

Solar Photovoltaic Module

Toolkit Structure

The **Local Energy Renewables Development Toolkit** is intended to be used as a reference by community groups and community based businesses. This module is one part of a series of documents and is designed to cover all sizes of project, although the scale and complexity of multi MW projects may require more detailed evaluation than smaller projects.

Other modules that may also be of particular interest to those reading this module are as follows.

- establishing a community group
- project finance
- procurement
- securing the site
- planning
- grid connection
- the Feed-in-Tariff
- investment ready process
- community investor
- sources of finance

This toolkit builds on the work completed for the Scottish Government's Community and Renewable Energy Scheme (CARES) by Local Energy Scotland and Ricardo-AEA.

Module Structure

This module is structured in four parts to act as a guide and reference document in the development of a solar photovoltaic (PV) project in Wales.

Solar PV context

Solar PV development statistics in Wales.

Project Overview

A brief introduction to the typical ways to develop a solar PV project and step by step summary.

Project Steps, Phases and Breakpoints

A more detailed look at each stage of a project, showing a logical progression with defined break points.

Further Information

Appropriate links, definitions and references to other information, collated for quick reference.

Solar PV Context

Electricity generated from PV may be used locally with overspill into the electricity grid. Other options for non-grid connected projects are usually specific to locations remote from the grid and will likely involve battery charging applications.

As the government incentives are a significant proportion of project income, it is very unlikely that any solar PV development in the recent past will have proceeded without making an application for this support.

The Distribution Network Operator (DNO) is a body licenced to distribute electricity through the electricity grid. In Wales there are two DNOs: Western Power Distribution and Scottish Power.

Ofgem's FIT report for the period from April 2010 to end of December 2014 shows there were 53,647 Solar PV schemes with a total capacity of just under 213MW that had been registered for the FIT in Wales. Of these installations, 1,786 are installations greater than 4kW (a typical domestic scale PV scheme).

The information given in Figure 1 and Figure 2 show the total declared net capacity (DNC) for each of the Solar PV projects greater than 4kW that are supported to date under the FIT scheme in Wales.

This data shows:

- The dominance of projects below 50kW, as this is the upper threshold for permitted development. At the time of writing all projects above 50 kW require planning permission in Wales.
- Groups of projects at 10kW and 150kW highlight where FIT incentive levels change.
- Solar PV installations are approximately evenly split geographically between North and South Wales: Western Power Distribution have 48% of the installations and Scottish Power have 52% of installations.
- That Western Power Distribution (area covering South and Central Wales) has a slightly higher installed capacity at just under 115MW.
- That between the tariff bands there are a wide range of sizes of installations, showing the modular capacity design of solar PV projects.

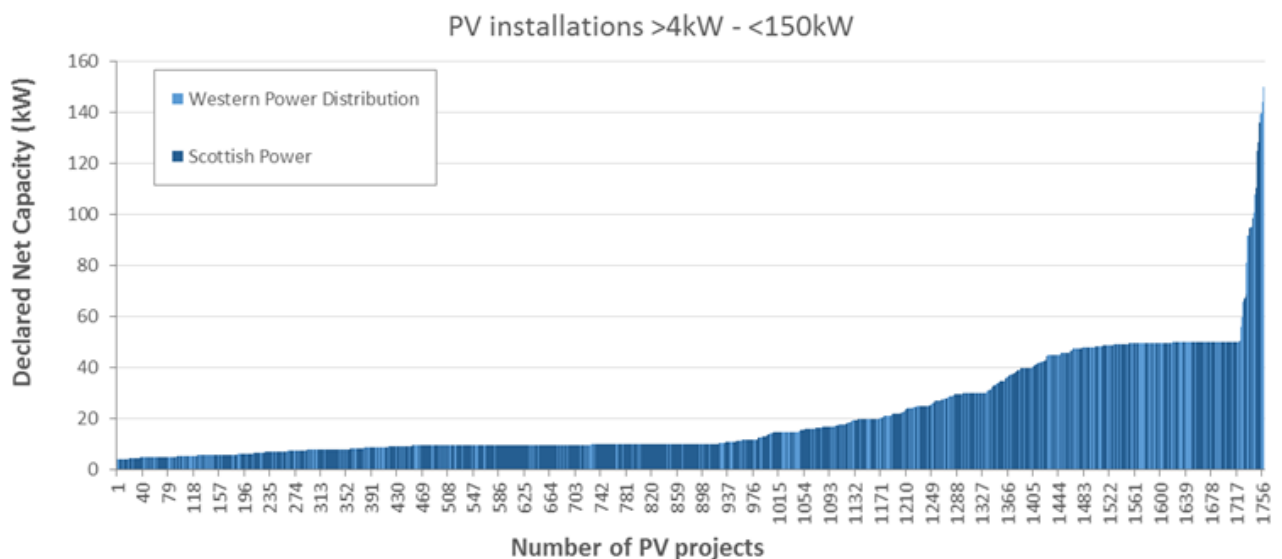


Figure 1 >4kW - <150kW registered for Feed in Tariff in Wales between April 2010 and December 2014

