

Module structure

The CARES Toolkit is intended to be used as a reference by community groups of all kinds and rural businesses. This module is one part of a series of documents forming the CARES Toolkit and is designed to cover all sizes of project, although the complexity of solar thermal systems which supply multiple systems, or multiple buildings may require more detailed evaluation than smaller projects.

Other modules that may also be of particular interest to those reading this module are:

- Establishing a community group
- Project finance
- Procurement
- Securing the site
- Planning
- Renewable Heat Incentive
- Construction
- Local energy supply

This module is structured in three parts to act as a guide and reference document for community groups in the development of a solar thermal project in Scotland.

Project overview

A brief introduction to the typical ways to develop a solar thermal 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.

Project overview

In general, the following sequence describes the typical progression of a solar thermal project irrespective of scale. It assumes that your community group or rural business is already in place. Information about how to form a new community group is included in the separate [Establishing a community group module](#).

It also assumes that no grant or other development support is available. In reality the loan support offered by CARES to fund the high-risk elements of a project prior to financial close may change the order in which work is undertaken. More information on this can be found in the [Project finance module](#).

The steps in developing your project outlined in the toolkit assume that the heat produced will be used at the point of production and that over the lifetime of the project the major benefit will come from the avoided cost of fuel purchase and the income from the Renewable Heat Incentive (see the [Renewable Heat Incentive module](#)).

Phase 1		Developing the idea		1 to 4 months
Step 1 Develop the vision		Agree why you want to undertake the project and define your key objectives.		
Step 2 Seek advice		Identify similar organisations that have developed solar thermal systems and use their insight and experience to plan your project.		
Step 3 Communicate		Communicate with the local community to explain the project to explain your plans.		
Step 4 Technology selection		Investigate the different solar thermal technologies and determine which may be suitable for your site.		
Step 5 Initial scoping		High level assessment of the feasibility of a solar thermal system for your site. Contact suppliers to get an indication of costs and savings.		
Break point 1		Is there a reason to develop		
Phase 2		Evaluate the project		1 to 4 months
Step 6 Establish an entity		Establish your Community Group as a formally constituted body or legal entity. A business may choose to operate under the business name.		
Step 7 Secure the site(s)		Obtain legal agreements for the use of the site where the solar thermal system is to be installed and where the heat is going to be delivered including any agreements for billing for heat.		
Step 8 Confirm heat load		Determine the heat loads that are to be met by the solar thermal system, this could be a swimming pool, domestic hot water or space heating.		
Step 9 Pre-planning Consultation		Meet with the local planning representatives and discuss your project, their relevant policies and any requirements they may place on an application		

Break point 2		Can the challenges be overcome
Phase 3		Develop the project
Step 10 Fix the project scope	Confirm the size of the solar array, where it is to be located, how it is to be mounted and what system or systems it is to provide heat to.	1 to 12 months
Step 11 Confirm capital cost and income	Obtain accurate capital costs, projections of RHI income and operating cost savings from suppliers.	
Step 12 Financial viability check	Confirm the project remains financially viable. The CARES toolkit Finance Model can be populated used with more detailed figures.	
Step 13 Secure pre-planning funds	Identify funding options to support ongoing development of the project through to a planning decision.	
Step 14 Planning application	Prepare and submit a Planning Application for the project. For large or complex systems it may be necessary to use paid consultants and prepare a variety of reports, surveys and visualisations.	
Step 15 Identify funding sources	Investigate routes to achieve capital funding. The most appropriate should be selected at this point as this will influence some future activities.	
Step 16 Develop full financial model	Complete a business plan and detailed financial appraisal with full project costs and projected project lifetime incomes to take to potential funders.	
Break point 3		Confirm consents and financial viability
Phase 4		Getting financial close
Step 17 Identify and contact suppliers	With consents and agreements in place the contract for the design, supply and installation of the solar thermal system can be formalised and programmed.	0 to 12 months
Step 18 Secure bridge funds	Identify if further funding is required (usually for deposits) prior to Financial Close.	
Step 19 Financial close	This is the point at which the funder releases the money and the project can be constructed.	
Break point 4		Can the project be funded?

