

Fact Sheet – Solar Photovoltaics (PV)



Photovoltaic (PV) panels convert light energy directly into electrical energy. When sunlight hits a solar panel, it creates an electric field across layers of semiconducting materials such as silicon, making electrons jump between the layers and creating an electrical current. The electricity produced by solar panels is DC and needs to be converted to AC by an inverter before it can be used in conventional electrical appliances or exported to the grid. Solar panels do not need direct sunlight to produce energy and so panels can produce energy even on overcast and cloudy days. However, PV panels generate more electricity the more sunlight they receive and to achieve the maximum generation in Scotland panels should have a south facing orientation, and be angled at a slope of between 30 and 40 degrees to the horizontal.

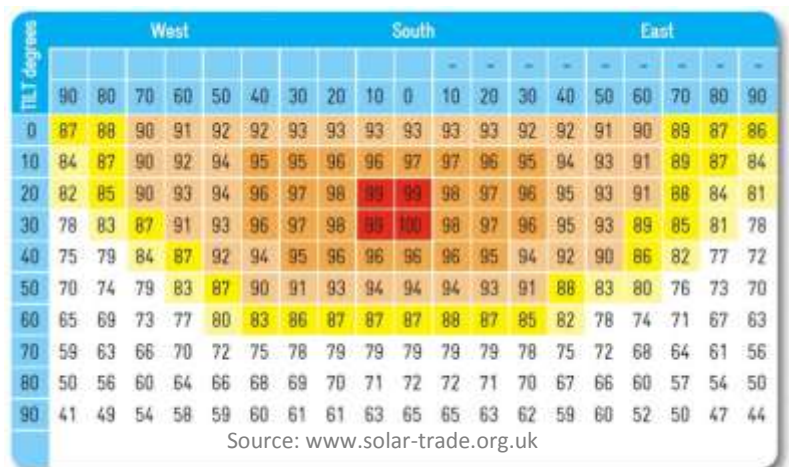
Farms are often ideally suited to solar PV installations due to the large areas of unshaded roof space that are available on agricultural buildings. If available roofs are not south facing or at the optimum angle, an alternative approach is to ground-mount panels on areas suitable for sheep grazing or unfarmed areas. Ground-mounted systems are supported on a framework which can use motorised tracker systems to enable the panels to follow the sun's path through the sky although tracker systems are rare in the UK due to higher levels of diffuse sunlight compared to other countries and high capital costs associated with these systems.

The graphic below is for average UK data and illustrates how the generation of solar panels is influenced by their orientation and angle of tilt, but shows that even panels which are oriented facing directly east or west can still generate over 90% of their potential output.

It is often expected that sites further South will have higher irradiation rates. However, coastal areas also have higher irradiation levels.

As such, in Scotland a great deal of the east coast has good conditions for PV, with high irradiation levels, especially in East Lothian, Fife and even Morayshire, while on the west side of the country the south and west of Galloway is also very well suited as well as parts of Argyll and the island communities. Solar modelling calculations can be carried out to assess the available solar resource at any particular site.

If a farm has high energy demands in the daytime hours then the energy savings made can be substantial, especially in the summer months when the sun is shining and power can be used for cooling of harvested produce that is in storage. Having a self-sufficient electricity supply also provides a degree of 'future-proofing' against the spectre of rising energy prices.



Q: What are the capital investment costs? How much space do I need?

A: For roof top systems typical values are shown in the table below.

System size (installed capacity)	Required roof area	Typical project costs inc. fees	Internal rate of return (20 year IRR) depending upon % of electricity consumed on-site.		
			25.00%	50.00%	75.00%
10 kW	80 m ²	£15,000	8.03%	10.41%	12.60%
30 kW	240 m ²	£41,500	9.22%	11.69%	13.96%
50 kW	400 m ²	£62,000	12.83%	14.24%	15.59%
100 kW	800 m ²	£130,000	10.78%	12.20%	13.56%
250 kW	2000 m ²	£280,000	12.74%	14.29%	15.78%

Q: Will my roof be able to take the extra weight of the panels?

A: Solar panels can be weighty, and a structural survey of your roof may need to be carried out to ensure it is able to carry the weight. Strengthening work sometimes needs to be undertaken before any panels can be installed.

Q: Do I need planning permission for PV panels?

A: Most roof mounted systems on domestic and commercial properties will not need planning permission and installations can be carried out under Permitted Development Rights (PDRs). Exceptions to this rule are properties that are listed buildings or situated in a conservation area, Area of Outstanding Natural Beauty or a National Park. However, your local building control department should always be informed of any intention to install roof mounted panels. Ground mounted panels covering an area of more than 9 square metres will require planning permission.

Q: What is an EPC and do I need one?

A: An EPC is an energy performance certificate that assesses how energy efficient a building is. These are usually only required for buildings which are habitable and heated. In order to qualify for FIT tariffs an EPC rating of D or above is usually required for habitable buildings. If the building in question does not reach the required energy efficiency, the installation will qualify for the FIT at a reduced rate (currently 6.38p/kWh).

Q: What maintenance is required and what is the life expectancy of a Solar PV system?

A: PV panels have no moving parts and require very little maintenance apart from regular checking and cleaning. Most PV systems come with a 25 year guarantee and inverters generally have a 5 year guarantee. Inverters do need to be replaced, usually at around 10 years and this should be factored into any payback calculations.

Q: What size of scheme should I install?

A: In order to maximise returns on investment, it is best to size a solar PV scheme to energy use at the farm/property as the saving achieved on using the electricity is about 11.5p/kwh compared to an export price currently guaranteed at a minimum of 4.77 p/kwh. However, large scale PV developers are currently looking for sites above 5MW (25 acre ground arrays) to be funded under the ROCS/CfD schemes which indicates that these large schemes are economically viable. Such schemes could be funded by farmers themselves through the CARES initiative.

Q: What rate of return can I expect?

A: The rate of return depends on the initial capital cost and rates of generation plus the FIT rate at the time of connection which is reviewed quarterly for solar PV with degression rates of 3.5% to 28% potentially imposed. However, for a South facing scheme where 50% of the electricity is used on-site, a project payback period of less than 10 years can be achieved.

Q: Which Solar panels are right for my property?

A: There are three established types of PV panels on the market. Monocrystalline panels are the most efficient; polychrystalline panels are cheaper but less efficient. Amorphous silicon panels are less efficient still, but are flexible making them a valid option when installation of a solid panel is not viable.