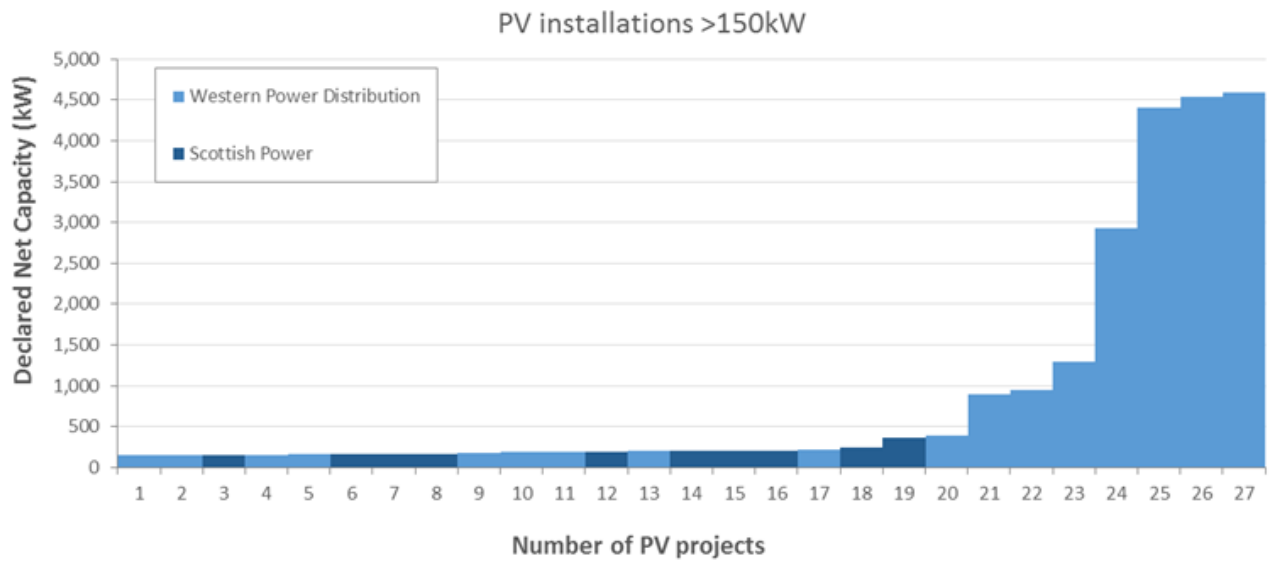


Figure 2 >150kW registered for Feed in Tariff in Wales between April 2010 and December 2014

Project Overview

Solar PV development options

In many ways the installation of solar PV is already commercially mature and thus capable of being developed and funded by community members. However, large (MW scale) single ground mounted arrays, or large arrays in single ownership spread across a number of roofs or other locations may introduce sufficient complexity to make alternative commercial arrangements more attractive. Many of these are based on some form of partnership with the community.

There are a variety of development models that involve community groups to a greater or lesser degree and generally, as the level of involvement and control increases, so too do the risks and rewards. The range of involvement extends from taking on the full development of a project, to simply receiving benefit payments from another developer.

Allowing a solar PV developer to lead the project and drive it through to completion offers the community group less risk, no cost and little work, however, the financial reward is relatively low compared to the same project being led by the community group.

As the benefits of engaging and sharing with the local community have been shown to create more successful projects, commercial developers are also creating different development models. Many of these are based on some form of partnership with the community, possibly in a Shared Ownership or Joint Venture arrangement.

Table 1 below sets out through 5 models the main options open to a community group wishing to be involved in a solar PV project. It identifies the role of parties involved, where the main risks lie and the potential benefits.

Overview of activities

Although the level of involvement in a project will depend on the role chosen by the community group, or indeed that offered to them, projects will generally move through a logical progression. It is valuable, in whichever role a community group undertakes, to have an understanding of the overall process.

In this module we have illustrated this progression of activities through a series of phases, up to defined break points. These break points are designed to review progress against a number of key challenges and confirm that a project has the potential to be viable and thus worth progressing to the next phase.

There are a variety of organisations that provide support to community groups overcome these challenges such as the Energy Savings Trust (EST), PlanLoCal and the Centre for Sustainability. Community Groups may be able to access preparatory grants to support the development stages of their project as well as capital loans or capital grants to help covered project costs through the Local Energy community programme.

Table 2 below outlines the steps in developing a solar PV project and who is leading the development. Although this module is focussed more towards solar PV projects <50 kW all steps are transferable to the initiation, development and implementation of larger solar PV projects.

Table 1 - Solar PV development options: The table below gives general descriptions of five approaches to project development that may be applicable to Community Groups.

Model	Option	Description	Group Role	Third party Role	Group Risks	Group Benefits	Comments
1	Community Group leads and owns the project throughout	The Community Group identifies, develops and operates the project	As full developer	None	Community Group bears all of the technical, commercial and financial risks	The Community Group gains all income from the project and remains in total control of the process and outcome	For the Community Group to retain all financial and other benefits it must act as developer and take responsibility for all project risks. The Community Group may also become responsible for making community benefit payments to others.
2	Community Group in partnership with another party (Shared Ownership Joint Venture)	Community Group identifies the project but shares further costs & risks	To undertake agreed tasks within the project development process	To undertake agreed tasks within the project development process	Risks are shared between partners & are usually limited to project costs	The Community Group gains a share of income & control, which remain in the proportions agreed with the other party	Depending on the detail and legal options taken, this can give the Community Group control of the project and can make the process of development easier. The transfer of benefits from the project will be agreed as part of the Joint Venture partnership agreement.
3	Community Group Initiates then hands over to a developer	Community Group identifies the project, gains rights to the site & seeks a developer to take the project forward	Site selection and initial viability then support for the project to make it a success	To confirm viability and take the project forward to operation	Work to identify an appropriate site usually involves more time than money, minimising risk	With rights to use the site the Community Group can negotiate more favourable outcomes in terms of ownership of the project	Community Group controlling the development site should generate higher benefits than those without control, however the bulk of income will reside with the developer
4	Developer leads & offers sale to Community Group (Shared Ownership Shared Revenue)	Solar PV developer leads the project and sells a percentage or the entire project to the Community Group	Initial support for the project to make it a success then raises funds for purchase	Provides development skills and sources initial project finance	Reduced risk as Community Group would take ownership of an asset or project shown to be viable	Low risk route to long term asset ownership of a project	Potentially an attractive option where the project has been initiated by a developer. Purchasing generally increases the capital cost and may also impact on the income period. Community Groups considering this option should focus on obtaining legal and financial support

5	Developer leads and owns the project throughout	Solar PV developer leads the project & offers the Community Group an annual payment	Initial support for the project to make it a success	As full developer	None	Community Benefit payments vary between projects but will be small for solar PV projects	Community Benefit payments to Community Groups will generally be a fraction of the income available from a project.
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Table 2 - Overview of activities. The table below summarises a logical progression for developing a wind energy project.

