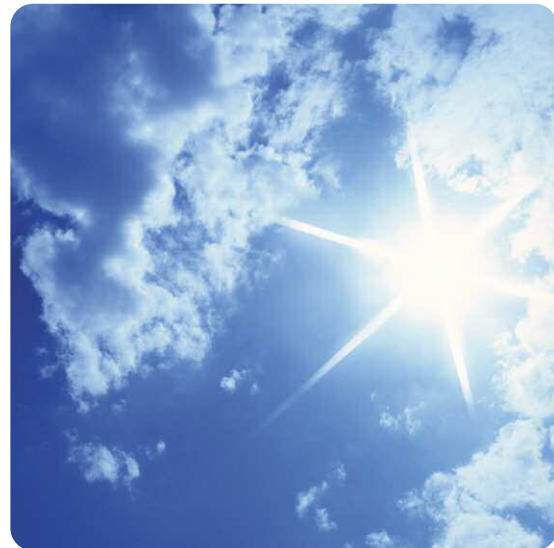
Capturing the sun's
energy to generate
electricity

We could help you save up to 50%
on your electricity bill and more. Read on...

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What is Solar Photovoltaic?

Solar photovoltaic cells (PV) enable light to be converted into electricity that can be used to power your property. They are already an important part of our lives with simple PV systems providing power for many small everyday items, such as calculators and road traffic signs. More complicated systems provide power for communication satellites and commercial processes. Few power-generation technologies have as little impact on the environment as photovoltaics. The systems quietly generate electricity from light without producing air pollution or hazardous waste. They don't require liquid or gaseous fuels to be transported or combusted and because its energy source, sunlight, is free and abundant, they can significantly reduce the running costs of any building on which they are fitted.



Types of Solar PV System

There are two primary types of solar system, dependant on how the outputs are used:

Standalone Systems

These PV solutions are popular in remote areas, where connection to the national electricity grid is expensive or impossible. Systems that are not connected to the national grid require energy storage facilities to allow for the time lapse between the production of energy and the energy requirement, these usually come in the form of rechargeable batteries. An inverter is then used to convert DC electricity to AC (alternating current - mains electricity).

Grid Connected Systems

Solar PV systems can also be connected to the national electricity grid. A special inverter and controller converts DC electricity to AC at a quality and standard acceptable to the grid. No battery storage is required. Any unused or excess electricity may be able to be exported to the national grid and sold back to your electricity supplier.

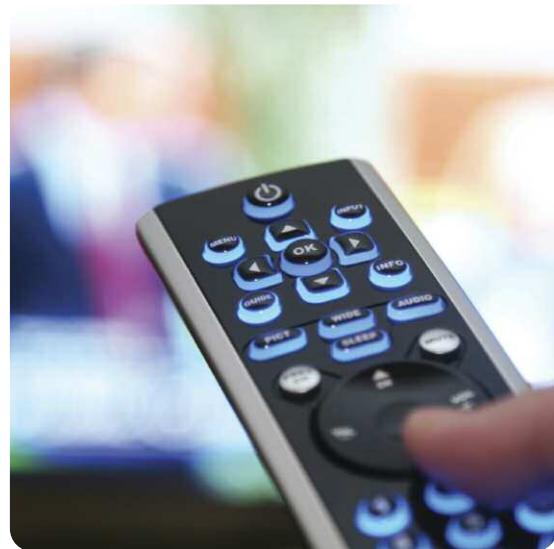


Typical Outputs and Costs

Solar PV cells, modules and arrays are rated at peak output power. Watts peak (Wp) is the peak power in Watts (W) produced in standard test conditions. These conditions are rarely achieved consistently in practice as the output fluctuates with solar radiation levels, which vary considerably during the day and also during the year. However, below will give you an indication of the typical outputs by system size:

