



INTRODUCTION TO RENEWABLE ENERGY

Renewable energy is the term used to describe any naturally occurring, theoretically inexhaustible source of energy such as biomass, solar, wind, tidal, wave, and hydroelectric power that is not derived from fossil or nuclear fuel. Useful energy may be in the form of heat, as with solar water heating or indirectly as electricity as with photovoltaics.

Fossil fuels are in contrast, finite sources of energy. Their combustion releases CO₂ which contributes to climate change. As the reserves of fossil fuels dwindle and demand increases, prices are tending to increase and security of supply is becoming an issue. Therefore the comparative viability of renewable energy is steadily improving.

The key challenge in using renewables is to derive usable energy, in a practical and economic way.

This guide covers the issue of photovoltaics and how it can be applied.

PHOTOVOLTAICS

Photovoltaic (PV) power is used in many different situations from calculator power sources through to supplying spacecraft with electricity. In the past few years the advances in PV technology has led to a situation whereby the generation of electricity from PV on a small scale has become economically feasible in some cases.

A PV cell consists of two or more thin layers of semi-conducting material, most commonly silicon. When the silicon is exposed to light, electrical charges are generated and this can be conducted away by metal contacts as direct current (DC).

The amount of power available from a PV installation depends on a number of factors:

- Direction in which the installation is to face; south facing is the best.
- Hours of daylight per day/year.
- Intensity of daylight.
- Space available for the installation; as large a space as possible is best.

As such it is not always possible to put together a viable installation if the area or situation is adverse. Traditionally the UK has not been considered a good area for PV but increases in the power available from a cell compared to the amount of light it needs has improved viability.

Currently there are approximately 2.3MW (peak output) of PV installations in the UK. This ranges from small scale home applications to visitor centres, small businesses and large factories. PV cells are generally referred to in terms of their peak output. This is the maximum output that can be produced from a cell during optimum conditions. When averaged over a year, 1kW of PV installation will generate about 900units of electricity per annum.

PV is eminently suitable for integration with other types of renewable energy such as wind or hydroelectric power generation. Integration with windpower is common as peak solar power and wind power tend to occur at different times.



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Some common photovoltaic applications are as follows:

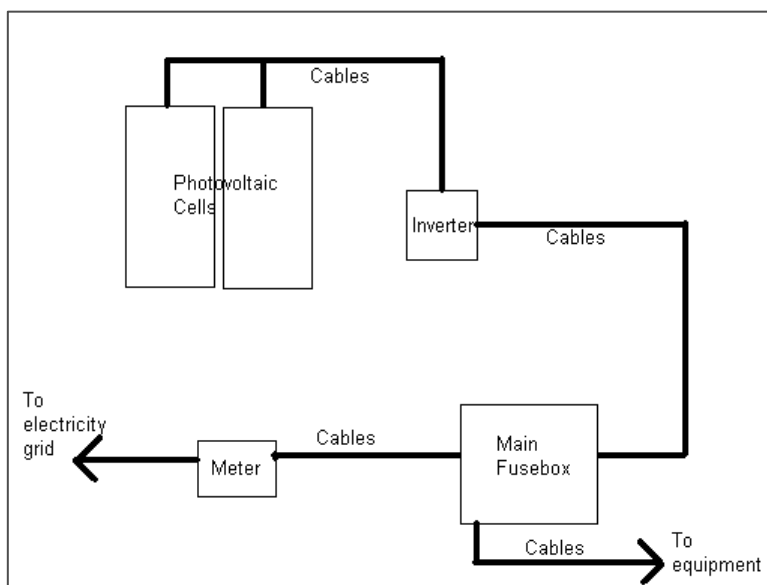
Application	Detail
Lighting	Domestic/ remote farm buildings
Battery charging	Electric fences/ metering equipment
Power	Small appliances in summer cottages
Security	Domestic/agricultural systems

TECHNOLOGY

A photovoltaic installation usually comprises the following key components:

1. Generating cells (the photovoltaic part).
2. Inverter (to convert DC to AC).
3. Cabling to connect to grid and to power equipment.
4. Switching systems to liaise with other power sources.

Photovoltaic setup schematic



SITING AND SIZING

Generally a photovoltaic installation requires a large south facing roof space and the equipment usually comes in the form of pre-constructed panels. However, a range of PV coatings that can be placed over roofing slates and glazing units giving a broader aesthetic value are now available.

A traditional roof up to a pitch angle of 40 degrees is suitable for PV cells. If the roof pitch is greater than 40 degrees the available exposed light is much reduced due to shading effects. Trees, chimneys, other buildings and the position of existing roof lights can also have detrimental effect and must be considered when planning a PV installation.

PV installations do not generally require planning permission if they are replacing existing roof

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tiles. However, permission may have to be sought if the building is subject to conservation status or the installation is to be a large ground mounted device. It is advised that the relevant planning authorities are made aware of any prospective PV project at an early stage so that unforeseen problems can be identified and rectified before any expense is incurred.

Connecting a PV system to the distribution network will require permission from the Distribution Network Operator (DNO). Also rates at which electricity can be sold back to the grid will vary with the energy supplier you are dealing with.

PV COSTS

Typically a roof area of 20 square metres is needed for an installation with 1.5kW (peak) output. This would normally generate approximately 1,200kWh of electricity per year. This translates to 1/3 of an average household electricity use. Typical installation costs for an installation of this size would be between £8,000 and £15,000 and, based on a typical electricity value of around £110 per annum, very long paybacks can be expected unless the installation is heavily subsidised.

This payback can be expected to reduce to around eight years if an installation grant is obtained. Such grants may be available for PV installations depending on the total output rating. Details of grants can be obtained from Energy Saving Trust (see below for contact details).

FURTHER ADVICE

<p>The British Photovoltaic Association National Energy Centre Davy Avenue Knowlhill Milton Keynes MK5 8NG Tel: 01908 442291 Fax: 0870 0529193 Email: enquiries@pv-uk.org.uk Website: www.pv-uk.org.uk</p>	<p>New and Renewable Energy Enquiries Agency Building 168 AEA Technology – Environment Harwell Didcot Oxfordshire OX11 0JQ Tel: 01235 432450 Fax: 01235 433066</p>
<p>The Centre for Alternative Technology Llwyngwern Quarry Pantperthog Machynlleth Powys SY20 9AZ Tel: 01645 705950 Fax: 01654 702782</p>	<p>Renewable Energy for the Home NEF Renewables The National Energy Foundation Davy Avenue Knowlhill Milton Keynes Buckinghamshire MK5 8NG Tel: 01908 665555 Freephone: 0800 138 0889 Fax: 01908 665577 Website: www.greenenergy.org.uk</p>
<p>Energy Saving Trust 21 Dartmouth Street London SW1H 9AZ Tel: 020 7222 0101 Fax: 020 76542444 Website: www.est.org.uk</p>	

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