Phase 1		Developing the idea		1 to 4 months
Step 1 Develop the Vision	A key initial step in solar PV development is to define why you want to undertake the project.			
Step 2 Seek Advice	Solar PV developments have already been undertaken by groups like yours.			
Step 3 Communicate	It is important to undertake early consultation with local residents & the wider community.			
Step 4 Find a Site	Sites can be assessed against key factors to identify if there is potential for a viable solar PV project.			
Step 5 Initial Viability	Contact suppliers to get an indication of the cost and the amount of electricity likely to be generated to help roughly gauge site potential.			
Break Point 1		Is there a reason to develop?		
Phase 2		Developing the Project		3 to 10 months
Step 6 Establish a legal entity	A Community Group may need to be established as a formally constituted body or legal entity.			
Step 7 Secure the site(s)	Obtain legal agreements for the use of the site where the solar PV system is to be installed.			
Step 8 Secure initial funding	Identify funding options to support feasibility work. Appropriately constituted community groups can apply for preparatory stage grants. Installers/suppliers may carry out feasibility study at no cost.			
Step 9 Feasibility study	Assess the technical, financial and regulatory viability for the site(s). This may be provided by installers/suppliers, carried out in-house or by a consultant.			
Step 10 Secure project funding	Obtain capital funding through capital loans or capital grants, community share ownership or other finance arrangements			
Step 11 Financial appraisal	Accounting of estimated expenditure and income should be carried out. There is a Toolkit Finance Model that can be populated for this purpose			
Break Point 2		Is the project viable?		
Phase 3		Getting to Financial Close		1 to 12 Months
Step 12 Applications	Apply for planning permission (if required), make an application for a grid connection (if required) and register for the FIT.			
Step 13 Procurement	Finalise the scope and amount of all quotations and confirm the suppliers/installers to be used. Procure the solar PV system and all associated works.			
Step 14 Financial Close	This is the point at which the funder releases the money and the project can be constructed.			
Break Point 3		Did the project reach financial close?		
Phase 4		Completing the Project		2 to 12 Months
Step 15	Secure any additional capital funding and repay development loans where required.			

Repay other loans	
Step 16 Construction	Post Financial Close, confirm all orders and contracts and the process of solar PV system delivery, installation and connection can take place.
Step 17 Operation	Ensure management is in place for the life of the project for collecting and distributing income and meeting operating, financial and other liabilities.
Step 18 Decommissioning	Solar PV arrays must be removed at the end of the productive life (generally 20 to 25 years) or when at the point where they are no longer used to generate electricity.

Phase 1 **Developing the idea**

Step 1 Develop the Vision

It is important you are clear about the reason for undertaking, or participating in, a solar PV development project. For example, this may be to gain income for use within the community or to become more energy self sufficient to offset rising energy prices. You may have environmental drivers to reduce carbon emissions. It is important that you fully understand and define your own drivers so that project viability and outcomes can be tested against your objectives.

For communities, an excellent way to identify needs can be through the development of a 'Community Action Plan', the production of which will allow the development of a strategic plan and allow local democracy to define and respond to local community objectives and opportunities. It also provides a robust mandate for the distribution of funds when a community related venture begins to provide revenue. A strategic plan provides overall direction on the long path from where things are now to where we hope they will be. Community work can be greatly enhanced by a clear vision, a mission statement, objectives, strategies, and an action plan.

Businesses can also benefit from the development of their own action plan, as this helps link business needs and objectives with the potential to develop a solar PV energy project.

The main points to consider in an action plan are:

1. What are the needs in your community/business and what evidence of these needs is there?
2. What potential, realistic changes can you envisage?
3. What actions and activities need to be undertaken to meet the needs and implement the changes?
4. What are the costs of the actions?
5. What are the short and long term priorities?

Eligible community groups can apply for Local Energy community program preparatory grant support developing a community action plan.

Step 2 Seek Advice

It is sensible to seek the advice and experience of those that have started from a similar position and are well placed to offer help and guidance. By seeking this input from the outset you will be able to build on the success of others when taking your project forward.

Centre for Sustainable Energy (CSE) and Co-operatives UK maintain case studies to facilitate the identification of suitable projects to approach & gain their insight.

Consider completing a skills assessment of those persons that can be involved in the project during the development stages as the need to buy in consultancy support will clearly add to the cost of the project. The **Establishing a Community Group module** describes the range of skills that could be beneficial.

Importantly, look for advice in relation to an appropriate scale of solar PV project to suit the project objectives.

Step 3 Communicate

To ensure the best outcome for the project, establish clear communication within the local community, neighbouring communities and other stakeholders early in the project, even before a site is identified.

Experience shows that this communication must be open and honest about what is being planned and must include good opportunities to receive and respond to feedback. This also avoids any misinformation being generated and to allow the vision for the project and the benefits from it to be fully explained. Eligible community groups can apply for a Local Energy community program preparatory grant to support communication of this nature.

If strong opposition remains after this process it may make it harder and more costly to obtain planning permission (if planning permission is required) and may cause lasting social impacts within your community.

There are a range of guidance documents available for engaging with the community referenced in the Further Actions section of this module.

Step 4 Find a site

There are six important points to consider when identifying a suitable site.

- Site
- Location
- Access
- Grid connection
- On-site electricity demand
- Planning constraints

Site

Solar PV systems can be located either on buildings (typically roof top) or on ground-mounted support frames. Typically a large open area should be sought. Barriers impeding the viability a solar PV installation in the area being considered should be assessed. For example, in almost all situations the installation of solar PV on a listed building will not be permitted. There may however be exceptions, at the discretion of the Local Planning Authority (e.g. where roof works are required and an integrated solar roof tile would not create visual concerns or raise any other concerns). Any obvious issues with roof structural integrity or the apparent lifetime of the building should be considered. For ground-mounted installations you may want to consider whether the area in question is prone to flooding or vandalism.

Location

The major determinant of project financial viability is the level and duration of solar irradiation. This in turn is linked to the location of the site, the level of shading and the orientation of panels. Understanding these three factors for each site will help you identify which project will result in the maximum theoretical output.

The location chosen should have the highest possible solar irradiation for as much of the year as possible to increase the 'availability' of the system. This is a measure of the number of hours per year that the solar PV will generate relative to the maximum theoretical output. Solar irradiation varies geographically as shown in the following diagram.