Phase 5	Completing the project	
Step 20 Repay other funds	Secure any additional capital funding and repay development loans where required.	1 week to – 3 months
Step 21 Construction	After financial close, confirm all orders and arrangements for the delivery, installation and commissioning of the system.	
Step 22 Apply for RHI	Once the system has been commissioned, RHI can be applied for.	
Step 23 Notify water authority	Notify the water authority of any new installation which has been connected to the mains water supply.	
Step 24 Operation	Ensure management is in place for the life of the project for Oversee the collection of RHI payments and ensure all on-going operating costs and other liabilities are met.	Up to 25 years
Step 25	At the end of the life of the solar thermal system it must be safely decommissioned.	

Solar thermal – process guidance

Step 1 – Develop the vision

It is important to have a clear outline from the start of the project as to why the project is being undertaken. For a solar thermal system this is most likely to be to reduce consumption of fossil fuels to reduce operating costs. Your community may also have environmental drivers to become carbon neutral. It is important that you fully understand these drivers so that project viability and outcomes can be tested against your objectives.

Guidance on how to form a community group is given in the separate [Establishing a community group module](#).

Step 2 – Seek advice

Solar thermal systems have been developed by community groups across Scotland. The experience of these organisations can be useful in planning your project. CARES and other organisations maintain case studies to assist in identifying suitable groups to approach. Seeking this input from the outset can help to identify what has worked well elsewhere, what issues have been encountered and how they can be overcome through careful planning.

Early liaison with your local development officer can highlight opportunities for knowledge transfer between community organisations and organise learning journeys. They will be

able to identify and promote connections to the most suitable similar schemes in order to facilitate learning opportunities based on the experiences of other groups such as yours.

Step 3 – Communicate

The success of any community project relies upon the support of the community and consultation early in a project can address any questions as they arise and ensure that the benefits of a solar thermal system are clear. It also allows you to become aware of and deal with any misinformation being generated.

From the very start of the project, you must establish clear communication within the whole of the community hosting the project and any other stakeholders.

Solar thermal systems by their nature tend to be visible and in many cases they can be designed to minimise visual intrusion but 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.

Step 4 – Technology selection

There are two main types of solar panel:

1. Flat plate
2. Evacuated tubes

Both have their advantages and disadvantages. Flat plate collectors can be installed with less visual intrusion, can be lower cost but have a lower output. Evacuated tubes have a higher output, particularly in winter but tend to be more expensive and are less visually appealing.

You should determine where you are going to install the panels to assist you in determining which technology is best for you. Solar thermal can be mounted on roofs, integrated into roof surfaces, ground mounted or even installed on vertical surfaces. In some instances, the site constraints will dictate the type of system to be used at this stage. In other cases, it will be appropriate to consider both types of panels until their financial performance has been compared.

Step 5 – Initial scoping

The suitability of your site for solar thermal and the relative merits of different designs need to be investigated. Suppliers of solar thermal systems are often willing to provide an indication of a system's viability and provide an estimate of costs, without charge.

Solar thermal is a well-established technology with few operational issues, where it is properly maintained. Good design is essential to ensure you get a system performs as intended.

Most community solar thermal systems involve a single building with a suitable heat load such as a swimming pool or a large domestic hot water load. Systems which require more heat in summer than winter, such as domestic hot water for a campsite, will tend to be well suited to solar thermal. You should be aware of whether commercial RHI will be applicable for the building being considered.

The performance of non-domestic systems should be determined by a supplier using modelling software such as TSol or Polysun. This can often be done by a supplier of solar thermal systems but there may be a charge.

Other costs

Examples of other costs include:

- Integrating the solar thermal system into the existing heating or hot water system
- Control changes to other heat sources to maximise use of solar thermal
- Physical and legal access to site to deliveries, installation and maintenance
- Loss of income during works
- Insurance issues
- Measures to prevent vandalism.