Array Size	1 kWp	2 kWp	3 kWp	4 kWp
Applications	Households	Households	Households and small commercial premises	Households, schools, local authority buildings, and small industrial units.
Annual Output (kWh)	700 - 800	1,500 - 1,700	2,500	3,400
% Of Typical Household Requirement (approx.)	25%	50%	75%	100%
CO ₂ Saving per Annum	400kg	800kg	1,200kg	1,700kg
Typical Roof Space Required	10m ²	20m ²	30m ²	40m ²
Estimated Costs (including Installation)	£6,000	£9,000	£12,000	£15,000

- These figures are a guideline only for affordability. There are many variables and types of system that can affect outputs, pricing and payback.
- Approximate national annual household energy consumption for three bedroom house = 3,500kWh



“A typical 2 kWp solar PV system will generate about 50% of the electricity consumed by an average household.”

How Does it Work?

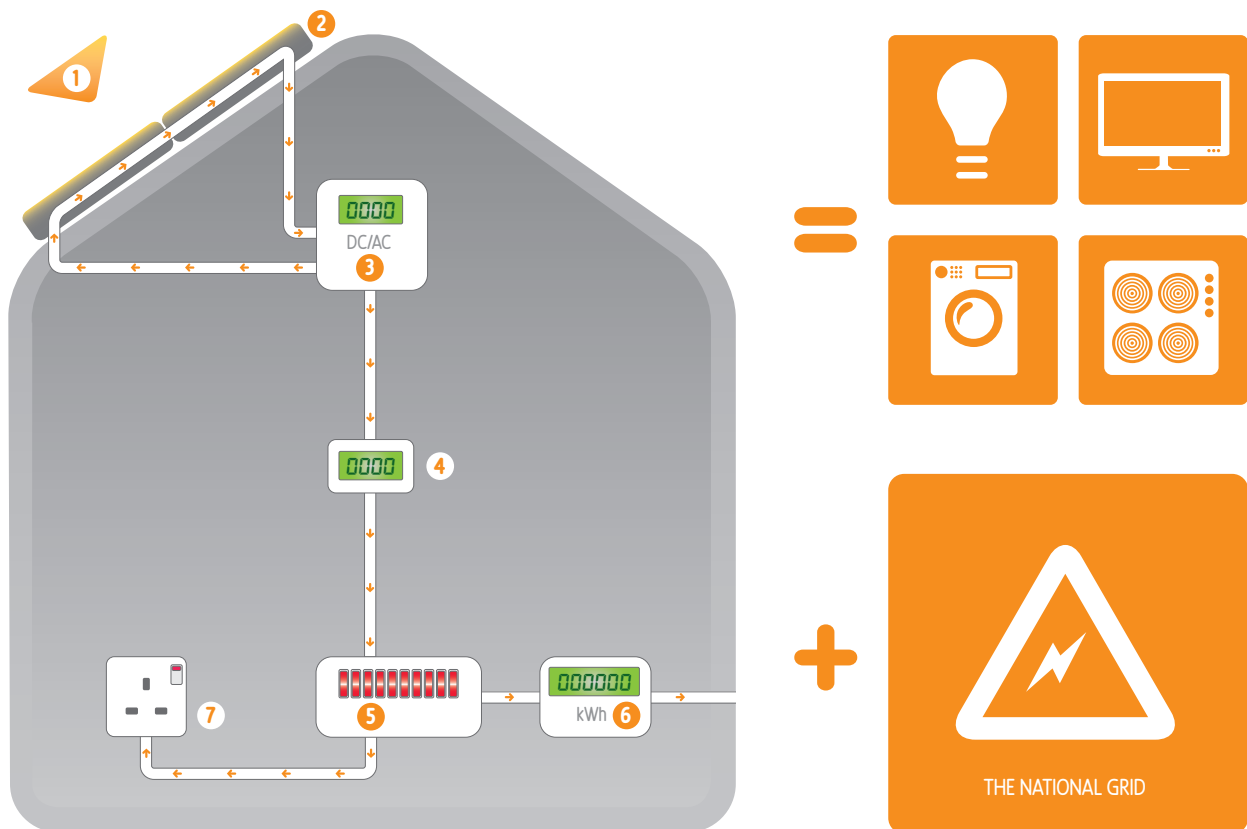
There are different types of Solar PV systems, but the principle on which they operate is similar. All Green Energy Doctor systems consist of two main components:

Solar PV Panels

Commonly known as solar cells, individual PV cells convert sunlight into electrical energy using semi-conductor materials such as silicon or gallium arsenide. When light shines on the cell it creates an electric field across its layers, causing electricity to flow. This electricity is then conducted away by metal contacts as direct current (DC). The amount of electricity produced will depend on the amount of light that falls on the PV cells. PV does not require direct sunlight, only sunlight to generate electricity, however the output from a PV cell will vary with the intensity of the light. All PV cells operate at a low voltage; therefore they are often connected together in series to form PV modules that may be up to several feet long and a few feet wide. Modules, in turn, can be combined and connected to form PV arrays of different sizes and power output for household or commercial needs.

Inverter

This converts the direct current (DC) electricity generated by the panels into alternating current (AC) electricity that matches the building's mains electrical grid supply. If the building is not grid connected the inverter is usually replaced with a battery bank to store the electricity generated.



Solar PV systems produce electricity, which is conducted away as direct current and converted to alternating current for use within the buildings AC electrical circuit. 1. Sun Rays, 2. Solar Panel/Array, 3. DC/AC Inverter, 4. PV Generation Meter, 5. Mains Electrical Board (Fuse Box), 6. Mains Electricity Meter, 7. Electrical Socket (Or Other Electrical Output e.g. Lighting).

“Significantly reduce your bills by generating your own electricity using the free and abundant energy from the sun.”

How Much Does It Cost To Install?

The cost of a complete Solar PV system, including installation, can vary dramatically depending on the type of system to be installed (grid-tied or standalone) and the installation method to be used (roof integrated, on roof, flat roof or ground mounted). Solar tiles cost more than conventional panels and panels that are integrated into a roof are more expensive than those that sit on top.

However, as a guide, costs range between £4,000- £4,500 per kWp installed with most domestic systems usually between 1.5 and 4 kWp.

Once the technical survey has been carried out and the property found suitable, Green Energy Doctor will provide you with a fixed price for completing the job.

Is It Suitable For My Requirements?

Which system is most suitable for your property or project depends on a number of factors that we will take into account prior to designing a solution.

In the meantime, the following gives a good indication of some general principles that should be taken into account when deciding if the technology is suitable, and if so, designing a cost effective Solar Photovoltaic system:

Panel Location

These systems work equally well in any environment (urban or rural) as they can be easily installed on the roof of most buildings and connected to an existing electricity circuit. Panels can be roof or ground mounted. Ground panels can be oriented due south, and can easily have snow swept off to maximise efficiency, but many buildings lack the ground space needed; in an urban setting, the roof is usually a better option.

Roof Mounting

Green Energy Doctor supplies and fits high quality PV modules in a wide variety of shapes and sizes which can be mounted in the following ways:

- **Solar Slates:** These come in variable sizes and can be installed on the roof in the same manner as roof tiles. Although it is more economical to install these on a new build property, they can be installed on an existing property.
- **Above-Roof Solar Panels:** The above-roof mounting system is typically used when fitting to existing properties, whereby rails are fixed over the roof tiles and anchored to the roof beneath. The rectangular panel is then attached to the rails.
- **In-Roof Integrated Solar Panels:** These are similar to above-roof panels but with the mountings allowing the panels to be fixed directly to the roof, flush with the surrounding roof tiles. These can be used on an existing property, but above-roof mounting is usually cheaper than in-roof integrated in this situation.

Orientation of the Panels

Ideally the collector should be on a roof within 80 degrees of South and with a pitch between 30 degrees and 60 degrees to allow them to capture the most light. However, the actual loss of output between due South and East is less than you would expect (circa. 16%).

Shading/Obstructions

Roofs that have any shaded areas for any part of the day would not be suitable for Solar PV systems. A solar shading analysis would be done by Green Energy Doctor to assess the roof's production potential.

