Frequently Asked Questions

Solar PV (Photovoltaic) system FAQ

What is Solar Photovoltaic power?
Photovoltaic (PV) systems use cells to convert solar radiation into electricity. A PV cell consists of two or more layers of a thin semiconducting material, usually silicon. Silicon is the second most abundant element (after oxygen) in the earth's crust. When light shines on the cell it creates an electric field across these layers, causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity. This electricity is conducted to an external circuit through metal contacts on the front and back of the cell. The electricity produced by a PV cell is direct current (DC), which means it must be converted to alternating current (AC) before it can be used to run most domestic or commercial appliances.

The voltage produced by a single PV cell is typically small (~0.5V for monocrystalline silicon), so several cells are interconnected to produce a module or panel with the desired peak voltage and current. Cells connected in series will give an additive voltage, while cells connected in parallel will produce higher currents. Modules are then linked and sized to provide the optimum output to meet a particular load (amount of electrical power required). The result is a PV array which supplies power to the building it is fitted on. If the building has mains electricity, any excess electricity can be exported to the national grid.

Alternatively, when demand is high, extra electricity can be purchased from the national grid through the utility companies. Where there is no mains supply, PV arrays can be used to charge batteries, potentially reducing or eliminating the need for diesel generators.

It is important that no part of the PV array experiences shading, as this can greatly affect its output. A PV array has no moving parts, generates no noise and requires very little maintenance. It can be integrated onto existing structures and can be designed to have very little visual impact.

What are the different types of PV cell?

The three main types of solar cells are:

- Monocrystalline
- Polycrystalline
- Thin Film

Monocrystalline silicon is the traditional material for PV cells, with typical efficiencies of around 15%.

Monocrystalline cells are cut from a single large cylindrical crystal and are usually the most efficient type of PV cell. The manufacturing process is relatively complicated and expensive however, making it one of the most expensive of PV technologies.

Polycrystalline silicon is formed from ingots of melted and re-crystallised silicon. This manufacturing process is simpler and cheaper than that of monocrystalline silicon, allowing the production of cheaper cells, but they are typically less efficient. Recent advances have succeeded in creating some polycrystalline cells that can match or even exceed the efficiency of monocrystalline PV cells. The Kyocera cells that we install use polycrystalline technology, and have a conversion efficiency of over 16%.

Thin-film PV cells are a much newer technology. Various different materials have been used, but all thin films require much less material than either mono or polycrystalline cells and are therefore cheaper to produce. This reduces the cost of the cells but also tends to reduce the efficiency. Some multi-layer thin films now have efficiencies comparable to crystalline PV cells.

What do I need in order for solar PV to work?

In order for your site or property to be suitable for a solar PV array, you will need an area of open roof or ground that is exposed to direct sunlight throughout as much of the day and as much of the year as possible. For best results, the panels should be south facing at a horizontal angle of 30-40 degrees, but in practice the panels can be faced between south-east and south-west and pitched between 10-50 degrees with little reduction in output. PV panels can be installed on flat or pitched roofs and a variety of mounting methods are available, depending on your particular site.

Despite the UK's reputation for lack of sunshine, solar PV performs well in this country and can even make significant contributions on cloudy and overcast days. Extensive testing and monitoring has shown that the annual output from solar PV is reasonably reliable, and should on average be around 800 kilowatt hours per kilowatt of installed capacity, assuming the panels are correctly sited and fully exposed.

The crucial factor when siting a PV array is that none of the panels experience shading and they are exposed to the sun for as long as possible. Remember that the sun will be lower in the sky during winter months than in summer months, and that this may increase the risk of shading in winter. Causes of shading can include trees, utility poles or neighbouring buildings. A 1kWp system would consist of around 4 panels (depending on size and rating) and occupy approximately 2.7m x 2.8m, depending on the mounting method and surface.

Will I be able to generate hot water?
The solar panels that we install are photovoltaic, which means they generate electricity and not hot water. Though this electricity could be used to heat water, for example with an electric immersion. Please see the section on the Coolpower EMMA for more information on how you can achieve this.

