Community-led heat projects: a toolkit for heat networks

Prepared by Regen SW for the Department of Energy and Climate Change March 2016

Photo courtesy of LOGSTOR
This toolkit aims to help community energy groups and local authorities understand some of the opportunities, and challenges associated with delivering a community-led heat network project. The toolkit is designed to de-mystify some of the aspects of community heat network projects, as well as provide signposting and links to additional resources.

The toolkit was produced by Regen SW on behalf of the Department of Energy and Climate Change, and we would also like to thank our peer review group from industry for their expert input.¹

1.0 Introduction

Increasingly, a wider range of heat network projects are being considered by community energy groups, local authorities and landowners. The purpose of this toolkit is to help these organisations understand the key elements of a heat network project and signpost to useful resources.

Every home and business needs heating of some sort. In fact, nearly half of all the energy consumed in the UK is used to heat spaces or provide hot water.² Currently, much of this heat is provided through individual boilers and plants serving just one property. However, with fuel prices predicted to rise in the long-term and increasing focus on heat’s contribution to climate change, heat networks are seeing something of a renaissance.

UK government is encouraging the development of more heat networks³ as they can offer:

- a more efficient way of delivering heat to multiple properties than individual plants
- significant carbon savings on individual systems
- the ability to switch to lower carbon forms of heat
- the removal of responsibility for heating systems from householders
- lower customer bills (since buying boilers, fuel and maintenance are no longer the responsibility of the consumer) and lower running costs through economies of scale.

You can find more details about the benefits of heat networks on the Department of Energy and Climate change website.

Unlike other energy projects, heat cannot be sold on an open market; it must have local customers willing to connect and purchase heat. For this reason, many heat network projects have been led by:

- local authorities (particularly in new-build developments and urban regeneration schemes)
- social landlords (particularly in blocks of flats)
- small to medium sized energy services companies (ESCOs)

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¹ With thanks to: Dan Nicholls, Cornwall Council, Sue Ansell and Ken Brady, Energy Saving Trust, Mark Prior, Forestry Commission
³ https://www.gov.uk/guidance/heat-networks-delivery-support
1.1 What is a Heat Network?
Heat networks enable one or more sources of heat energy to provide hot water and space heating to many users. Any scheme generating heat and providing it to two or more buildings can be classed as a heat network, regardless of what type of building is being heated. (You can also have community heating where multiple dwellings are contained in one building - such as multi-storey flats). In fact, heat networks often work best with a variety of building types, (i.e. residential, retail, industrial) as this helps to balance heat demand on the system.

![Diagram of heat network Image credit: Regen SW](image)

The heat network conveys its heat to each building via hot water (or sometimes steam) in a system of pipes insulated to reduce heat loss and normally buried much like any other infrastructure.

Water in the heat network is at a high temperature, typically 70-90°C (and can be over 100°C for a large system), and customers access this heat through a Heat Interface Unit (HIU) or heat transfer sub-station.

![A typical Heat Interface Unit (shown without pipe insulation for clarity). Photo credit SAV Systems](image)
The HIU contains a heat exchanger enabling customers to extract heat from the main network into their own central heating and hot water system to then supply, for example, radiators or hot taps. Each residential customer has an individual heating control system (very similar to conventional central heating), and meter so they can be billed for the amount used. The HIU is typically a similar size (or smaller) to a small domestic gas boiler.

Pipes being welded together prior to being laid in Bristol. Photo credit: Bristol City Council

Heat is produced in one or more energy centres. Hot water is usually stored in insulated (thermal) stores, or accumulator tanks, so the system can deal with times of high and low usage whilst running the energy centre at maximum efficiency. Most of the heat networks in the UK use gas or biomass (mainly woodfuel) to create hot water. Other potential sources of heat include harvesting waste or residual heat or using large heat pumps. Increasingly developments are generating both heat and electricity using the same plant (known as Combined Heat and Power or CHP) as this can provide additional revenue through electricity generation for the project owner, but requires a balance between the heat and power generated.
Energy Centres will come in all shapes and sizes, depending on the scale of the network

Photo Credit clockwise from top left: E.on, Dunster Biomass Heating, British Gas

The pipes feeding the network come back to the energy centre, making it possible to easily change the primary heat generator at some point in the future. This can introduce benefits to the whole network in one go, whether that’s reducing carbon emissions by switching to renewables or improving system efficiency and reducing cost by installing newer, improved technology.