Suitable Space

Both the rectangular panels, and the solar slates, are invariably fitted in multiples and they can be fitted in any configuration, but for the average three-bedroom house wishing to produce 50% of the electricity requirement, you would ideally need 20m² for the solar array. For a two-bedroom house, this may be smaller, although this will depend on your electrical usage.

Energy Requirement and System Sizing

System sizing is an important question for off-grid electric systems; but is less of a problem for on-grid systems, where the excess electricity can be sold to the electricity company. You can easily estimate the number of solar modules you need by determining your wattage needs from your electricity bills. You can calculate the power production of a system by multiplying the number of hours of sunlight by the number of watts of the solar panel or array. Not to worry though, as Green Energy Doctor can advise on whether a particular solar panel or array is enough to meet your needs.

Please feel free to call us, send us an email or send us a drawing of your specific project.

How To Get Started...

To find out more information on our services or to understand what technologies might be suitable for your needs, please visit our website and use our renewable energy decision tool, or give us a call to organise a no obligation home visit.

Contact the Green Energy Doctor today on:

☎ 0845 009 5652
✉ info@greenenergydoctor.co.uk
🌐 greenenergydoctor.co.uk



What Are The Benefits?

▷ Reduce Your Electricity Bills by Up to 50%

Solar energy is free and with an on-grid system you can sell electricity back to the grid. So if you have a typical 3 bedroom property with a properly sized and installed 4 kWp solar system, you can expect to save 50% off your electricity bill. The only limiting factors to you producing electricity and selling the excess, is the budget you have to buy and install the system, and the space available for the PV array. Installations on commercial buildings are particularly suitable for PV, as demand for electricity occurs at the same time as generation.

▷ Generate Significant Income via the Feed-In-Tariffs (FITs)

FIT's is a scheme which requires energy providers to pay householders or businesses who generate their own electricity from low carbon or renewable sources. A minimum payment for all electricity generated is guaranteed and index linked to inflation (Retail Price Index). These payments are made in addition to any savings made on your energy bills. The payments are for all electricity generated, not just that which is exported. A fixed payment from the electricity supplier for every kilowatt hour (kWh) generated (the "generation tariff") is paid. The payments are guaranteed for 25 years. For householders it also has the benefit of being tax free!

▷ Sell Surplus Electricity Back to Grid

If your on-grid solar PV system is producing more electricity than you require, the excess can be exported back onto the National Grid using an export meter. The rate paid is 3p per kWh.

▷ Reduce Your Carbon Footprint

The sun generates solar PV electricity, so it's a clean fuel source. They don't pollute the air like power plants that rely on combustion of fossil fuels, such as coal or natural gas. They don't produce atmospheric emissions that cause acid rain or greenhouse gases. Therefore, a typical domestic solar PV system will save 450kg of CO₂ per year for each 1kWp installed.

▷ Peace Of Mind On Your Fuel Costs

The sun is a plentiful and free source of energy and is estimated to be secure for the next 4 billion years. This can provide you with the peace of mind that a proportion of your energy is under your control and will not increase in price as a result of volatile pricing by energy providers or the prevailing economic climate.

▷ Low Maintenance Cost

The technology is proven and established. The panels have no moving parts and as such there is very little that can go wrong with them, which means that maintenance costs are kept to a minimum.

▷ Unobtrusive & Scalable

A Solar PV system is silent and can be integrated into or mounted on an existing roof and so is relatively discreet. The systems are also modular which means they can be added to at any time to increase the energy output.

▷ Improved Energy Performance Ratings For Buildings

Using a Solar PV system in new or refurbished building stock could help to improve its overall environmental energy performance and help it to achieve lower carbon emissions as represented in an EPC (Energy Performance Certificate).

“Fitting a Solar PV system is like having your own silent power station that will reduce your energy bills and carbon emissions.”



Energy & Resource Conservation



Sustainable Energy



Energy Efficiency



Renewable Energy



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