Robert Porteous
Roofing, scaffolding
&
Solar PV specialists

Tel: 01665833270 / mob: 07709165734
Email: rob@robporteous.co.uk

Solar PV Information Pack

About Our company:

Our company is an MCS accredited solar PV company and we also have over 30 years of experience in the roofing & roofline trade.

Our company offer you a friendly, reliable, honest & high standard of service from a quotation to the final commissioning of the installation.

All of our staff are fully accredited to deal with any aspects of the solar procedure, and we are the first solar PV roofing company in the North-east to become accredited. We feel we can save you time and cost involved with the procedure of Solar PV system Installation.
No extra cost for roofing assessments also being in the roofing trade we have full knowledge of how to install your modules without causing disruption to your roofing materials e.g. slates, tiles,

We will keep you informed at every stage of the installation, making your new renewable technology a happy experience.

Please read this information pack we have provided and if you have any further queries or questions please do not hesitate to contact us on the details provided on the front of our pack. You can request a call back from our website, as we ensure our customers experience with our company is a happy one.

Kind regards

Robert & The team

Introduction:

Installing a Solar Photovoltaic (PV) system at your home or business is a rewarding achievement that will bring financial and environmental benefits for years to come.

There are many related products on the market and selecting the right equipment for your properties requirements (being domestic/ commercial) can be a daunting procedure. The technical specification and associated performance of equipment combined with suitable selection of supporting components can be a complex and time-consuming process. Our company offer full assistance and advice required to make sure that your project is designed with optimum performance and operation from day one. We provide the technical expertise, choice of economic equipment, Installation and on-going services so your project can be successfully integrated to your home or business.

The two primary benefits of incorporating a solar PV system are the production and consumption of free electricity and the consequent saving of carbon emissions and other greenhouse gasses. As a technology it also has a number of other benefits:

- Straight forward to install as the panels are modular light
- Reliable technology- panels are guaranteed to last between 20-25 years
- Reduced electricity bills
- Excess electricity can be sold back to the national grid, giving you an extra tax free income

Our information pack outlines the processes involved and the various factors needed to be taken into account if you are thinking of having a solar system installed by our company. We would like you to be aware of any requirements that may be needed before your installation can be installed such as: is your building suitable? Is planning permission needed? How much electricity will it produce?

We will help you through every stage of the project process from the initial outline appraisal and consideration through to installation and commissioning of the system and electricity export.

- Determine the Solar resource on-site to inform sizing of solar equipment
- Assess the site suitability for Solar PV using our site survey forms
- Undertake an electrical assessment to ensure all electrics are in good working order to enable the installation to go-ahead
- Design and develop a system to achieve economic production and saving of co2
- Present a quotation of which a sap calculation will be included so you can see the return you can get back from installing the system
- Educate and explain to our customers and present the available options to you going forward
- Project manager, install and commission your install
- Arrange grid export / sell back of excess electricity generated.

Grid connection

Before installing a PV system which you intend to connect to the mains electricity supply network, it is important to ensure that you have the following approvals:

- Permission from your local distributing network operator (DNO) to connect to the electricity grid. Note that your DNO is the utility company responsible for operating the distribution network in your area and may not be your electricity supplier.
- Approved equipment for use within the UK, notably inverters.

These are mandatory requirements largely to ensure that distributed grid-connected generation systems (like PV) will not cause safety risks to engineers working on the network, and that the electricity fed into the network complies with mains power quality requirements. It is important to appreciate that these permissions are required for all grid-connected generators.

Note: Those reputable PV system installers will normally ensure that all the required approvals are in place for you so that you can have full confidence in your new system.

For small systems the DNO must only be told about the installation at the time of commissioning but for larger systems or a number of small systems, discussions should start as soon as possible with the DNO to ensure the project goes to time. It is likely that DNO personnel would need to be present at the time of commissioning for larger projects. Our company will undertake all necessary paperwork and submissions regarding connection arrangements.

Types of PV Systems:

Grid support:

The Solar PV system is typically connected to the local electricity network and a battery-bank to store any access energy. When you pay more for import of power (10p/kwh) than export (7p/Kwh) it is sensible to have a certain amount of energy storage to off-set the re-import costs. Additionally, this arrangement is ideal for those living in rural locations at the end of the electricity distribution and transmission network and liable for frequent power cuts and an unreliable supply. Power conditioning and control systems installed as standard will “decide” when and where to send any power-no ‘manual, user control will ever be required.

