# Solar Photovoltaics

## Practical Guide

Solar power refers to energy derived from the sun in terms of either direct heat or daylight. The sun could easily provide all our power needs; the problem is capturing it.

Solar renewable systems can be divided into two types; Solar thermal, which relies on heat from the sun to provide heating and hot water, and solar photovoltaics (PV), which converts daylight into electricity.

Incentive payments for large scale solar PV installations (>5MW) have been withdrawn for new schemes and feed-in tariff (FIT) payments for new smaller installations are now much lower than they previously were. FITs for solar PV installations award payment on all electricity generated plus sale of surplus power to the grid. This is coupled with additional savings on the electricity bill through using electricity generated by the PV cells rather than mains electricity.

Where there is an on-site demand for the electricity produced that matches the yield profile of PV, then appropriately sited PV installations can offer an attractive, if long term, return on investment. A survey carried out by Farming Futures suggests that 80% of farmers would like solar PV on farm roofs.

**This Practical Guide concentrates on the opportunities for producing electricity from solar photovoltaics (PV) on farm, which could help to provide an additional income and reduce farm GHG emissions.**

**Top tips for every farm:**

- ✓ Carry out an energy audit.
- ✓ Monitor and reduce energy use.
- ✓ Benchmark — how do you compare with others?
- ✓ Assess all opportunities for renewables — for example a mix of renewable technologies such as wind and solar may be best suited to your farm.
- ✓ Compare information from different suppliers.

## Feed-in Tariffs (FITs)

When you join the FIT scheme, a fixed generation tariff is agreed and paid for the amount of energy you produce. This amount depends on the specific installation and currently (April 2017) ranges from the highest rate, of 4.04p/kWh for PV schemes of up to10 kW and associated with a building to the lowest rate of 0.42p/kWh for stand alone schemes. The generation tariff is fixed over a 20 year period, however rates available to new schemes decrease over time as calendar and installed capacity milestones are met. Electricity sold to the grid also qualifies for an export tariff currently 4.91p/kWh.

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## Websites

www.farmingforabetterclimate.org

www.gov.scot

www.ipcc.ch

www.ofgem.gov.uk

www.carbontrust.co.uk

www.energysavingtrust.org.uk

https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

www.microgenerationcertification.org

www.agrecalc.com

www.renewableenergyonfarms.co.uk

www.calu.bangor.ac.uk/energybooklet.php.en

The European Agricultural Fund for Rural Development: Europe investing in rural areas
Scottish Government Riaghaltas na h-Alba gov.scot
SAC Consulting
SRDP Farm Advisory Service

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**Solar Heating & Hot Water**

Solar panels for heating and hot water use different technology to solar PV. These systems rely on the heat in sunlight to warm water in special panels or tubes.

The system consists of a roof mounted collector plate, fixed to an unshaded south or near-south facing roof, a hot water storage tank and a pumped circulation system. The most common type of collector units are either a flat plate or evacuated tube design.

Typical supplementary systems can cost from £3,000 upwards and a correctly sized unit can provide 100% of domestic hot water during the summer months.

RHI payments may be available for solar thermal installations.

**Is Your Site Suitable?**

- Are there any planning requirements?
- If opting for a large scale solar array at ground level, are you near to a load or grid connection; do you need permission to cross anyone else's land?
- If retrofitting to shed roofs, has your supplier taken into account the additional loading that panels could put on the building, especially taking into account the weight of heavy snowfall?
- Remember hours of daylight are not constant throughout the year, affecting generation potential.
- Assess current energy use. An energy audit will help you identify unnecessary losses and assess energy and heat needs.

## Solar PV opportunities on farm

Solar PV cells convert daylight into electricity, the amount of energy they produce varies depending on the light falling upon them rather than on the air temperature. Solar PV panels can make good use of existing farm roofs, so no additional space is needed to site equipment.

Solar PV systems are normally connected to the National Grid, so power can either be used during the day as it is generated, or sold back to your electricity supply company.

A mix of renewable technologies including solar PV can be particularly useful in off-grid situations, providing light and power to houses and farm buildings. Small solar PV panels are already in use to power pumps to supply water for livestock drinking troughs and to charge batteries used for electric fences.

## Installation and maintenance

Siting is a key consideration to maximise output - solar PVs need to be sited in a south or near-south facing direction. Panels can be retrofitted to building roofs, incorporated into the roof design as tiles in the external layer or, as seen in larger schemes, mounted at ground level in fields forming a bank of solar arrays.

Ideally, a PV array should be connected to the National Grid with an inverter to change power from DC (direct current) to AC (alternating current). This will also allow two-way metering where power can be sold directly to the grid when a surplus of energy has been generated or buy in electricity when the demand exceeds the current level of generation.

Aside from making sure the panels are clean, maintenance requirements are low. Some manufacturers are claiming panel life spans in excess of 35 years if correctly maintained, performance will gradually deteriorate over time. Inverters may need replacing during the life of the panels, at around 10 years.

Planning permission may not be required, though guidance from the local planning office should always be sought at an early stage.

To qualify for the FIT scheme you will need to make sure that both the panels and the installer are covered by the Microgeneration Certification Scheme (MCS). More information is available from the Ofgem website.

## Solar PV costs

Costs will vary depending on your site and size of scheme. A 10kWp system covering around 70 $m^2$ of roof space with 40 solar PV panels, could cost in the region of £9,000. A good site in Scotland would give an annual return of around £360 from the FIT generation tariff (as of April 2017). Depending on geographic location and how much electricity you generated and use on site, this could give a payback period of around 9 years after interest on capital has been accounted for (assumes 50% on-site use). The internal rate of return (IRR) on this investment would equate to 12% per annum over the 20 year term of the FIT scheme.