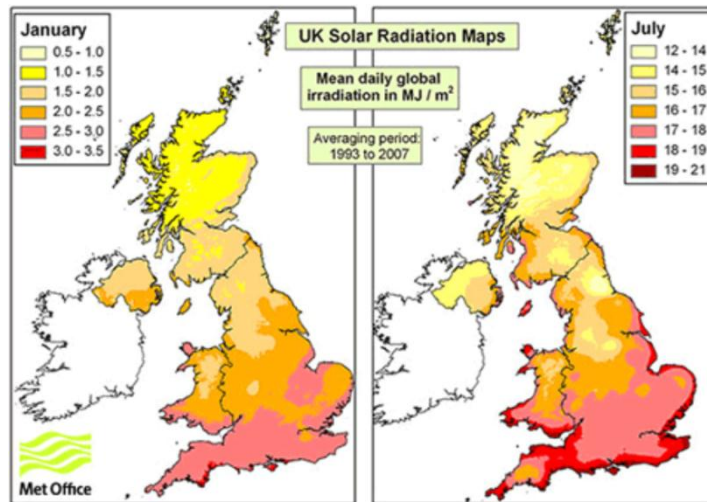
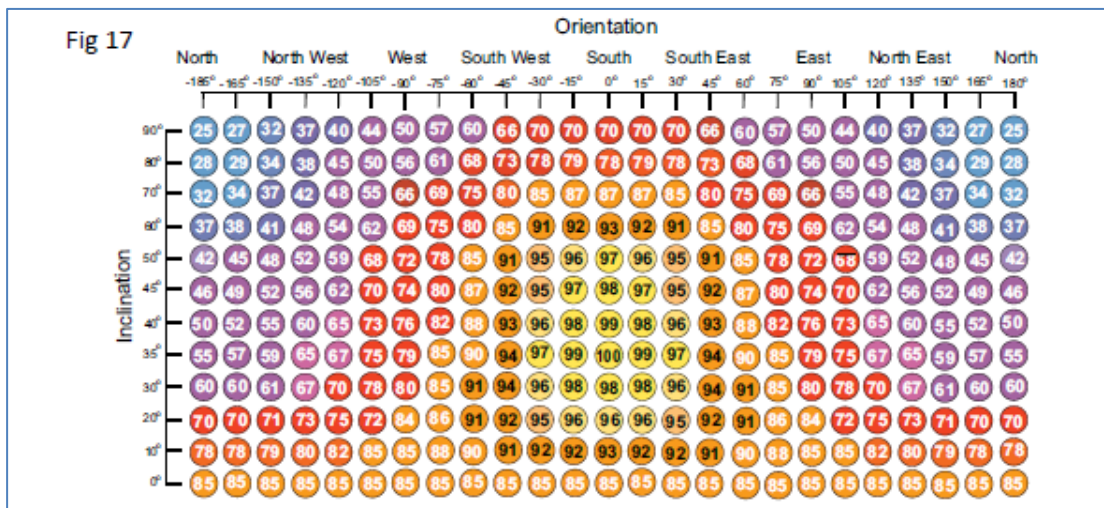


Figure 3: Solar Radiation maps (Source: <http://www.metoffice.gov.uk/renewables/solar>)

Potential shading from nearby buildings, vents, vegetation as well as adjacent solar panels should be avoided to maximise solar panel exposure to direct sunlight throughout the year. Solar PV system technologies are being constantly improved to reduce generation losses associated with partly shading solar PV arrangements but it should be noted that partly shading a solar PV panel may reduce the output of your solar PV system by more than the electricity that would have been produced by the shaded area.

Impact of orientation on the output of the panels is shown in the following diagram. The combination of orientation and location of panels may lead to issues with visual intrusion and in some cases reflection. This is of particular importance if the site is near an airport flight path.



Access

There must be physical and legal access to the site to deliver, erect and maintain the solar PV system. While this is likely to be of limited concern in most instances, large ground mounted arrays in remote locations may require legal agreements to be drawn up or temporary access tracks to be constructed. Note that barriers to roof access will increase installation and ongoing maintenance costs.

Grid Connection

Connection to the electricity grid will be required for most projects and can be available at an early date in some areas whilst restricted in capacity for a long period of time in others. Grid connection can be a significant issue across parts of Wales especially if large amounts of electricity are being generated (>50kW export capacity). The further the solar PV array is from a grid connection point the higher the cost of connection will be. Early discussion with the DNO may give broad cost of connection, subject to detailed connection studies. This is covered in more detail in the **Grid Connection module**.

The extent to which these issues affect smaller Solar PV installations may be less of a problem, however they must be considered. Similarly, basing your project on multiple, discreet, scattered solar PV systems may provide a route to higher yield overall from your project. However, the cumulative effect of a number of Solar PV installations in a given region may introduce other issues especially associated with planning or local grid stability.

If you intend on connecting to the grid it is important to establish the correct process for registering the solar PV system early on. This can be done by contacting the relevant DNO. Note that the process for registration will vary by DNO and by solar PV system size.

It is possible for solar PV systems to be installed without a grid connection (off grid) but these systems require suitable batteries which are expensive and often have limited life span. Off grid systems are eligible for FIT payments but you must ensure that all electricity generated is used.

On-site electricity demand

Electricity generated by the solar PV panels can either be exported to the grid, used on site or stored for later use. You may want to consider what portion of on-site electricity demand may be met by the proposed solar PV system. Given that electricity tariffs are almost always higher than the export tariff received from the DNO, maximizing the portion of on-site electricity demand met by the solar PV system will often increase the economic returns of the project.

Naturally, sites with higher electricity demand during daylight hours will benefit most from on-site electricity generation unless battery storage is utilized. However, sites with multiple meter point administration numbers (MPAN) and relatively small electricity demands associated with each MPAN (e.g. tenants in a block of flats) will likely require separate solar PV systems and may be a complication worth avoiding.

Planning constraints

Currently, solar PV installations no greater than 50 kW fall under Permitted Development rights in Wales and can therefore be installed without planning permission.

Permitted developments will need to observe a number of conditions and limits. These conditions and limits vary slightly between domestic and non-domestic installation, as well as for solar panels mounted on buildings and solar panels ground mounted. Please refer to the Further Information section in this module. If your solar PV installation is not a permitted development you will need to apply for planning permission.

Clearly, designated areas such as Sites of Special Scientific Interest (SSSI), Areas of National Outstanding Beauty (ANOB) and National Parks have significant planning restrictions associated with them. Development in these areas will therefore require additional consultation and will likely require more detailed background information to be supplied as part of the planning process compared to other locations.

