Factors for roof top selection for solar PV installation

Introduction

Although solar Photovoltaic power systems are increasingly widespread and relatively affordable, this does not mean that every roof surface in a community is suitable for installation. In many cases this is because a particular issue would push the installation costs beyond what is viable as an energy project for a community group. The most likely items are explained below. In some cases the issues may also determine what the legal status of the community group should be so the separate guide to this should also be consulted.

Orientation and Inclination

Ideally the roof should face due south to give the maximum possible generation over a year. Any direction away from this will reduce the total output but this is relatively small if the direction is kept between south east and south west. The shallower the roof angle from the horizontal the less the difference. A very shallow slope (near horizontal) will maximise generation in the summer and a very steep slope will maximise production in the winter but a slope of about 35° will give the highest overall output in most cases.Look up tables showing how electricity generation potential varies with inclination and orientation by postcode area are provided in the official Microgeneration Certification Scheme "Guide to the Installation of Photovoltaic Systems" handbook that give a more complete understanding of the figures. In some circumstances a roof which has surfaces facing almost exactly east and west can be used – especially if the property has a use for the power generated throughout the full day as the additional energy savings may outweigh the reduced production. Note that putting panels on a number of different facing roof surfaces may add to the cost of installation by a few hundred pounds because the inverter required to handle the varied inputs from the panels is more complex.

Shading

There are two types of shading to take into account. Firstly, shading from distant objects that will probably cast a shadow over the whole array of panels. Unless the property is set at the bottom of a steep slope or overshadowed by tall trees or buildings, in which case overall suitability for PV may be questionable anyway, this type of shading will often only usually affect performance when the sun is low in the sky and output is low anyway – such as in the depths of winter or early in the morning. An assessment of the proportion of solar access at that site is used to calculate the reduction in performance and an installer would use a specialist device to quantify this. The second type of shading is from objects relatively close to the installation that cast a distinct shadow over part of the array. Although this might only affect a small part of the total area, because of the electrical properties of the individual components of the system, there can be a completely disproportionate reduction in power generation until the shadow moves off the panel as the sun rises in the sky. A tall thin object, such as a smoke flue, can be particularly bad for performance. If the object cannot be moved elsewhere or the array layout cannot be moved clear of the shadow, then this situation would require additional electrical equipment installed to make each PV panel electrically independent of its neighbours. This would be at additional installation cost – perhaps £500 - and is also likely to add to long term maintenance costs.

Planning Issues

Although roof top PV installations can qualify for Permitted Development status in many circumstances, there are a number of situations where planning permission would be needed. The rules are quite complex so a check with the Local Planning Authority is always advisable but the issue often arises when the installation would be on a Listed Building or likely to affect its setting or when the property is within a Conservation Area. Permitted Development PV on non-domestic buildings is more restrictive than on domestic so the rules here should always be checked.

Roof Surface and Condition

As the Feed in Tariff (FiT) would last for 20 years and the PV panels probably for a decade beyond that, the roof being used needs to be in a condition where it is not likely to require further attention for that sort of period. Heavily mossed tiles or slates or corroded roof coverings will be an indication of potential problems – installers will add to the cost of the quotation if they think they are likely to have to spend more time on the work (a slate roof may be £600 more than conventional tiles) or risk having to repair damage caused by the roof work because of brittle roof surfaces. A reputable installer will inspect the underside of the roof surface and take dimensions of the supporting structure to ensure it will be strong enough during the install process and subsequently. In some cases the roof may be covered by a warranty that would be invalidated if the PV is not installed correctly – the existence of any such warranty needs to be clarified early.

Access

In the vast majority of cases there will inevitably need to be some sort of scaffolding to allow safe access to the roof surface – installers that propose to use ladders only are unlikely to have an adequate respect for Health and Safety. The scaffolding may be of the portable type (and supplied at minimal cost by the installer) for cases where the roof gutter level is relatively low, the slope is gentle and there is a flat paved surface under the whole working area. More often static scaffolding will be required at several hundred to a thousand pounds, and issues may arise if it has to extend over the property boundary onto a neighbour's territory or a public area such as a pavement. In some cases the roof surface that is due to have the panels may only be accessed over another property's roof.