Our grid connected systems compromise of a number of components which are outlined, for reference below:

- PV generator(PV array-comprising of a number of PV modules connected in series/ parallel)
- Installation kit(Roof integrated, on roof, flat roof, canopy, façade and ground mounted)
- DC Isolator(safety switch/disconnector)
- DC cabling
- DC-AC Inverter
- AC cabling
- AC I solator(safety switch/disconnector)
- kWh Meter (only required for export arrangements)

Types of PV systems

Grid connected

The most popular arrangement of a Solar PV system for homes and businesses is one that is connected via your mains circuit board to the local electricity network allowing any access solar electricity produced to be sent to 'the grid' and sold to any electricity supplier. Depending on your usage and electricity consumption profile electricity is consumed – for free. For example, during the day the home/ business will consume power generated direct from the solar PV array, in the evening it will consume direct from the stored energy in a battery bank, whilst should this renewable electricity be fully-consumed then during the night electricity will be imported from the grid under the cheaper night- time tariff. If, during the day, you have a little requirement for power any electricity produced will automatically be sent to the grid via an electricity meter for which you will be sent a monthly cheque from your electricity supplier for that which has been produced.

The Solar PV system produces power as direct current and is converted into useful AC current by an inverter for use either in the home or export. If you are planning a new- build or are not connected to the mains electricity distribution system (e.g. mobile homes) then much scope exists to introduce DC appliances such as fridges, lighting and TV's that will not require the use of an inverter within the system thus saving on the conversion losses associated with this power conditioning (up to 5% on some arrangements)

Types of PV Systems

Off Grid
Completely isolated from the grid, the solar system is directly connected to a battery bank through charge controllers which maximise the electricity stored. From here your in house loads(fridge's, TV's, computers, lighting) will be supplied from this DC current if enabled or powered via an inverter that produces AC current from the DC supply stored in the battery bank, enabling the use of normal appliances without mains power.

Where can photovoltaic's be used?
Photovoltaic systems can be used anywhere-with varying degrees of success-they can be mounted as 'solar tiles' in replacement of normal slate or roof tiles, they can be installed on vertical walls .

System set-up

Assessing your building is one of the most important steps to take when making the decision as to whether to purchase a PV system. It is important to know where on your site the PV equipment is to be placed. If this can be estimated accurately energy generation figures can be calculated for your project.

The following factors should be taken into account and will help you assess the feasibility of installing a solar energy system on your property:

- **Location:** Systems should be in locations that will be un-shaded at all times of the day if possible. Gable roofs, chimneys, cables, TV Ariel's, trees and other buildings in the vicinity should be identified as potentially shading the modules, particularly in the early morning or early afternoon. The performance of a whole panel will be affected even if only part of it is shaded.
- **Orientation:** Solar energy works on all roofs, but the modules should ideally face between south-east and south-west.
- **Tilt:** Solar products are suitable for pitched, flat and curved roofs, although the optimal roof angle is 30 degrees-40 degrees for the UK.
- **Available area:** The more surface area available, the greater the power potential. For a grid connection system the minimum required area is approximately 10m2. In some cases where suitable roof area is not available we can install a solar PV system on garages and out-houses or on a frame located close to the property.
- **Ventilation:** Photovoltaics need to be ventilated (behind the modules) so that they don't heat up- there efficiency decreases as their temperature rises. Suitable ventilation is easier to ensure for bolt on systems. Rear Ventilation is less important for some thin film modules which can be mounted directly on to the roof cover.
- **Loading capacity:** The system must be carefully positioned to the roof to take account of the loading capacity of the roof.
- **Meters:** Care must be taken if the systems are to be fitted to social housing properties (or other properties) with pre-payment meters as some meters do not allow the export of electricity and can be damaged by attempted export.
- **Vermin:** If the area is known for a bird population (e.g. seagulls) they may need to be discouraged from perching near the systems to prevent the need for regular cleaning.

System set-up

Roof mounted:
The PV modules easily align above the surface of the roof. These conventional systems have the advantage that the roof tiles will hardly need to be displaced in order to fasten the panel frame securely, ensuring that this type of installation is the most convenient and economical solution for the majority of existing properties.

Roof mounted installation systems offer the right fixing units and the right fixing anchors for every module construction type and for every type of roof covering. A large range of modules are available on the market for both grid tied and stand alone.