Most planning authorities have published Planning Policy Guidance covering solar energy projects and this should be your first port of call for background information. In addition many Planning Departments welcome early informal discussions with solar energy developers about their plans. If large solar PV projects have been proposed, or built in the

area, the local authority web site will contain details of the planning application, the objections and any restrictions on the development of large solar PV projects. This can be a valuable source of local information. While results from this background research can never guarantee that planning consent will be granted on any given site, it may help to identify where there may be serious barriers and the basis for this. The **Planning Module** contains more information on this.

To develop a solar project on a site will require a lease for the lifetime of the project (usually 20 – 25 years). You will need to identify site owners of potential sites and approach to confirm their willingness in general terms to make the site available, to give you access and to do so for at least a 20 year period. The **Securing your Site module** contains further guidance on this which can be reviewed when you have identified a site.

Step 5 Initial viability

Having identified a potential site (or sites) consideration of the commercial viability of the project should begin. Suppliers should be contacted for indications of the cost involved in a project. Suppliers are often able to give an estimate of project costs for the purpose of making an initial assessment of viability when provided with the location of the proposed site, the approximate size of the array (in kW) and the type of installation (e.g. ground mounted or roof mounted).

Web tools can also be used to provide an initial assessment of solar PV project viability, some of which are reference in Further Information later in this module. As a rule of thumb, at this point in the development of the project a site generating an estimated payback of 6 years or less has the potential to make a viable project.

Break point 1 Is there a reason to develop?

The development process in Phase 1 is intended to identify the need for a project, help gauge local support and find potential sites. If all of the following are true then there is good reason to develop a solar PV project and no reason for it to be stopped at this stage.

- Available to purchase (larger ground mounted systems), or where access can be secured on a long lease (at least 20 years)
- Accessible for solar PV installation and maintenance
- Close to a point of grid connection (although not required)
- Likely to have a good solar yield, being free of overshadowing and capable of having cells mounted at close to the optimum orientation.
- Unlikely to cause unacceptable impacts on local people
- Potentially able to gain planning permission (if not already a permitted development).

There are two actions that are useful throughout the entire ongoing project development, which you may choose to start now.

- 1) Investment Ready preparation – If you will be approaching a bank for finance, you will need to provide them with a business plan with all the relevant information proving the financial viability of your project. This should be stored in a central secured location in an ordered fashion.**
- 2) Project Development plan – a project development plan detailing key tasks, responsibilities and schedule for completion can help you meet the important deadlines that influence the success of your project. A template plan which can be downloaded as part of the toolkit.**

Phase 2 **Developing the project**

Step 6 **Establish a legal entity**

In order to make funding applications, establish banking facilities, secure a site, and enter into contracts or joint venture arrangements, to pay bills and to receive income there should be a recognised legal entity taking the project forward.

For rural businesses, it is important that any liability insurance or the conditions of existing bank finance allow diversification into renewable energy generation so that this activity is covered. In the case of larger projects or stand-alone projects it may also be prudent to isolate the liabilities of the solar PV project from the core business.

For community groups that are not already constituted, this means an appropriate formally constituted body or legal framework, usually where the constitution provides some protection against personal liabilities and potentially including appropriate insurance. The **Establishing a Community Group module** contains more information on establishing a legal entity.

The form of legal entity taking on the project can influence the range of finance options available and could be critical in securing the finance option most suited to the project objectives. Further information on finance options can be found in the **Project Finance module**, and a review at this stage may support consideration of the appropriate legal entity to progress the potential solar PV project.

It is important that legal advice from a solicitor who has experience of completing this type of work is obtained at this stage.

Step 7 **Secure the site(s)**

Once the above legal framework is in place then the site(s) must be secured. This frequently requires you to enter into a legal agreement with the site or roof owner that guarantees your tenure over or access to the site for several years after the expiry of the FIT payment contract. It is likely that this will involve some kind of payment being made to the owner.

Depending on the requirements of the funder you may need to enter into a formal lease agreement or buy the site to enable financial close to occur. At this point you are then liable for all agreed payments.

However, subject to the requirement of funders, you may wish to postpone this step until after the feasibility study has been carried out. A memorandum of understanding (MOU) could be used at this point to secure the site or roof owners intentions in writing. This would reduce risks of purchasing a site, or entering into a lease agreement, only to find that the project is not feasibility.

Step 8 **Secure initial funding**

Local Energy preparatory grants of up to £30,000 are available to contribute towards the more speculative, early stages of your projects development such as initial public consultation, feasibility studies, and to secure basic land rights.

Step 9 **Feasibility Study**

The financial viability of any project depends on the cost of borrowing the capital relative to the income the PV system will generate, after operating costs. These operating costs will include land rent for the site (if appropriate), maintenance, insurance and rates.

The depth of analysis needed will depend on the scale and complexity of the solar PV project. This could be carried out at risk by the installer/supplier, paid consultants or by the community energy group.

Capital Cost

Solar PV is now a mature technology and there is a good market for panels, associated equipment and services. This means that the best source of good estimates on capital costs is from Solar PV panel installers/suppliers through a process of competitive tendering. This will certainly be possible if the size, location and operational parameters of the project are known.

Other costs may include a support frame or base if the system is ground mounted or on a flat roof. Provision will also have to be made to replace inverters at least once during the life of the FIT payment regime. Where possible, costs of known items or activities should be identified through competitive tendering to generate 'real' quotations.

If your solar PV project is 50 kW or less, then to be eligible under the FIT scheme your installation must be commissioned by a MCS-certified installer using a MCS-certified product, or be certified under an equivalent scheme. When you have reached the stage in your project development that you need to engage with MCS certified installers or suppliers references are available in the Further Information.

Grid Connection

The amount of electricity generated, the number of panels installed, the point of connection and the distance from the connection point, will all influence connection costs.

Grid connection issues are covered in more detail in the **Grid Connection Module**. This will allow you to determine whether you need to make any specific arrangements for your grid connection. Small scale single rooftop installation can generally be connected to the grid by a certified MCS installer without your group needing to make any additional arrangements.

