CARBON BITES

From the CIBSE ENERGY PERFORMANCE GROUP

Photovoltaic Panels

Photovoltaic (PV) panels convert solar energy into direct current (DC) electricity. This can either power DC loads or be converted into alternating current (AC) by an inverter. AC electricity not consumed onsite can be fed into the local grid. PV installations can be ground-mounted, mounted onto the roof or walls of a building, or built into the roof or walls of a building (known as Building Integrated Photovoltaics - BIPV). Essential design considerations include:

- Avoid shading of the panels (partial or full shading of PV can lead to a 90% drop in output);
- Orientate and mount panels so they are angled (30-35 degree optimum in the UK) to face the southern solar radiation;
- Design in adaptability for future expansion;
- Ensure the structural integrity of the mounting surface can support the PV installation over the planned lifetime (usually a minimum of 25 years); and
- Model the electrical output on the annual solar irradiation of the location rather than the peak.

As a rule of thumb a well designed PV installation sized at 1kWp (~7-14m^2 and £3k-4k/ kWp) can generate between 780-850 kWh per year (depending on solar irradiation available). This can offset 445-485 kg CO_2 per year.

The most common PV panels are made from silicon. Their efficiency at converting solar irradiation into DC electricity under standard test conditions are approximately:

- Mono-crystalline silicon, 15-18%
- Poly-crystalline silicon, 12-15%
- "Thin film" technology; amorphous silicon, CdTe, CIGS, 5-12%

Key benefits include low operational costs, negligible maintenance and noiseless operation. The main drawback is high capital cost. However, the Government's Feed-in Tariff (FiT) scheme, implemented in April 2010, has incentivised the adoption of PV as the owner of the installation can claim additional income for the electricity generated and exported. The expected rate of return can be as high as 8% over 25 years; however, this depends on factors including the ownership and management model, the cost of the offset energy and whether the generated electricity is consumed onsite or exported.

Sarah Royse, 01 March 2011

Key issues

- The system efficiency is the percentage of solar irradiation converted to electricity. Solar irradiation in the UK ranges from 1,200 kWh/m2 in the south-west to 900 kWh/m2 in Scotland.
- Design the installation so air can flow freely around the panel. A 1°C rise in the temperature from ambient of the panel can lead to a 0.5% drop in efficiency.
- For PV installations < 50kWp to qualify for the FiT the installer must be MCS accredited.

Web links

- The Solar Trade Association - http://www.solar-trade.org.uk/
- Manufacturers and suppliers -
- http://www.therenewableenergycentre.co.uk/power-from-the-sun-(photovoltaics)/pv-panel-manufacturers-and-suppliers/7
- Feed-in Tariff information - http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/feedin_tariff/feedin_tariff.aspx
- Microgeneration Certification Scheme (MCS) - http://www.microgenerationcertification.org/