Roof integrated:
Roof integrated photovoltaic systems are compatible with almost any roof covering. Aesthetically, they are less intrusive than the on- roof systems. There are two methods of roof integrating the PV systems.

- PV tilting system. This system is best suited for new build projects or for buildings that are being re-roofed. It is the most expensive of the integrated systems.
- PV modules integrated system. Although it is slightly more intrusive than the tiling system it is equally efficient.

Ideally photovoltaics should face between south-east and south-west, at an elevation of about 30-40 Degrees. However, in the UK even flat roofs receive 90% of the energy of an optimum system

Planning

For the majority of properties, Solar panels typically fall within what are known as 'permitted development rights'. This means that, if a solar panel or system is more or less flush with an existing roof, the council will not ask for a planning application.

The planning authority will assess what visual impact, if any, solar photovoltaic systems would have on the local amenity. Systems can be designed so visual impact is minimised. For example, some systems can be intergrated flush to the roof and when this occurs they are no more intrusive than a roof light(velex window/window in the roof). This is most cost effective when the system is part of a new build development rather than when being retrofitted on an existing building.

Planning permission may be required if the installation projects significantly beyond the roof plane where it faces a public right of way or the solar array so enlarges the roof or property that it exceeds the permitted development limit. Solar arrays that face away from the roads and footpaths are unlikely to need a planning application.

A major part of each project is the planning application stage which may often take the largest part of the project duration. Fortunately planners are increasingly looking favourably to small time scale renewables.

Quote

Having read the proceeding information and having made your own assessment into the merits of installing a PV system and you think you are ready to go ahead with an installation, we will provide you with an initial quotation. Our company will provide you with an accurate quotation when all the areas of uncertainty have been identified and resolved and we are confident that we can meet every aspect of the customers' requirements.

Our company follows a clear and simple process in order to be able to give you an all-inclusive and accurate quotation for your PV installation.

1. **Initial evaluation:** Based upon the information you provide the company we will assess the suitability of your site and proposed project for a PV system. If there are any areas of concern we will discuss these with you and ensure they can be addressed before proceeding to the next stage
2. **Site Survey:** A full site survey may be undertaken by a member of our team to both ensure that the site is suitable and to obtain all the information that will be required to generate a complete quotation and subsequent planning and funding applications.
3. **Analysis:** We will analyse all the information gathered from you, and possibly the site survey, and fully cost any special items that have been identified during the process. We will then produce a complete quotation for the installation.

Once you have obtained planning permission, and whatever funding you are entitled to, you are ready to place your order for your PV installation.
Our company will then confirm your quotation, including any amendments that may have become necessary following the planning process, and provide you with a re-validated full quotation and estimated installation date. If you are happy with the quotation and wish to proceed then all you need to do is sign the order confirmation and send it back to our company along with your deposit.

Installation

The installation is comprised of multiple aspects and it's possible that these will be undertaken by different engineers on different days. Our company will always seek to minimise the disruption at your site and will discuss and agree with you the dates and methods of each aspect of the installation.

The key steps in the process are as follows:

1. **Site preparation:** This includes Scaffolding to be erected where required
2. **Fixing the roof attachments**(mounting rails)
3. **Mount the PV modules**
4. **Fit electrical equipment**
5. **Electrical connections**
6. **Commissioning & handover**
7. **Issuing warranty & completion certificate**

The Finished solar system is comprised of solar modules interconnected electrically in parallel strings of series connected modules. The solar modules are fastened to a support structure that is fastened to the roof of the property. Before practical installation work commences a health & safety assessment and method statement may be required.

Our company will supply & install all the electrical components that enable the PV system to be connected to the grid and for you to claim your **feed in tariff** rates. It is also possible that the local electricity company will need to change your meter for a Bi-directional one. Once all the elements are in place the system will be commissioned and will start generating power and start **saving you money.**

Upon the completion of the installation you will receive a completion certificate, a handover pack with all system specifications, and an information sheet explain what to do in the event of a fault.

Price examples and return on investment:

Please note these prices are only examples and not an actual price figure.