Wind Power FAQ

What is wind power?
Wind turbine The power of the wind has been harnessed for thousands of years for milling grain and pumping water. Today it is the second biggest source of renewable energy after hydroelectricity. The power available in the wind is harnessed through the use of large aerofoil blades that rotate under the force of a moving air mass. This converts the kinetic energy of the wind into the mechanical power of a rotating turbine shaft, which is then used to generate electricity. Power from the wind varies with the cube of the wind speed. This means that doubling the wind speed results in eight times as much power. Relatively minor variations in wind speed can therefore result in large changes in potential output and proper siting of the turbine is very important.

A wind turbine essentially consists of a set of tower-mounted blades that are connected to an electrical generator. Wind speed increases with height above ground level, so higher turbines are usually able to generate more power. The vast majority of wind turbines installed today are horizontal axis. This means that the blades rotate around an axis perpendicular to the turbine tower. In order to ensure as much power is captured as possible, many turbines have a yawing mechanism that allows them to continue facing into the wind when it changes direction.

The electricity produced by a wind turbine is alternating current (AC), but a rectifier and inverter are usually required to stabilise the voltage and frequency of the output before it can be connected to any electrical loads. If the building supplied by the turbine has mains electricity, any excess electricity can be exported to the national grid. Alternatively, when demand is high, extra electricity can be purchased from the national grid through the utility companies.

How fast does the wind have to blow?
Most wind turbines will generate electricity only when the wind speed falls within a certain range. The minimum "cut-in" speed of the Proven turbines we install is 2.5 m/s. Below this speed, your turbine will not produce any electricity. Unlike many wind turbines, Proven turbines have been designed to safely withstand high wind speeds whilst continuing to generate, and therefore have no maximum "cut-out" speed. As the wind speed increases, the blades twist to reduce their aerodynamic efficiency. This allows it to keep running in even the fiercest of storms. Proven turbines reach their maximum output at 12m/s. Wind speeds above this will not result in any further increase in electrical output.

What do I need in order for a wind turbine to work?
In order for your site or property to be suitable for a wind turbine, you will need an open area of land exposed to the prevailing wind. Because the wind turbine is so sensitive to changes in wind speed, it is essential that it be kept as far away as possible from any obstructions and sources of air turbulence, including trees and buildings. The performance of the turbine will also depend greatly on the wind resource in your area. A good average wind speed is required throughout the year, typically above 5 m/s. The DTI UK Wind Speed Database can provide an estimate of annual mean wind speeds throughout the UK. This acts as a guide for assessing wind speeds in your general location, but local topography and obstructions can lead to actual average wind speeds being different from those predicted.

What is the lifetime of a wind turbine?
A wind turbine will last approximately 20-25 years or more if properly serviced and maintained. Servicing should take place annually in order to check all mechanical and electrical parts.

Ground Source Heating FAQ

What is a Ground/Air Source Heat Pump?
A heat pump is a device that can extract heat from one place and deliver it to another place at a higher temperature. In the UK, the ground about 1 metre below the surface stays at a constant temperature of around 11-12oC throughout the year. Ground/Air source heat pumps (GSHP/ASHP) can transfer this heat from the ground/air into a building to provide space heating and pre-heating domestic hot water. For every unit of electricity used to run the heat pump, 3-4 units of heat are produced. As well as ground source heat pumps, air source and water source heat pumps are also possible. A ground source heat pump consists of three main components:

Evaporator - takes the heat from the water in the ground loop.

Compressor - moves the refrigerant round the heat pump and compresses the gaseous refrigerant
to the temperature needed for the heat distribution circuit.

Condenser - gives up heat to a hot water tank which feeds the distribution system.
In addition to the heat pump itself, a ground loop is required to extract the heat from the ground. This is a length of pipe, typically several hundred metres long, containing a mixture of water and bio-based antifreeze that is pumped around a closed circuit to pick up the heat from the ground. Ground loop can be buried underground in either a vertical bore-hole or a horizontal trench, depending on the area of land available. The heat pump and associated vessels are located within the house, leaving no external signs of the system.