Electricity Use On-Site

It should be determined what portion of electricity generated will be used on site and what portion will be exported to the grid. There may be limitations on using electricity generated by the solar PV system across multiple MPANs. Where relevant (e.g. solar PV project on a block of flats), the cost/benefit of connecting the solar PV system to one MPAN should be compared against the cost/benefit of connecting smaller solar PV systems on the same roof to multiple MPANs.

Planning

If the proposed solar PV system is greater than 50 kW or if you think that your solar PV system will require planning permission, then you will want to contact the local Planning Officer to confirm what work will be required to make a planning application and the studies and fees that will be involved. The requirements of planning will vary with the size and location of the Solar PV array or arrays. For some projects the appointment of a planning or environmental consultant may be required and the cost of this will need to be estimated.

Community Benefit

Renewable energy projects developed by the community in Wales are not required to provide a Community Benefit payment but it is considered good practice.

Generation Income

There are three forms of generation income:

- 1) Savings in the electricity that would have been purchased (only applies if the solar PV is connected to a building that uses electricity).
- 2) The value of the electricity sold to an electricity supplier.
- 3) The value of the Government incentive for renewable energy.

The incentive that is likely to comprise the largest element of income for most schemes will be the FIT (see the **Feed-in Tariff Module**).

The annual energy yield can be estimated in kWh based on the solar irradiation data for the site location. Although some consideration has been given to this at Step 4 it will need to be recalculated using the same tools, but for the specific size of array, type of panels and site conditions.

The actual yield from the panels will depend upon a number of factors and more detailed modelling can be provided either by a supplier at the time of detailed quotation (smaller systems) or by a suitably qualified consultant engineer (larger systems).

You must be aware that the rate of the FIT is under constant review. It is therefore important to keep up-to-date with any changes to the FIT and look at any projections made by Government for future FIT levels for solar PV.

Step 10 Secure project funding

If project funding has not been identified already, then it will almost certainly be required from this stage on. The separate **Project Finance Module** gives guidance on the types of finance that may be available and potential sources of that finance. Links can be found in the Further Information section of this module.

There are a range of finance options, each of which has different attributes and requirements. These include traditional bank loan finance, establishment of a co-operative (via the sales of shares), or by partnership with a developer.

Considerations that will influence the choice of finance route include:

- The appetite for risk and reward.
- The ability to find a share of the capital cost.
- The ability to manage the development and operation of the project.

Each form of funding will have specific attributes (interest rates, target investment types, loan conditions). Early discussion with the funders will establish if your project matches the funder's criteria. Changing a project to meet funding criteria may be justifiable but care should be taken not to impair the core reasons for developing the project.

Solar PV is a well-established technology, leading to lower perceived technology risk. Other routes to local funding may be possible such as where members of the Community Group each fund part of the project rather than depending on a single loan

Step 11 Financial appraisal

The financial viability of any project depends on the cost of borrowing the money required to buy the solar PV panels, inverters, cables and the cost of installation relative to the income after operating costs. The schedule of incurred costs and the length of time to install and commission the project all influence the financial viability of the project. The **Project Finance Model** is available to download and use to complete a detailed financial appraisal of your project and the **Financial Model guidance document** provides indicative costs taken from a number of different market studies.

In order to complete the financial appraisal as accurately as possible, the capital costs of the solar PV system, installation, connection and other capital works such as grid connection, civil works and installation should be defined as accurately as possible. The detailed feasibility study should outline all the potential costs associated with your project and provide an indication of the scale of these costs. If not done so already, quotes will need to be obtained to confirm the final costs. Operational costs such as maintenance, ground rent and insurance must be determined and other ongoing expenditure such as community benefit payments must be accounted for.

A potential lender will also want to see a full business plan for the duration of operation of the solar PV system with a detailed cash flow and balance sheet that includes repayment of loans provided. The **Project Finance Model** provides this facility and more detail on this is covered in the **Project Finance module** and the **Finance Model guidance**.

Break point 2 **Is the project viable?**

The assessment process in Phase 2 is intended to:

1. Identify capital costs in as much detail as is possible based on generic or model specific data.
2. Estimate the additional costs involved (e.g. grid connection, planning permission.)
3. Use the data on solar irradiation, area of the panels and their quoted performance to calculate the energy yield.
4. Use the relevant FIT rates to estimate potential income from the predicted energy yield.
5. Gain an estimate of annual maintenance/annualised inverter replacement costs to subtract from the income.
6. Use the data above to estimate potential project financial performance.
7. Investigate funding options.

If the predicted yield appears attractive, then the project can progress if the group is still committed to its development. If at this stage the scheme looks unviable it must be stopped, or re-designed to reduce cost or boost income. One way in which this can be done is to look at the impact of changing the size of the scheme.

At this point, the scale of the project should be confirmed and potential suppliers of solar PV technology identified as these details will be needed in support of achieving a suitable grid connection, applying for planning permission and securing funding. You should also progress with financing the project using whatever model you have selected.

Phase 3 **Getting to Financial Close**

Step 12 **Applications**

The **Grid Connection Module** provides guidance on obtaining a grid connection.

A particular issue for remote, large, ground mounted solar PV arrays is the potential distance of the installation from a point of connection. This is because the very nature of an open site that makes it ideal for a large solar PV array is unlikely to be attractive for other development requiring electricity supply. While distribution network wires passing close to the site is potentially an advantage ‘tapping in’ to this network may require significant investment in suitable transformers. The ideal connection is where this kind equipment already exists, into a point of termination or into an existing point of off-take/demand. As a result, long cable runs may be required and these may have to be underground, which can be expensive.

Other issues are around the intermittency of solar PV generation and the potential this has to create instability in the network. Again, while this problem can be solved, this is at the expense of more costly control gear relative to base load generation technologies.

Planning Application

If the proposed solar PV installation is not a permitted development then planning permission must be sought. Your earlier investigations should have determined whether permission is required for the size of array proposed and the site you have selected.

As finance is unlikely to be secured until all planning consents and grid connection agreements are in place it is important that the planning application is made no later than at this point in the process.