So what produces the heat? A heat network project will get its heat from at least one source, located in the energy centres. Big networks often have more than one energy centre to help balance how the hot water is pumped around, and provide some ability to take an energy centre ‘off-line’ for maintenance, known as redundancy. They can also provide fuel source flexibility to vary fuel inputs depending on price fluctuations.

Because hot water is fairly easy to produce compared to other processes (such as producing electricity), there are several suitable energy sources:

- Gas - if there is a big enough gas connection available then this is currently the cheapest fuel (other than residual heat) and is typically seen as a fairly low risk to investors
- Biomass – wood chips or pellets can be burnt to provide hot water and, where sustainably sourced, provide a carbon neutral source of heat
- Heat pumps – increasingly, ground or water source heat pumps are being considered for small heat networks, the benefit being very low fuel costs and no need for a gas connection
- Geothermal energy – heat is extracted from underground wells/aquifers or hot rocks.
Other heat sources such as anaerobic digestion (AD), biogas and energy from waste can also be used to drive heat networks. You can read more about these types of heat generator on the community energy hub.

2.0 Where to begin?

There is a lot of emphasis on community energy groups and local authorities working together, but how does this happen in practice? A really good place to start is by finding out who could help and making a list of all the people you want to involve, then working towards building an agreed set of objectives and ways of working.

Every local authority will be structured differently, but it is advisable to start at the top and look to form political support for your project early on. You could do this by meeting your local elected councillor and asking their advice, or by meeting the leader of the council. Use these meetings to get support for your idea and to help you find the right departments and people who you will need to work with on a day-to-day basis. There might be an energy section in the local plan or the council may have its own energy strategy. Find out what the council’s aims are and start working with them towards a formal cooperation agreement. This will help ensure you are working towards the same aims and a way of working that will suit all parties.

Bath and North East Somerset (B&NES) Council have a Cooperation Agreement with Bath and West Community Energy⁴ that enables them to work together to help:

a) B&NES deliver its Environmental Sustainability & Climate Change Strategy aim of providing the leadership to enable a 45% cut in district wide CO₂ emissions;

b) maximise the proportion of the District’s 2020 renewable energy target in the draft Core Strategy that will be delivered using a strong community model;

c) build community resilience, for example, by alleviating the impact of rising fossil-fuelled energy prices, and retaining economic benefit locally;

d) establish a significant ‘community fund’ for re-investing in local energy projects in the area.

Totnes Renewable Energy Society also has a cooperation agreement with South Hams District Council.⁵

Town, City and Parish Councils – It is advisable to talk to your town, city or parish council early to find out about any previous heat projects in the area and they can also be a useful source of information about other local community groups or housing associations who might be interested in a community heat project.

3.0 The community energy group – Getting started

If you are a local authority or an individual interested in starting a community heat project, you should find out if there is already an energy group locally who might have already thought about district heating or could help develop a project. According to the DECC Community Energy Strategy⁶,

⁵http://regensw.s3.amazonaws.com/tresoc_shdc_cooperation_agreement_a_8eb61f9249422a94.pdf
there are over 5000 community energy groups in the country, although Community Energy England estimates that there are closer to 450 groups actively dedicated to community energy. To find a group near you:

- have a look at the Community Energy England members’ page or Community Energy Wales members’ page
- look at the Community Biomass Guide on the Forestry Commission website
- google community energy in your area
- get in touch with regional community energy support organisations for example: Low Carbon Hub, Regen SW, Centre for Sustainable Energy, or Community Energy South
- find out if there is a transition group near you doing anything about energy
- ask your parish or town council
- ask your local authority

Community energy groups often emerge from transition or local green groups, and are usually motivated by wanting to do something about:

- ever increasing energy bills for homeowners and community assets
- climate change
- energy efficiency
- fuel poverty
- energy security
- local air quality

A district heating project in the community will help address some of these concerns so it’s useful to approach local community energy groups with these common objectives in mind.