Air source units use an outdoor collector unit, similar to an industrial air conditioning unit instead of the ground loop, but operate on the same principal.

What do I need in order for a heat pump to work?
In order for your site or property to be suitable for a ground source heat pump, you will need an open area of land in which to install the ground loop. The amount of land required will depend on the heating requirements of your property and whether you are using a bore-hole or trench system.

A GSHP or ASHP system works only in a modern building meeting current insulation standards. The heat pump is most efficient when being used to provide continuous low-level heating, for example through underfloor heating, rather than using them to significantly increase the building's temperature in a short space of time as gas boilers are often used. However, heat pumps can be used to feed existing radiators and to provide domestic hot water. They can produce up to 55 degrees of hot water, which can be boosted to 60 degrees in conjunction with an immersion heater when needed. It is also possible to use a heat pump in combination with existing gas or oil heating systems.

The heat pump unit itself is approximately the size of a household refrigerator. Because some additional vessels and filters are required though, a heat pump could be considered plant-room equipment and may be best located out of sight within a large cupboard rather than sitting out in a room.

Coolpower EMMA FAQ

What is EMMA?
EMMA (Energy and Microgenerator Manager) is a device which monitors for excess generation from a renewable source and proportionally diverts it to a load. The

best use for the EMMA is on grid connected systems when there is expected to be times when the generation exceeds demand, and the power would normally be exported to the grid. Instead, the device will divert it into a useful load, ideally an immersion heater in a hot water tank.

Is it worth me getting EMMA?
The best application for EMMA is when hot water is required on the premises and you would otherwise be heating the water with an inefficient/expensive source, such as oil boiler. This means you will reduce the cost of water heating, effectively getting water for the export rate of 3p/kWh. If you already have a tank and immersion heater installed, the EMMA installation is usually relatively straightforward if completed at the same time as your generator – though the device can be retrofitted. For more details, get in touch with us and we will be happy to advise.

Grid Connection FAQ

Do I require a connection to the National Grid?
A connection to the national grid is not necessarily required for solar PV and wind turbine systems, though it is becoming the most popular style of system. If no grid connection is available, the renewable generation system can be connected to a remote battery system in order to store the generated electricity.

Because battery systems can be expensive and more difficult to maintain, it is now more common for systems to be connected to the National Grid where possible. This means that you can always draw in more power if you need, but also allows you to export your excess generation so that it can be used by others.

Can I make money from my generated electricity?
Many utility companies are now willing to pay you for any excess electricity that you export back to the National Grid from a renewable microgenerator. The price paid for this electricity is currently set at around 3p/kWh. The Government also have a “Feed in Tariff” scheme, where they pay your for generated power regardless of whether or not you make use of it. The rates vary dependant on your technology installed and its size. See the Energy Saving Trust website for more details on the current scheme.

Will I be able to generate my own electricity during a power cut?
No. When your renewable energy generation system is connected to the National Grid, it constantly monitors the electricity in the grid for fluctuations and interruptions. If a power cut occurs, your system will automatically shut down and you will not be able to continue generating even if the wind is blowing and the sun is shining. This is done so that if the National Grid requires any maintenance work to be performed, your system will not be supplying power to the line, potentially causing danger to any engineers working on it. It also ensures that the output

from your system is still compatible with grid electricity when the supply is re-established.

Planning Permission FAQ

Do I need planning permission?
It is always best to speak to your local authority's planning department. It is likely that they will ask for more information about your development.

Planning permission is often required for wind turbines, but most local authorities are keen to support the installation of micro-renewables. Obtaining planning permission is usually straightforward. You should not require any planning permission to install ground source heating.

Solar PV systems on pitched roofs are usually allowed under “Permitted Development” unless you are in a conservation area or have a listed building. Flat roof and Ground Mounted systems are worth checking with your installer to check whether they are included under the permitted development scheme.

Funding FAQ

Do I pay VAT?
The standard rate of VAT is 20%. For a household, there is a special reduced rate of 5%.