

QUICK GUIDE

Solar Photovoltaic Systems



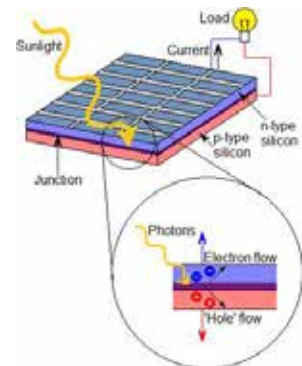
Solar Photovoltaic (PV)

PV cells are made from layers of semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced. Groups of cells are mounted together in panels or modules that can be mounted on your roof.

The power of a PV cell is measured in kilowatts peak (kWp). That's the rate at which it generates energy at peak performance in full direct sunlight during the summer. PV cells come in a variety of shapes and sizes. Most PV systems are made up of panels that fit on top of an existing roof, but you can also fit solar tiles.

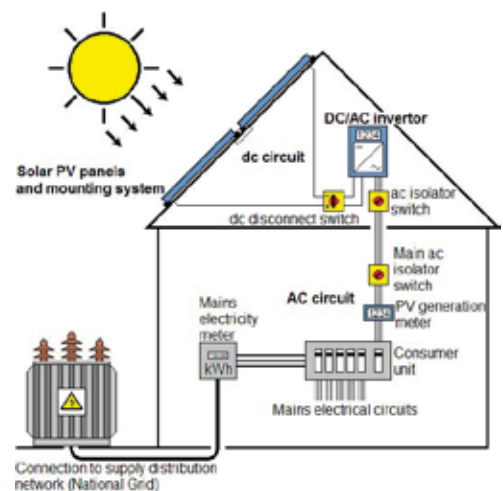


The solar PV cell operation is based on the ability of specifically engineered semiconductors to convert the absorbed energy from sunlight (the so called photons which can be considered like individual energy packets hitting the top surface of the solar PV cell) directly into DC (direct current) electricity by exploiting the photovoltaic effect.



In the conversion process, the incident energy of the sun's light creates electrically charged, free electrons in the solar cell, which are then separated by the engineered semiconductor's (solar cell's) internal structure to produce electrical current which is collected to an external electrical load.

Solar inverters, also called grid-tied inverters, convert the direct current (DC) electricity produced by your solar PV panels to alternating current (AC) electricity that can be used in the home and exported back to the grid.



Solar invertors also:

- ensure compliance with regulations about feeding electricity into the grid, for example, by immediately disconnecting if there is a power cut
- maximise electricity production by constantly varying its resistance (load).

Solar inverters are very efficient, usually 93–96% depending on the make and model – never 100% because they use some of the input DC power to run, generally around 10–25W.

Installation Location

The first consideration, is there a suitable place for the panels?

Usually these are fitted to the roof but they can be fitted to a wall or anywhere else where they can be supported, providing they face between south-east and south-west at an appropriate angle.

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

TILT deg	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	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	83	78	74	71	67	63
70	59	63	66	70	72	75	78	79	79	79	79	78	75	72	68	64	61	56	
80	50	56	60	64	66	68	69	70	71	72	72	71	70	67	66	60	57	54	50
90	41	49	54	58	59	60	61	61	63	65	65	63	62	59	60	52	50	47	44

The table above shows the percentage of the ideal annual output you will get for a system with a different orientation and tilt.



If fitting them to a roof, then a check will need to be made to ensure that it can support the panels' weight. A structural survey would be a good idea.

Also, is there anything that will substantially shade the panels, e.g. overhanging trees, large neighbouring buildings? These will influence the effectiveness of the panels.

Planning Requirements

In England, Wales and Scotland, you don't need planning permission for most home solar electricity systems, as long as they're below a certain size – but you should check with your local planning officer, especially if your home is a listed building, or in a conservation area or World Heritage Site. You'll find full details on the government's legislation sites.

Permitted development rights for solar PV (roof mounted) permitted unless panels protrude more than 200 mm when installed.

Your local Building Control Office may want to check that your roof structure is suitable – your installer should be able to give advice on this.

Building Regulations Requirements

The installation of solar PV panels on the roof on a house needs to comply with Building Regulations including Part A on Structural Safety. If the loading to the roof is increased by 15%, or more, this is a material alteration and a formal Building Regulation approval is required.

✓ Advantages of Solar Photovoltaic

- Benefit from the Governments feed-in tariff, which pays a set rate per kWh of electricity generated and an additional rate for any exported back to the national grid.
- The feed-in tariff is guaranteed by the Government for 20 years.
- Panels designed for European countries generate power even on cloudy days; they simply need light to produce electricity.
- Clean energy means carbon emissions can be reduced by up to 1 tonne per annum.
- Producing your own power protects against rising energy prices.
- Once installed requires very little maintenance.

✗ Disadvantages of Solar Photovoltaic

- A large area of unshaded south, south-west or south-east facing roof is required to maximise payback. Smaller systems can be installed but payback will be longer.
- Panels degrade over time by approximately 20% over 25 years; this however is taken into account in most reputable suppliers' calculations.
- It may be beneficial to replace the inverter after 10 years to optimise power generation, although this is not essential.

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