Power Supplies

Assuming that the property is already connected to the mains grid, there will be an existing limit on how great the power of a PV installation can be before needing permission from Western Power Distribution (WPD), the local Network Operator. For most domestic properties with a single phase connection this is 3.68 kW – usually compatible with 16 250W panels. It is likely that WPD would raise a charge of several thousand pounds to increase the capacity of the connection by upgrading that part of the local supply network. The next level up is a 3 phase connection, found in some large houses and many commercial buildings and businesses. This would allow 11.04 kW of PV although it often is better to not exceed 10 kW to maximise Feed in Tariff payments. Beyond this it is necessary to check with WPD what the existing connection level is and what the cost of any upgrade would be. WPD will also quote for a completely new connection at the necessary power level if the proposed roof for PV is on a building with no power at the moment but this is likely to be in excess of £10,000 in most cases. It is assumed that the existing wiring and distribution arrangements are safe and adequately compliant with current rules – a professional electrician would refuse to connect the PV to the existing circuit if he feels safety is compromised by a poorly maintained connection.

The Marley Thatch 225kW wind turbine at South Brent, Devon, has a connection rated at 237kVA; this cost £18000 and involved a relatively short cable run to the supply which was in the same field.

Energy Efficiency and Feed in Tariff

Since 2012, it has been a requirement of any building-mounted PVapplication for Feed in Tariff (FiT) payments that the property must have a valid Energy Performance Certificate (EPC) of Level D or higher (55 points). If this does not already exist then a survey would need to be carried out by the appropriately qualified Assessor. This can be done to take into account the future installation of PV as this can substantially improve the score. If, despite this, the final score is below 55 then a much reduced rate of FiT would be payable. If the building proposed for installation has poor levels of insulation or has an expensive heating system (eg electric only) then it may not be possible to achieve a Level D. There is an exemption from this requirement if the PV installation is on a non-domestic building and is being carried out by a community group which is one of the following types of legal entity: Community Interest Company; Cooperative Society; Society for Community Benefit. In these cases the community group can apply in advance of installation for exemption from the Level D requirement (although an EPC is still required) while also securing the FiT rate applicable at the time for 12 months – an important factor if there are likely to be delays in proceeding because of getting planning approval or legal agreement.

Visit the SWDCEP's website to download a guide and case studies to help your community group choose the right legal entity for your needs.

Ownership and Legal Issues

Unless the community group is installing PV on a building it already owns, many questions will arise: who will own the PV installation, who will receive the FiT payments, who is responsible for maintenance and what happens if the building is sold? The actual ownership of the building needs to be clearly understood, especially if a third party such as a bank has an interest through a mortgage. Before installing PV these issues need to be settled between the parties concerned and, if ownership of the PV by the community group is to be retained, a legally agreed lease may well be required between the appropriate interested parties. However, there is rarely a generic form of lease that can be readily agreed and an appreciable amount of legal time can be expected to be expended on achieving agreement between the solicitors acting for each side - £3000 might well be a typical minimum cost. Clearly this would not be financially viable for individual small domestic scale PV installations that only cost perhaps £6-7000 or so. Typically either a "bulk buy" arrangement via a social housing association might work or agreement would need to be for a substantially larger PV installation on a commercial premises.

Use of Energy Generated

Clearly the PV installation will generate power during the hours of daylight and this is available for use within the building the PV is connected to, saving on costs of otherwise importing the power through the meter at perhaps 15p per unit. The savings will be maximised if the building is occupied and/or has plant that needs to run during the day. Good examples are schools (except for holidays), surgeries, shops and cold stores. With the occupants away at work for example, many houses consume very little power in the day unless appliances can be programmed by timer to come on at peak PV production. In some cases, unused power can be diverted by a specialist electronic circuit into an immersion heater in a hot water tank. This can save on heating costs although this would be the most cost effective if the heating fuel was one of the more costly such as LPG or oil. At least for smaller PV installations, the export component of the FiT payments is deemed rather than metered so actual use of the energy generated is not taken into account. While the energy bill savings will be an important motivator for the property owner to have PV installed and agree a lease, it is less likely that the community group will gain as such from this aspect except from the ability to directly reduce carbon emissions within the community itself.