If there is no community energy group locally and you want to set one up there is guidance on how to do this on:

- The community energy hub website
- The National Federation of Community Organisations
- KnowHow Now Profit
- The Centre for Sustainable Energy has a video overview of managing a community project

4.0 Overview of project development

Every building, home and business needs heat. Unlike electricity or gas, heat cannot be cost-effectively transmitted or moved great distances. This means there is no national infrastructure and market for heat as a commodity, and heat must be produced, supplied and consumed on a local basis, although this can still be a relatively large geographic area and up to several thousand homes.

This means that for any heat network, the customers must be local and make a decision to connect to that local system. This is different to other types of energy project, such as wind farms or solar arrays, as the electricity generated by these schemes enters a national market and doesn’t necessarily need local residents to buy it.
So heat projects start and finish with localised communities – this has a significant impact on how heat networks projects are developed.

Heat network projects need different levels of technical/design expertise according to their scale and complexity, in much the same way as a domestic rooftop solar energy installation will have a different development pathway to a large solar ground array.

In general, every heat network project will need to follow the above steps.

The above project journey is intended to be a guide only, as every project will be different with regards to scale, technology, customers, project lead and business model. However, the topics in the diagram will all feature in every project to some degree. For guidance on specific stages for specific technologies consult trade bodies, such as the:

- Association for Decentralised Energy (ADE)
- Chartered Institute for Building Services Engineers (CIBSE) specifically their Heat Networks Code of Practice
- Euroheat & power (an international association for heat networks and CHP)

You can also get further information on the project stages from the Community Biomass Guide and the Heat Network Delivery Unit websites.
5.0 Factors influencing a network’s viability
Community scale heat networks are usually, from a technical point of view, fairly straightforward to implement. They require a heat source, some pipework to transport the heat a control system and, of course, some customers who have a heat demand. The challenge, of course, is for a community heat network project to meet the objectives of the community-led group. A key hallmark of a viable heat network project is that it can generate enough revenue to cover its costs over the lifetime of the project, whilst lowering (or at least not increasing) customer bills compared to the alternative. Whether this test is satisfied or not will depend on a number of factors and no two opportunities will be the same.

Broadly, the more boxes that can be ticked below, the more likely it is that a heat network project may be viable in your location:

<table>
<thead>
<tr>
<th>Heat network ‘opportunity’ factor</th>
<th>✓ or ✗</th>
<th>More information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a ‘local plan’ for your area that includes support for heat networks?</td>
<td></td>
<td>Each local authority should have written (or be in the process of writing) a local plan that may contain policies encouraging heat networks</td>
</tr>
<tr>
<td>Is there a ‘Neighbourhood plan’ for your area that includes support for heat networks?</td>
<td></td>
<td>Many communities are writing neighbourhood plans that can specifically encourage certain improvements to local areas such as heat networks. Visit the RTPI website pages on neighbourhood plans to find out more.</td>
</tr>
<tr>
<td>Is the area to be served by the heat network off the gas grid?</td>
<td></td>
<td>Natural gas is currently one of the cheapest ways to heat homes and businesses. Buildings already heated by gas may not see much (or any) in the way of energy savings by switching to a heat network supply, but this is not always the case. At the very least, understanding what your customers currently use for fuel and you’re your heat network might use for fuel is important. You can find on the CSE website a list of postcodes that were off the gas grid as of 2011.</td>
</tr>
<tr>
<td>Are there any buildings with a large heat demand that could connect?</td>
<td></td>
<td>Buildings using heat regularly and throughout the year are useful as they can help balance the load. The more buildings that have high heat demands (schools, leisure centres, care homes etc.) that can connect, the better the opportunity. Some heat may be being produced locally as a by-product of an industrial/commercial process. This could potentially be used in a heat network.</td>
</tr>
<tr>
<td>Are many of the houses that might connect reasonably close together?</td>
<td></td>
<td>Typically, a hamlet with 5 or 6 detached homes with lots of space in between them would not be a good opportunity due to the need for long pipes to low demand customers.</td>
</tr>
<tr>
<td>Are there any blocks of flats or multiple-resident properties in your local area?</td>
<td></td>
<td>Single buildings with multiple bill payers can offer a good opportunity for heat networks, often with lower capital costs than a network associated with separate buildings.</td>
</tr>
<tr>
<td>Could you join up customers without pipes being laid in the road?</td>
<td></td>
<td>Roads are expensive to dig up and put pipes into and so can make projects unviable, laying under grass is much cheaper(this is known as ‘soft dig’ rather than ‘hard dig’).</td>
</tr>
<tr>
<td>Is there somewhere central for the ‘Energy Centre’ with good access to roads that are big enough for construction/fuel deliveries?</td>
<td></td>
<td>The energy centre is the ‘boiler house’. This is where the heat is generated and the pipework terminates. Its size will depend on how big your network is and how many customers it is serving. Thinking about future expansion of the network is important when looking at energy centre sites.</td>
</tr>
</tbody>
</table>
If your heat network is **biomass** fuelled: is there a suitable location onsite for storage of fuel?

