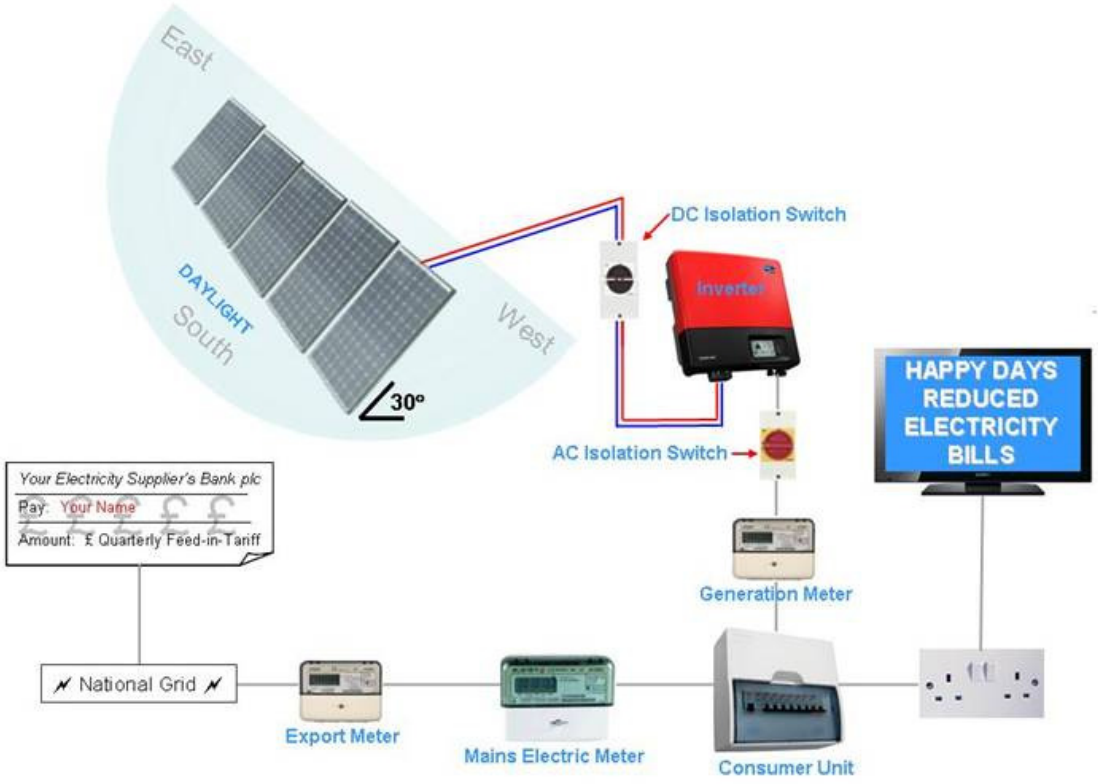
Mechanics of a Solar PV System

Solar PV Systems convert daylight (not sunlight) into electricity. **PV Modules** (PV Solar Panels) are made up of many cells each containing one or two layers of a semi conducting material. An electric field is created when daylight reaches these cells making electricity flow between the semi-conducting layers.

To be effective the **PV Modules** need to face within 90º of South – optimum performance is obtained when facing directly south. The Modules need to be pitched at an angle between 20º - 50º - the majority of residential roofs fall within this range. A pitch range of 30º to 45º is ideal. Output performance is also affected if the Modules are partially shaded by trees or adjacent buildings.

PV Modules can be integrated into a roof, or mounted just above the tiles on a rail system. For flat roofs and suitable land sites Modules can be mounted on a 'pitched' racking system. Given the overall weight of the Modules, including any mounting infrastructure, it is important to ensure that the roof can bear the load. A professional site survey is really essential to check this out and the other suitability factors. Where there's doubt a full structural survey should be commissioned.



Unlike Direct Current electricity, Alternating Current can be transmitted over long distances at high voltages using relatively low current. This is why AC electricity supply is used throughout the modern world.

All PV Systems therefore have an **AC/DC Inverter** to convert the DC electricity into usable AC power with safety measures including **DC & AC Isolator Switches**. Once converted to DC, the electricity flows though a **Credit Meter** to record and display how much power is being produced before arriving at the **Consumer Unit**. It is here that mains electricity enters a domestic property and is distributed through one or more ring circuits around the building. **Solar PV System** generated electricity is routed through the **Consumer Unit** where it either be called upon for consumption within the property (to help power TV, lighting, appliances etc.) or exported to the Grid if it's surplus to requirement.

In this way a **PV Solar System** creates a tax free income through **Feed-in-Tariff** payments, reduces our consumption of commercially generated electricity, so lowering our bills and carbon emissions.