Renewable Heat Incentive

Income from the Renewable Heat Incentive (RHI) scheme will depend upon the size of the solar array and the profile of the heat load to be met. Suppliers are often willing to give an initial estimate of the output of a system in kWh along with a budget estimate. There may be a charge for providing performance modelling prior to an order being placed. Please note that the non-domestic RHI is due to close to new applications on 31 March 2021. Systems above 100kW need to submit a Stage 2 Ofgem application by this date and may commission up until 31 March 2022. More information is provided on the RHI in the [Renewable Heat Incentive module](#).

Savings

An assessment of the cost savings that a system will provide is done by determining the useful thermal yield (in kWh) and multiplying this by the cost of the fuel that has been displaced by the solar thermal system.

If after consideration of the above issues you think that your proposed project looks viable, then the next stage of development can go ahead.

Break point – Is there a reason to develop?

As a result, the development process in Phase 1 is to:

1. Identify potential sites for solar thermal development that are:
 - a. Available and can be secured for a long period (potentially 25y).
 - b. Accessible for collector installation and maintenance.
 - c. Amenable to feed into the existing heating system and capable of physical connection.
 - d. Likely to have a good solar yield, being free of overshadowing and capable of having collectors mounted at the optimum orientation.
 - e. Unlikely to cause unacceptable impacts on local people.
 - f. Potentially able to gain planning permission (where required).
2. Confirm that the income is potentially high enough to be attractive
3. Take an option on, or otherwise secure access to sites which meet the above criteria.

If these criteria cannot be met, then the project should be stopped at this stage.

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

1. Investment Ready preparation – CARES has developed a tool for recording the progress in developing your project and storing all the supporting documentation in a secure, online site. CARES can assist in setting this up.
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. CARES has produced a template plan which can be downloaded.

Phase 2 – Evaluate the project

Up to this point little if any financial investment has been required to develop the project, with almost all input being that of time. From this point on costs may be incurred in advance of any capital draw down from a finance provider ('financial close'). This makes it essential that you are confident that the project it you propose is viable.

That said, of all the renewable energy technologies solar thermal is likely to require the least investment during the development process. This is because as a mature industry, any system integration designs are likely to be standard and undertaken by the system supplier at no cost and no electrical connection issues are involved. In most instances solar thermal is likely to be considered as 'permitted development'. Where issues of scale or location mean that planning permission is required then some costs will be involved and you should identify what fees may be required and to budget for them.

CARES is one potential source of development loan funding, making it important to contact CARES at this stage in the development process.

Step 6 – Establish the formally constituted body/legal entity

In order for the project to progress, your community group must be constituted within an appropriate formally constituted body or legal framework. This is to ensure that from the outset you have the capacity to raise finance, register for the RHI, receive grants, receive and distribute income from the operating project, pay bills, and take out insurance. It is also important that the form of the formally constituted body or legal entity protects individual members of the community group from personal liabilities for any financial shortfall or other redress.

Similarly, for community-based businesses it is important that any liability insurance and the conditions of bank finance allow diversification into renewable energy generation so that this activity is covered.

The [Establishing a community group module](#) contains more information on establishing the legal entity.

At this point you will also need to develop a proper project plan and allocate responsibilities to individuals. A sample project plan can be downloaded from our [downloadable tools section](#) of our website.

Step 7 – Secure the site

Once the above framework is in place then the site(s) must be secured if appropriate, or the agreement from individual community members to collaborate obtained. Commonly this requires you to enter into a binding agreement with the site or roof owner that guarantees that the project will be viable for at least as long as any loan and ideally for the duration of the RHI agreement. You should be aware here of the possible impact of location on the RHI, which has a separate domestic and commercial scheme.

There is a range of guidance about the issues to look out for when trying to access roof space from third parties for Solar PV installations. In general, these will also apply to solar thermal installations where any kind of 'roof lease' is involved and so are worth referring to.