Step 13 **Procurement**

At this point the process of finalising suppliers of equipment and services will need to be completed. Again, note that if your solar PV project is 50 kW or less, then to be eligible under the FIT scheme your installation must be commissioned by a MCS-certified installer using a MCS-certified product, or be certified under an equivalent scheme. It is good practice to seek competitive tenders and the process of seeking competitive tenders from suppliers should now be completed and a supplier selected. Factors to consider in your tender brief and in your assessment of responses include not just the capital cost of the panels alone, also but the relative cost of fixings, inverter replacement, alternative securing mechanisms, warranty and projected operating performance and annual maintenance costs.

Some suppliers may also undertake installation as part of the panel price. To identify the financial value of this work, quotations from alternative suppliers of these services should be sought. However, it must be recognised that not using the supplier to install the panels may impact on technology warranties.

The timing, process and completion of the procurement process will be dictated by the route to capital drawdown which in turn is linked to the means by which the project will be funded.

More guidance on procurement issues are provided in the **Procurement Module**.

Step 14 **Financial Close**

Using the detailed financial appraisal previously completed with the Project Finance Model, or another finance model, which has been verified by an accountant, it should be possible to secure finance through your chosen route.

Your finance providers will complete a full due diligence of the project, which includes a detailed analysis of potential project performance, all associated costs, warranties and

liabilities. The lender may also require a significant financial floating bond be set up to pay the banks costs irrespective of the result, positive or otherwise of the due diligence process.

Financial close is the point at which all contracts are signed and funds are transferred between your lender and all your suppliers. Prior to this point your suppliers are likely to have requested deposits for all materials and services. At financial close the balance of payment is made.

This can be a busy period, so it is important to ensure that the relevant people with delegated responsibility are available to sign off any legal agreements.

Break point 3 Did the project reach financial close?

If you have reached financial close you can move ahead to construct the PV system. If not, the steps 11 to 13 need to be repeated until this is achieved and the capital needed to construct the project is made available.

Phase 4 **Completing the project**

Step 15 **Repay other funds**

Any debt that is due for repayment should be paid back (with interest) at this point if required. The debt provided by the funders should include provision for this repayment if necessary.

Step 16 **Construction**

Once all of the permits and permissions are in place and all relevant planning constraints have been addressed, construction can commence and the solar PV panels can be installed, commissioned and grid connected. It is good practice to appoint an appropriately qualified person to oversee installation and commissioning in order that the project performs to specification. This is especially important for larger projects.

CDM application

If your construction project is longer than 30 days or involves more than 500 person days of construction work, the Health and Safety Executive (HSE) have to be notified (see appendix).

Your appointed project manager, civil contractor or turbine supplier may manage this for you, but as the Community Group, you need to:

- Check competence and resources of all appointees
- Ensure there are suitable management arrangements for the project welfare facilities
- Allow sufficient time and resources for all stages
- Provide pre-construction information to designers and contractors

This is ultimately your responsibility under the CDM regulations.

Step 17 **Operation**

The income from the project will need to be managed carefully. The funder may expect there to be cash held to cover fixed costs such as interest and loan repayments, O&M contracts and land rent. Only after these costs have been met can the project distribute the remaining income.

Proper management will need to be in place for the life of the project to oversee the process of collecting and distributing income and managing liabilities. It is also important that the performance of the solar PV panels are regularly monitored as large fluctuations or low output might indicate a technical problems and this in turn will reduce income, leading to reduced financial returns.

The planning consent will state the date and requirements for decommissioning the solar PV panels. The costs for removing the panels, the requirements to remove mounting frames and money to cover the cost of any roof damage during the process need to be estimated.

The **Establishing a Community Group Module** provides further guidance on dispersing any income generated for the community group.

Step 18 **Decommissioning**

When solar PV panels are no longer needed for generation they should be removed as soon as reasonably practical. This condition must be observed for permitted developments and will likely be a condition for projects that require planning permission.

Further Information

Solar PV Context

- Ofgem's FIT database includes data on the distribution network operator (DNO) that has connected the solar PV installations to their system - <https://www.ofgem.gov.uk/environmental-programmes/feed-tariff-fit-scheme/feed-tariff-reports/fit-update-reports>
- Farmers should note that the NFU provides specific guidance for farmers on the development of solar PV projects (see <http://www.nfuonline.com/membership/farmer-grower/member-services/farm-energy-service/business-guides/>)
- Local Energy Scotland have produced a range of documents on joint ownership, which are also applicable to the rest of the UK - <http://localenergyscotland.org/resources-advice/joint-ventures/>

Project Overview

Step 1 Develop the Vision

Information about how to form a new Community Group is included in the separate **Establishing a Community Group module**.

To contact the Welsh Technical Development Officers, see the Energy Savings Trust Website:

- <http://www.energysavingtrust.org.uk/organisations/content/ynnir-fro-community-programme>
- <http://www.energysavingtrust.org.uk/organisations/sites/default/files/Development%20Officers%20Bin%20Wales.pdf>

Example community actions plans can be found on the following organisation websites:

- PlanLoCal: <http://www.planlocal.org.uk/>
- The Source, Centre for Sustainable Energy: <http://www.cse.org.uk/thesource>
- Energy Savings Trust: <http://www.energysavingtrust.org.uk/organisations/content/communities>

Step 2 Seek Advice

The Centre for Sustainable Energy (CSE) and PlanLoCal provide information and advice for organisations and community groups to collaboratively progress renewable energy projects and is a useful place to start for those wishing to invest.

- Centre for Sustainable Development <http://www.cse.org.uk>
- PlanLoCal <http://www.planlocal.org.uk>

See **Establishing a community group module**.