Solar PV Systems require little in the way of maintenance over a 25 year lifecycle – just periodic cleaning of the Modules and wiring/system checks by a qualified technician. No greenhouse gasses or sound pollution are produced.

Unlike Direct Current electricity, Alternating Current can be transmitted over long distances at high voltages using relatively low current. This is why AC electricity supply is used throughout the modern world.

Should I have an Export Meter fitted, or not?

For working households largely unoccupied during the week and low electricity consuming businesses, it's likely that more than 50% of the electricity generated will be exported. For example, if 80% of the annual 4,000 kWh were exported the annual Export Tariff income amounts to £99.20 (3200 kWh X 3.1p). That's £37.20 more than would have been paid under the 50% Deemed Export option. This implies that it would take a near five and half year payback period to recover the cost of a £200 Export Meter. If a Smart Meter was installed before the Export Meter payback was reached a material loss would result.

In March 2011 the Government announced its intention to install Smart Meters in all UK households as soon as is practical. Smart Meters have a built in Export Meter function that can be remotely accessed by SIP Licensees. Export Meters and the Deemed Export option will ultimately become redundant.

Each prospective PV Investor will need to make a judgement based on their personal or commercial circumstances. Owners of systems with a generating capacity of up to 30kWh inclusive can avail themselves of the 'Deemed Export' option.

How can I use more electricity when the property is unoccupied?

A clued up small system PV Investor may conclude that investing in an Export Meter delivers very limited upside reward.

For low consumption households and businesses a simple strategy would be to run appliances and other machinery that can be safely left unattended on a daytime timer programme. This would boost consumption of self-generated electricity whilst the building is empty. There's a need to avoid running such appliances simultaneously, as the demand for self-generated energy will likely exceed the solar PV supply. If it's practical, run the appliances sequentially ideally an hour either side of midday when the sun is at its meridian.

There is no claw back penalty for 'deemed 50%' option Solar Investors exporting less than 50% back to the Grid. The arrival of Smart Meters will bring this option to an end though.

Remember, consumption of self-generated electricity is matched by a corresponding reduction in expensive commercially generated electricity. The more consumed on site the greater the savings on commercial bills.

What about Moving Home or Premises?

PV Investors moving home during the 25 year FIT scheme period will find they have a predictable income to sell alongside their property. Generally, it's logistically impractical to relocate a PV system and ownership attaches to the property via the electricity meter's PAN or unique reference number. It is therefore saleable as part of the property and importantly the remaining FIT benefits are transferable.

It's possible to project the number of kWh expected to be generated between the legal completion of the sale and the FIT scheme end date. Multiply the sum by the prevailing Generation Tariff and similarly calculate the smaller Export Income. Adding these together provides a basis for negotiations. Future income is generally sold on a discounted basis as the buyer carries the risk of future default and the cost of maintenance, running repairs and module performance degradation. These could be mitigated to a degree by not including savings on household electricity bills in the calculations. The savings would be difficult to calculate as the vendor's and buyer's electricity consumption demands could be widely different.

For commercial premises the situation the situation is broadly the same, but depends on whether the building or land (ground site) is owned outright or leased/rented. If leased or rented, Leaseholder or Landlord consent would need to have been obtained prior to the Installation. It therefore depends upon what agreement was reached with such parties regarding ownership of the Solar PV System at the end of the lease or rental term. It's important to factor this into consent negotiations, even if the prospect of moving premises seems remote.

For ground sites it is not simply a question of moving and reinstalling the hardware at a new site. The FIT benefits will not be transferable; they are in effect tied to the electricity meter at the vacated site. It the FIT scheme is still in operation when you relocate system hardware the FIT payments will almost certainly not be as generous. The Government is currently reviewing FIT payments which are expected to be significantly lower that the inception FIT sum of 43.3 pence per kWh.

What are kW, kWh and kWh?

A kW is a measure of electricity consumed or generated in one hour.

A kWh (kilowatt hour) is a ‘unit’ of electricity used by power companies to measure and charge for customer consumption.

kWp (kilowatt peak) is the theoretical maximum power output of a module in perfect conditions—this is obviously rarely if ever achieved. It is simply a point of comparison between one module and another.

How a well installed Inverter should look?

A good Inverter installation should look like that depicted in the picture below. The emergency shut down procedure and electrical schematic have been encapsulated in waterproof plastic to ensure a long and serviceable life. The latter will help and keep safe any electrician who works on the Solar PV System at any point in the future.

What happens during and after a Power Cut?

The PV System will automatically shut down from the onset of a power cut or failure. This is an essential safety feature designed to protect those working on the Grid to repair or rectify the cause of the power outage. Once power has been restored PV Systems are designed to reboot following a mandatory three minute delay.

If power is restored during daylight hours it may take a few minutes for the System to build power generation momentum.