Fuel is often forgotten about. Biomass powered heat networks require large volumes of fuel storage.

### 6.0 Identify objectives and potential stakeholders

Heat networks are infrastructure projects that stay in place for a long period of time. Typical expected lifespans for the heat generation plant are 20-25 years and significantly longer for the pipes in the ground. This longevity creates two important points to consider when thinking about heat network projects:

1. Infrastructure could provide long-term returns on investment
2. Because they have an immediate impact on residents, heat networks should be considered as part of wider plans for the community, which may include benefits other than financial returns

**Heat network projects start and stop with local customers**

For some of the wider benefits attributed to heat networks, see the [Sustainability Exchange’s ‘Heat Networks Code of Practice for the UK’](#).

Given that heat projects need to provide heat at the right price to the right customers, clarity on objectives and stakeholders is paramount. Being clear on these factors from the outset will make outlining all subsequent aspects of the project far more straightforward:

1. Explore what the main objectives of the project will be
2. Once the objectives are clear, this makes identification of key stakeholders easier
3. With a list of the key stakeholders, you can begin to map out an engagement plan

So the very first task when exploring heat network opportunities in a local area, even before identifying potential heat demands or customers, is to **identify the project objectives**.

Being clear on what you believe the heat network should be trying to achieve will have an impact on how the project is setup, and more importantly, may influence people’s support for the project.

Some typical **primary** aims for heat networks are:

- stabilising energy bills for local residents
- delivering lower bills for local residents and businesses
- helping to combat levels of fuel poverty (by providing more efficient and cheaper heat with longer term price security)
- providing revenue streams and reducing costs for operators
- lowering communities’ carbon emissions
- enabling heating to be provided by local fuel production, e.g. biomass
creating local jobs
retaining wealth within local communities
making homes safer by reducing dependency on individual gas boilers

Once you have a clear view of what your network should be aiming to achieve, you can then begin to draw up a list of the key stakeholders who will need to be involved, what category they are in (e.g. key stakeholders or those needing to be kept informed), and their influence on the likely outcome. This list should be considered in two parts:

1. The list of stakeholders who need to be engaged with the project from the outset and who will help shape the project. This is normally a core, small-ish group with excellent knowledge of past energy projects, the local environment and the people in your community. But it is also very important to engage with individual householders from the outset who may be potential stakeholders (particularly in relation to social housing).

2. Stakeholders who will need to be involved in the project, but will not play a part in defining its aims or scope

For example:

<table>
<thead>
<tr>
<th>List one – project shapers</th>
<th>List two – Other stakeholders to involve/consult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any community energy group or transition group that is already active in your area</td>
<td>Highways agency</td>
</tr>
<tr>
<td>The local authority + local Housing Associations</td>
<td>Relevant local authority departments</td>
</tr>
<tr>
<td>Any existing resident associations or parish councils</td>
<td>Building control</td>
</tr>
<tr>
<td>Potential customers (if a small network)</td>
<td></td>
</tr>
<tr>
<td>Landowners who own land the network will cross</td>
<td></td>
</tr>
<tr>
<td>Utility companies/Distribution Network Operator (DNO) if CHP is proposed</td>
<td></td>
</tr>
</tbody>
</table>

All of the stakeholders listed above (as well as others that are relevant to your location) will have some involvement in your project. Awareness of the individuals and organisations that will be
involved in your projects is critical to informing a stakeholder engagement plan: consulting the right people at the right time. You will need to assess and map these to take forward your business case and project plan. Keeping them engaged will also form part of the project’s aims throughout its lifecycle.