Step 8 – Confirm heat load

A solar thermal system can only supply heat if there is sufficient demand. It is essential to accurately determine the heat load to be met in order that an assessment can be made of the likely savings.

It is often the case that a solar thermal system will provide heat to only one of a number of heat uses in a building but the information on fuel usage is for the whole building. An

example would be where a solar thermal system is to provide hot water only where the existing system consists of a single gas boiler provides space heating and hot water. The gas used by the boiler will be a combination of space heating and hot water but to assess the potential performance of a solar hot water system, the energy used hot water is water is required.

Determining as accurately as possible, what heat load is and how this load varies throughout the year is essential to ensure that estimates of financial performance can be relied upon.

Step 9 – Pre-planning consultation

Development in certain areas will require additional consultation and may require the provision of more detailed background information to be supplied as part of the planning process. These areas include Sites of Special Scientific Interest (SSSI's), National Scenic Areas and National Parks.

Most planning authorities publish planning policy guidance for solar thermal systems. The likely issue will be the visual impact if a large solar thermal array is planned. Planning authority web sites also contain detailed information on past and current solar thermal applications

Small scale solar thermal schemes fall under permitted development regulations in Scotland. These are permitted unless:

- They are installed on any part of the external walls of the building if the building contains a flat.
- The installed panels are situated on a flat roof within 1 metre from the edge or protrude more than 1 metre above the plane of the roof.
- The installed panels project higher than the highest point of the roof (excluding the chimney), or
- The building is within a conservation area or World Heritage Site and the solar thermal equipment is installed on a roof which forms the front of the building and is visible from the road.

The solar thermal equipment must, as far as is reasonably practical, minimise its effect on the amenity of the area and be removed when it is no longer needed or used for domestic microgeneration.

Many planning departments also welcome early informal discussions with developers of large-scale schemes about their plans.

The [Planning module](#) provides additional guidance and should also be referred to.

Break point 2 – Can the challenges be overcome

A frank and impartial assessment of the project should be carried out against the main challenges:

- Is the site tenure secure?
- Is it a viable project?
- Are the local residents aware of the development?
- Is there potential to get planning consent at the scale anticipated?

If the potential remains, then the project can be taken to Phase 3.

Phase 3 – Develop the project

Step 10. Fix the project scope

The scope of your project must now be fixed.

For a solar thermal system this often includes deciding what size the solar array should be, where it should be located, how it is to be mounted, the capacity of domestic hot water tanks or thermal stores and how the solar thermal system will integrate into the system already on site.

It is important to note that the aims and objectives of the project relative to its scale must be clear as this underpins how funding applications will be assessed.

Step 11. Confirm capital cost and income

Once you have agreed the scope of the system a detailed cost can be determined and an assessment made of the financial benefits generated by the system.

Using the information determined above it is necessary to seek detailed quotations from suppliers based on your previous discussions at step 5 and the scope agreed at Step 10

For large or complex systems it may be appropriate to conduct a detailed feasibility study, however for moderately sized solar thermal systems, the cost of such a study could be disproportionately high when compared to the cost of the system to be installed.

Step 12. Financial viability check

A more detailed review of project viability is recommended at this stage.

The Finance Model can be populated with capital costs, RHI income and fuel cost savings.

This viability check should be considered along with any other key constraints from your discussions with suppliers and the planning department.

Step 13. Secure pre-planning funds

Funding will now need to be sought for taking the project through the next stages of development. It should be noted that progression through this phase with grant funding can put income from government incentives at risk. Most developers secure funding through loans or private finance to ensure the income potential from the solar thermal development is maintained.

Step 14. Planning application

It is likely that the only application you may need to make is for planning permission. That said it is also likely that most solar thermal schemes will not require planning permission. For more complex applications it may be necessary to use planning consultant.

Finance is unlikely to be secured until all required consents are in place it is important that any planning applications that are required are made no later than at this point in the process.

Step 15. Identify funding sources

Once the project has been confirmed to be potentially financially viable it is essential to address how it is to be funded.

