FACTSHEET 2: Introduction to Solar PV

Introduction

The sun's energy is the most abundant form of energy on the planet, and has the potential to provide for all our energy needs many times over. As a source of energy it is free and widely available. Solar Photovoltaic (Solar PV) panels convert the sun's energy directly to electrical energy. On houses the panels are usually erected on a south facing roof where they receive the maximum amount of sunlight, and the electricity produced can then be used to power appliances, charge batteries, or be fed back into the grid. Although direct sunlight is not essential, electrical output increases with greater light intensity.

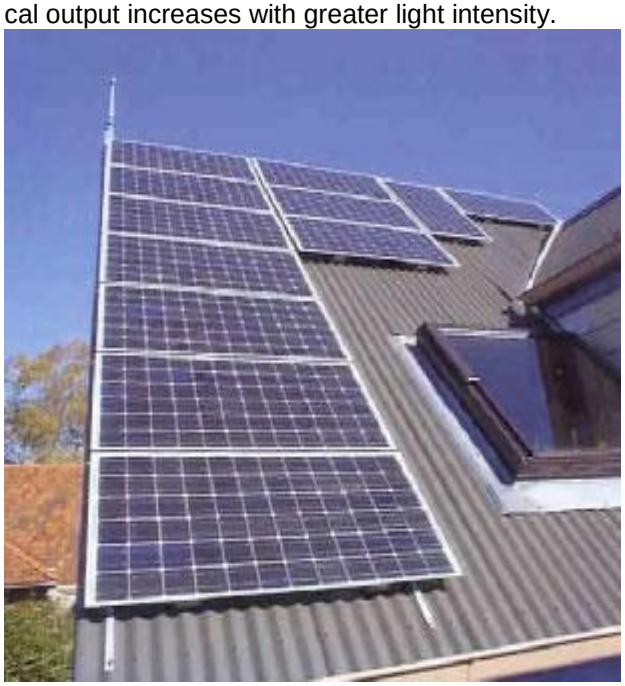

FIGURE 1: ROOF MOUNTED SOLAR INSTALLATION

1. The technology

Solar PV panels consist of a series of solar cells, made of silicon, each one capable of producing around half a volt of electricity.

Individual PV cells will be connected together to form a module or panel, and then individual panels are then linked together to meet a particular need. When a photon (a unit of light energy) hits a PV cell, this increases the energy level of the electrons in the silicon, which creates a flow of electrons – i.e. electricity. Solar cells come in three main forms – monocrystalline, polycrystalline, or thin film – each working at different levels of efficiency and suitable for different types of installations.

FIGURE 2: LARGE-SCALE PV INSTALLATION (SOURCE – SOLAR CENTURY)

Solar panels produce direct current (DC) electricity. The electricity we use for most applications is at 240 volt alternating current (AC), so the electricity produced from panels will need to be converted. Solar panels will only produce electricity during sunlight hours, so a back up system of power will also be needed.

If sites are not grid connected, the electricity will be used to charge a bank of batteries connected to an inverter. This converts the DC into 240 volt AC, providing usable current for most applications.

If a site is grid connected the panels can be connected to a two-way meter, which measures the current imported into the building from the grid, and the Solar PV current exported out into the grid. This allows the householder to sell the electricity to the grid when the panel is producing more energy than needed and to import energy from the grid when the panel is not producing enough electricity (i.e. at night). Therefore there will be a constant supply of electricity, and the solar electricity produced will not be wasted.

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2. Area of panels

With solar PV panels being low power, quite a large area of panels will be needed in order to provide a reasonable amount of usable power. A large unshaded south facing roof is ideal. But flat roofs can also be used if they are not in the shade. Panels are then mounted on frames at the correct angle.

$6m^2$ of high efficiency panels will produce around 1 kW at peak output. A typical system for a house will cover between 15 - $18m^2$ and be rated at around 2kWp, providing for around a third of a household's electricity needs (as long as the house is not heated by electricity). The size of a system will depend upon the area of roof available for panels, so that systems providing for much larger buildings than purely domestic dwellings can be created.

FIGURE 3: DOMESTIC SOLAR PV (SOURCE - SOLAR CENTURY)

3. Cost

Solar PV panels are relatively expensive for the amount of power they produce, and so cost will be a major consideration in these installations. A domestic system producing 4kWp will cost from around £6,000 - £7,000. As these systems have increased in popularity, the price of silicon has dropped and government incentives have been introduced the price has fallen.

The feed in tariff enables owners of renewable electricity systems to earn an income from the electricity which they generate. This financial incentive consists of three parts, and aims to provide a financial return of around 5% - 8% on the investment required to pay for the system's installation.

1. **Total generation:** is payment received for every kWh which the system generates.
2. **Export:** is payment of 4.5 p/kWh, which is received for electricity that is exported – for small domestic systems this will be assumed (or "deemed") at 50% of total generation unless the system owner chooses to meter it.
3. **Own consumption:** the system owner will also save approx 16 p/kWh by using the electricity generated on site.

For the latest guidance on the Feed in Tariff includes rates please visit:
http://www.ofgem.gov.uk/Sustainability/Environment/fits/tariff-tables/Pages/index.aspx

FIGURE 4: INTEGRATED SOLAR TECHNOLOGY

Modern solar panels can also play a functional role in buildings as a roofing or cladding material – solar cladding panels, solar roofing tiles, solar roofing panels and solar glass are all products that can be integrated into a building. This will not only produce electricity, but also save on the cost of conventional roofing and cladding materials. This means that the economics of solar systems integrated into new buildings or refits can work out favourably, even if integrated solar components can be more expensive than conventional sit-on-top solar panels.