Solar PV System	System Output Kwh/year	Approximate Installation Cost	25 Year return On investment	Extrapolated 25 Year return on Investment
1. 85Kwp	1560 Kwh	£9,167.00	£19,529.00 (Tax free profit= £10,085.00	£40,152.00 (Tax free profit= £30,985.00
2. 22Kwp	1872Kwh	£11,000.00	£23,435.00 (Tax free profit= £12,435.00	£48,183.00 Tax free profit= £37,183.00
2. 96Kwp	2496Kwh	£13,667.00 To £14,667.00	£31,264.00 Tax free profit= £16-£17,597.00	£64,244.00 Tax free profit= £49-£50,577.00
3. 33Kwp	2807Kwh	£14,500.00 To £16,500.00	£35,152.00 Tax free profit= £18-£20,652.00	£72,274.00 Tax free profit= £55-£57,774.00
3. 88Kwp	3272Kwh	£16,225.00 To £19,225.00	£40,985.00 Tax free profit= £21-£24,760.00	£84,211.00 Tax free profit= £64-£67,986.00

Basics- Understanding Photovoltaics:

The photoelectric effect is the basis chemical process by which a PV cell converts the photons in sunlight into electricity. When light shines on a pv cell, it may be reflected, absorbed, or pass right through. That light which passes through (approx. 40%) contributes towards the generation of electricity.

The energy in the absorbed light stimulates the flow of electrons in the atoms of the PV cell (semi-conducting silicon). These electrons escape from their normal positions in the atoms of the PV material and create a current flow in an electrical circuit which provides the force, or voltage, needed to drive a current through an external “load”, such as a light bulb.

Commonly known as solar cells, Individual PV cells are electricity-producing devices made of semiconductor materials (amorphous silicon, polycrystalline silicon, monocrystalline silicon to name but a few). These PV cells come in many sizes and shapes- from smaller than a postage stamp to several inches across. They are usually connected together to from PV arrays of different sizes and power output.

The size of an array depends on several factors, such as the amount of sunlight available and the power requirements of the consumer.

The modules that make up the array constitute a major part of the PV system, which can also include isolation switches, charge controllers, mounting hardware, power conditioning equipment and batteries that store the solar energy for use at a later date.

These arrays or modules are connected to an inverter that converts the direct current (DC) produced by the panels into useful alternating current (AC) electricity that is delivered to your mains circuit board in your home/business for normal consumption from your wall sockets.

Types of Solar cells

The various types of Solar cells listed below compromise the majority of Solar PV modules available in the marketplace.

Mono-crystalline silicon cells: Made using cells saw-cut from a single cylindrical crystal of silicon, for standard installations this is the most efficient of the photovoltaic (PV) materials. The principle advantage of mono-crystalline cells are their high efficiencies (typically around 15%), however as the manufacturing process is more complicated this has resulted in slightly higher production and therefore retail costs than other PV materials

Multi-crystalline silicon cells: Produced from cells cut out of an ingot of melted and re-crystallised silicon. In the manufacturing process, molten silicon is cast into ingots of poly-crystalline; these ingots are then saw-cut into very thin wafers and assembled into complete cells. Multi- crystalline cells are cheaper to produce than mono-crystalline ones, due to the simpler manufacturing process. However, they tend to be slightly less efficient, with average efficiencies of around 12%, creating a granular texture.

Thick film Silicon: Another multi-crystalline technology where the silicon is deposited in a continuous process onto a base material giving a fine grained, sparkling appearance. Like all crystalline PV, this is encapsulated in a transparent insulating polymer with a tempered glass cover and bound into a strong aluminium frame.

Types of solar cells

Amorphous Silicon: Amorphous silicon cells are composed of silicon atoms in a thin homogenous layer rather than a crystal structure. Amorphous silicon absorbs light more effectively than crystalline silicon, so the cells can be thinner. For this reason, amorphous silicon is also known as a "thin film" PV technology.

As amorphous silicon can be deposited as a thin film on both rigid and flexible materials it makes it ideal for curved surfaces and "fold-away" modules.

Amorphous cells are, however, less efficient than crystalline based cells, with typical efficiencies of around 6%, but they are easier to manufacture and therefore cheaper to produce. Their low cost make them ideally suited for many applications where high efficiency is not required and low cost is important.

Other thin films: A number of other promising materials such as cadmium telluride (CdTE) and copper indium diselenide (CIS) are now being used for PV modules. The attraction of these technologies is that they can be manufactured by relatively inexpensive industrial processes, in comparison to other crystalline silicon material, yet they offer higher module efficiencies than amorphous silicon. Such is the chemical process of the semi-conducting device each of the solar PV cells require photons-found in massive quantities in both overcast and direct sunlight conditions- to generate a current flow. The manufactured modules are generally blue/ grey in colour and have been proven to have been successfully deployed in all parts of the UK, including the far most out-reach of Northern Britain.