The separate [Project finance module](#) gives guidance on the types of traditional finance that may be available and potential sources of that finance.

There are a range of finance options, each of which has different attributes and requirements. These include traditional bank loan finance and establishment of a co-operative (via the sales of shares). Restricting traditional funding options. At the same time the relatively modest cost of solar thermal collectors may make funding by community members achievable, especially if individual 'packaged' financing options are made available.

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
- The potential to identify a 'packaged' finance arrangement that individual community members can access to fund their own system.

Each form of funding will have specific attributes (interest rates, target investment types and 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.

Step 16. Develop full financial model

The financial viability of any project depends on comparing the cost of borrowing the money required to buy the solar collectors and associated equipment and pay the cost of installation (including changes to the hosts heating systems and controls) with the income from the system (including savings) after operating costs. In the case of solar thermal these operating costs will be possible 'roof rent' payments (if appropriate), maintenance, insurance, and rates.

Calculation of potential financial performance

The financial assessment method used will depend upon the potential sources of funds for the project. The method used by most funders will be a cash flow analysis, covering the long-term costs and income from the project.

This is covered in more detail in the [Project finance module](#).

If this is not sufficiently attractive, then your project will either stop at this point or you may need to re-configure it to produce the desired financial return.

If your project appears capable of being financed, then the next phase is one of project development.

Break point 3 – Confirm consents and financial viability

The outcome from Phase 3 of the development process should show that all the following are in place:

- Planning consent granted
- Energy yield predicted
- Income predicted
- Financial viability confirmed
- Funding options investigated.

If consents are in place and the project appears financially viable, then the project can progress to Phase 4. If at this stage the scheme looks unviable it should be stopped, or re-designed.

Phase 4 – Getting financial close

Step 17. Identify and contact suppliers

Finalising suppliers of equipment and services will now need to be completed. It is good practice to seek competitive tenders and this process should now be completed and a supplier selected. Factors to consider here are not just the capital cost of the solar collectors, but also the relative cost of fixings, the modifications required to the heating systems, warranty, projected operating performance and annual maintenance costs.

Some suppliers may also undertake installation as part of the solar collector price. For larger systems 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 and for micro-renewable systems the installer must be MCS accredited.

More guidance on procurement issues is provided in the [Procurement module](#).

Step 18. Financial Close

More detail on financing projects is given in the [Project finance module](#).

It should now be possible to secure your chosen finance. You will need to satisfy the finance providers' process of due diligence and provide more detailed analysis of estimated system performance. However, you should have gathered this by now by following the process outlined in this Toolkit.

Break point 3 – can the project reach financial close?

This phase of work was about making the required applications to achieve the required permits and permissions to move the project to financial close. If planning permission has been obtained (where appropriate) and you have secured funding you can complete the contract with your equipment supplier.

Once you have specified the solar thermal system to be installed, received quotations for all work required to supply install and integrate the solar thermal system, you have received all the permits and permissions your system requires, and you have secured funding for the whole project then you can move to the next phase.

Break point 4 – Can the project be funded?

Provided all consents, grid connection, contracts and funding is in place the project should be ready to construct.

A professional team of managers and suppliers should be responsible for taking the project through to commissioning. If any member of this team is not yet in place they should be appointed prior to moving into Phase 5.

Phase 5 – Completing the project

Step 19. Repay other funds.

Any debt that is due for repayment should be paid back (with interest) at this point. Development loans (where applicable) are set up to be repaid at Financial Close. The debt

provided by the funders should include provision for this repayment.

Step 20. Construction

Once all of the permits and permissions are in place and all relevant planning constraints have been addressed, construction can commence and the wind turbine(s) installed and grid connected. The [Construction module](#) outlines the community group's obligations as a developer, the construction process and the additional roles in the construction process. The module addresses the community group's duty of care as a developer for the site workers, environment and general public, additionally covering basic legal responsibilities with additional links to guidance and regulatory documents.

Step 21. Apply for RHI

After the system has been commissioned the RHI application can be completed. Your equipment supplier will be able to guide you through this process and will often complete the application for you. More information is available in the [Renewable Heat Incentive module](#).