CSE maintains a variety of cases studies: <http://www.cse.org.uk/thesource/browse/case-studies-24/renewable-energy-projects-330>

Co-operatives UK takes a look at a group of community energy case studies and provides some insight into what makes these enterprises tick. <http://www.uk.coop/community-energy-case-studies>

Step 3 Communicate

There are a range of guidance documents available for engaging with the community including:

- Planning Aid have developed a useful guide to support community development and communication – see <http://www.rtpi.org.uk/media/6312/Good-Practice-Guide-to-Public-Engagement-in-Development-Scheme-High-Res.pdf>
- The Home and Communities Agency (HCA) has also developed a Community Engagement Toolkit – see http://www.homesandcommunities.co.uk/community-engagement-toolkit?page_id=&page=1

PlanLoCal provides information on understanding community engagement:

<http://www.planlocal.org.uk/pages/getting-people-involved/running-a-community-consultation>

PlanLoCal provides information on running a community consultation:

<http://www.planlocal.org.uk/pages/getting-people-involved/running-a-community-consultation>

CSE provides information on consulting and involving the community:

<http://www.cse.org.uk/thesource/browse/consulting-and-involving-the-community-5>

Step 4 Find a site

The Scottish Governments' Renewable Energy Handbook outlines the technologies that have been employed by community groups, the principles of how each technology works and the key issues regarding installation and operation as well as environmental impacts. These are also applicable the UK more widely - <http://www.localenergyscotland.org/funding-resources/resources-advice/renewables-handbook/>

Location

There are many maps of solar irradiation available online and guides to help you maximize solar irradiation including:

- The European Union's database on solar irradiation which allows you to enter different types and orientation of panel to determine the potential generation. <http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php>
- The following site uses the same data set but allows you to enter a postcode in the solar irradiation estimation tool <http://www.rensmart.com/Weather/PVGISSolar>.
- UK Solar Energy provides guidance on the key issues. <http://www.ukSolarenergy.org.uk/installing-Solar-panels.html>

There will be a number of possible constraints on your project which you will need to identify:

- Sandia National Laboratories provides a free on-line Solar Glare Hazard Analysis Tool. <https://share.sandia.gov/phlux>

Grid connection

The **Grid Connection Module** should be referred to.

Planning constraints

The **Planning Module** provides additional guidance and should also be referred to.

Information on planning permission requirements for non-domestic solar PV projects can be found here: <http://www.planningportal.gov.uk/permission/commonprojects/solarnd>

Information on planning permission requirements from domestic solar PV projects can be found here: <http://www.planningportal.gov.uk/permission/commonprojects/solarpanels/>

Securing a Site

See step 7.

Step 5 Initial viability assessment

Web tools can also be used to provide an initial assessment of solar PV project viability <http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php>.

For installations up to 50 kW you need to use an MCS certified installer and product to be eligible for FITs.

- Search for accredited installers here: <http://www.microgenerationcertification.org/consumers/installer-search>.
- Search for accredited projects here: <http://www.microgenerationcertification.org/consumers/product-search>

A number of difference sources can be used to obtain indicative project costs. These include:

- The **Project Finance Module** provides indicative costs taken from a number of different market studies
- The Department of Energy & Climate Change publishes annual reports with statistic on approximate solar PV installation costs for projects up to 50 kW. <https://www.gov.uk/government/statistics/solar-pv-cost-data>

Step 6 Establish a legal entity

The Establishing a **Community Group module** contains more information on establishing the legal entity. It is important that legal advice from a solicitor who has experience of completing this work is obtained at this stage. This solicitor will be required at various stages throughout the project to support all legal and contractual activities, of which there will be many.

Step 7 Secure the sites(s)

The Law Society has published some information about the issues to look out for when trying to access roof space from third parties for solar PV installations (see <http://www.lawsociety.org.uk/advice/articles/the-pitfalls-of-Solar-panels/>).

The Building Society Association has also published advice about the impact of long term lease arrangements for solar PV on any mortgage arrangements (see http://www.bsa.org.uk/feature/Solar_panels.htm).

The Council of Mortgage Lenders has produced guidance on the minimum requirements for solar PV lease arrangements (see <http://www.cml.org.uk/cml/publications/newsandviews/110/412>).

See the **Securing the Site module** for more details and for a set of example draft agreements. If parties do not want to enter an options agreement at this stage, an exclusivity agreement should be considered.

Step 8 Secure initial funding

The separate **Project Finance Module** gives guidance on the types of finance that may be available and potential sources of that finance.

Local Energy Preparatory Stage Grant provides up to £30,000 to help fund early stage activities like feasibility studies, community consultation and other preparatory costs. <http://www.energysavingtrust.org.uk/organisations/content/yinnir-fro-community-programme>

Step 9 Feasibility Study

For installations up to 50 kW you need to use an MCS certified installer and product to be eligible for FITs.

- Search for accredited installers here: <http://www.microgenerationcertification.org/consumers/installer-search>.

- Search for accredited projects here:
<http://www.microgenerationcertification.org/consumers/product-search>

Grid connection

The **Grid Connection Module** should be referred to.

Planning constraints

The **Planning Module** provides additional guidance and should also be referred to.

- PlanLoCal provides guidance on procurement covering contracts, agreement and tendering:
http://www.planlocal.org.uk/media/transfer/doc/planlocal_ee_5_contracts_agreements_tendering.pdf

Step 10 Secure project funding

The separate **Project Finance Module** gives guidance on the types of finance that may be available and potential sources of that finance.

Local Energy Capital grants up to £300,000 are available to be put towards the capital costs of a renewable energy project.

<http://www.energysavingtrust.org.uk/organisations/content/ynnir-fro-community-programme>

Energy savings trust highlights a variety of paths to securing funding for community energy projects: <http://www.energysavingtrust.org.uk/organisations/content/finding-funding-wales>

Step 11 Financial viability check

A range of financial assessment methods can be used, but the method used by most funders will be a cash flow analysis, covering the long term costs and income from the project. The **Project Finance Tool** can be used at this stage to determine the financial viability of your project.

Step 12 Applications

The key applications to complete when developing your project are:

- Planning application – see **Planning module**
- DNO application – see **Grid connection module**
- Feed-in-tariff – see **Feed-in-tariff module**

If you have employed a project manager or consultant they will be able to complete this for you.

Step 13 Procurement

More guidance on procurement issues are provided in the **Procurement Module**.

Step 14 Financial Close

This is a very busy time for the project and it is important to have the right support in place. To support community groups in the delivery of their community projects it may be worth considering professional services including lawyers, financial advisors and project managers.

Step 15 Repay other funds

Step 16 Construction

Construction, design and management regulations. Further guidance can be found on the HSE website at <http://www.hse.gov.uk/construction/cdm.htm>.

Step 17 Community Benefit

The **Establishing a Community Group Module** provides further guidance on dispersing any income generated for the community group.

Step 18 Operation

Step 19 Decommissioning

Commissioned by the Energy Saving Trust.

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