Please note that the non-domestic RHI is due to close to new applications on 31 March 2021. Systems above 100kW need to submit a Stage 2 Ofgem application by this date and may commission up until 31 March 2022. Stage 2 Ofgem applications require projects to have obtained all necessary consents and have full funding secured.

Step 22. Notify water authority

If you have connected new fittings to the mains water system, such as a new pressurised solar hot water cylinder, then it will be necessary to inform Scottish Water.

Step 23. Operation

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

You will need to ensure a suitably trained person is in charge of managing the system to ensure it is properly maintained, that RHI income is collected distributed and all liabilities are managed. It is also important that the performance of the solar thermal array is regularly monitored as large fluctuations or low output might indicate technical problems which would reduce income and in turn reduce financial returns.

Solar thermal systems require relatively little maintenance compared to other systems as they have few moving parts but it is important that they are checked at least annually in particular the quality and concentration of the antifreeze monitored and safety devices inspected to ensure the safe and efficient operation of the system.

The [Establishing a community group module](#) provides further guidance on dispersing any income generated for the community group.

Step 24. Decommissioning

Depending how your project is constituted, you may be responsible for decommissioning at the end of the project, however that is defined. This may also include a requirement to restore the host heating system to its pre-project configuration. The costs of these works should be identified at an early stage so that adequate financial provision can be made.

Further information

Step 3. Communicate

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

- The [Scottish Community Development Centre \(SCDC\)](#) has developed a useful on-line resource to support community development and communication
- [National standards for community engagement](#)
- The Home and Communities Agency (HCA) developed a [Community Engagement Toolkit](#).

Step 5. Initial Scoping

To maximise the useful heat output is important to consider:

- The panel orientation as close to facing south as possible.
- The ideal inclination of the panels will depend upon the location of the site and the seasonal profile of the load. There will be an optimum angle at which the panels should be mounted to maximise their heat output. It may be possible to achieve this where the panels are being mounted on A-frames on a flat roof, or the ground; however, on pitched roof the panels will tend to be installed at the angle of the roof. Mounting the panels at a lower angle increases output in summer and mounting at a steeper angle will increase output in winter.
- Where the system is providing domestic hot water there should be a solar hot water tank that is at least large enough for the hot water demand for 1 full day in addition to the tank used by a backup boiler or electric immersion heater.
- The coil in the solar hot water tank must be large enough to fully transfer heat from the panels to the water at their maximum output. Under-sizing this coil will reduce the potential yield. As a rule, a system should have at least 50 litres of solar storage per m² of solar panels but this can be up to 100 litres depending upon the type of panels and their location.
- A house which uses around 200 litres of water per day would have a solar hot water tank of 200 litres to pre-heat the water in advance of the existing hot water tank and would have a solar array of around 4m². If the panels were on a west facing roof it may require over 5m².
- In all cases the system MUST be designed to prevent against the spread of legionnaires disease and the HSE offers guidance on this.

The [Microgeneration Certification Scheme \(MCS\)](#) certifies installers and products and is a useful way of finding installers and there is guidance on the standards to which system should be designed and installed.

- [UK Solar Energy](#) provides guidance on discharging excess heat.
- Energy Saving Trust provides [guidance on solar thermal systems](#).

- The Health and Safety Executive provides guidance on [preventing the spread of legionella](#).
- CARES Toolkit [Renewable Heat Incentive module](#).

RHI Income

The [Ofgem RHI website](#) has details of tariffs, regulations and how to apply.

Step 6. Establish the formally constituted body/legal entity

- [A sample project plan](#).

Step 7. Secure the site(s)

- [The Council of Mortgage Lenders](#) provides guidance regarding leases of roofspace for fitting solar panels.

Step 9. Pre-planning consultation

SNH has a [web-based mapping tool](#) that will show some of the relevant land designations.

Step 23. Notify water authority

Scottish water has guidance on [how to comply with water regulations](#).