6.1 Thinking about future proofing
Part of clarifying the objectives of a heat network project will involve some ‘crystal ball gazing’. New developments and changes in building ownership may mean that your list of potential customers may look different in 20 years (which is well within the lifespan of a typical heat network). Whilst it is impossible to second-guess how big a heat network project may grow over decades (especially if you are starting with a very small project but could feasibility expand), some consideration of significant changes is important at an early stage. For example:

- If a new school is planned within the next five years, the local authority may well be interested in adding this to the network, or using it to begin one.
- A new build residential development has been in development for a number of years at the other end of the village. Could this impact on the viability of the network?
- There are plans for some major town centre refurbishment – does this impact on your plans for a network and give you an opportunity to install one?
- Energy efficiency measures being deployed in the area (perhaps due to public or private initiatives) will help lower bills, which may change the economics of a heat network project. (Note: finding ways of improving the thermal efficiency of buildings before examining their heating system is always best practice).

You will not necessarily have answers to these questions at the early stage of the project, but understanding how other developments and plans for the community may impact any heat network plans is important. At the very least, finding out what developments are planned will help identify key stakeholders such as local authority officers, planners, and developers that can be incorporated into your stakeholder engagement planning. It is also important to engage in risk mapping in order to offset risks that you know about in the early stages, although much of this is formalised at the feasibility study stage.

7.0 Stakeholder engagement (including potential customers)
Stakeholder engagement is a project management term for talking to people and enabling them to get involved; it is a two way process of sharing information, listening, understanding and responding to suggestions, developing trust and effective working relationships that benefit the people involved. You can find more information on engagement in the ‘Communications and engagement’ section of the Hub.

Stakeholder engagement is an essential and arguably the most important aspect of any heat network project, as a heat network must have local customers with heat demand who are willing in the longer term to connect and purchase heat. Stakeholder engagement should take place throughout the entire process to ensure people are informed and have the opportunity to be involved, ask questions and influence the development. Heat network projects can take a long time to develop and the stakeholders may change so ongoing engagement is necessary. It is very
important to get at least one ‘anchor’ load with a large heat demand, and it is also important to ensure a balanced heat load over both daytime and evening use. This can be address to certain extent using thermal stores.

Early and ongoing engagement, which keeps people informed and enables them to contribute in a meaningful way, will build support for the project in the long term, reduce conflict and result in a better project that is right for the community. Objections and resistance are time consuming and costly and can be avoided if engagement is planned and effectively delivered. Every community and project is different; however, there are some as standard processes to ensure your engagement is positive and useful to everyone. Guides to engagement are available such as this one hosted by the Royal Town Planning Institute (RTPI) and this one produced by Regen SW for DECC.

Encouraging home owners and businesses to change how they think about their heat needs is challenging, and may take a long time. Things like particularly cold winters, boiler failures or replacements and expensive fuel prices may help trigger interest in a communal heat network. Keep track of why potential customers (and that can include new-build developers) are reluctant to connect and see if it changes over time.

It is advisable to start by drafting an engagement and communications plan that includes: an introduction with a clear outline of the purpose of the engagement; principles for good engagement such as making it timely, inclusive, ongoing and transparent; and a work plan. A work plan might include:

1) **Who you want to engage**

Stakeholders for heat projects typically include:

- local landowners
- residents associations/parish councils
- community groups
- potential customers
- the local authority (as either a project partner or to engage with departments such as land ownership, highways, planning etc)
- developers (if major regenerations or new build developments feature in the project)
- other groups that may be interested in the project, such as social landlords, commercial premises

2) **Methods to use for each group at each stage of the project**

You need to use the most appropriate methods for engaging stakeholders at different stages of the project, which should be flexible and agreed with the people involved. For example:

- **Meetings with developers and the local authority** should be planned in early and used to work out the most effective ways of keeping them involved, which could be by email or regular meetings. It is important to be clear on what you envisage each stakeholder’s role could be before approaching them, i.e. do you want your local authority to consider land sales or planning or to become an investor?
- **Public stakeholders** (land owners, residents’ associations/parish councils, community groups and potential customers) require a range of methods but you could start by talking to key people and getting their advice on the best ways to engage everyone.
• **Provide clear and accessible information to raise awareness and understanding** about the project which could be done through a local newsletter, leaflets, website, social media, local press and radio, or display boards in public places. Make sure people know what parts of the project are flexible, how they can respond (e.g. online, via a survey, at an exhibition) and the timelines are clear. Disseminate information on existing district heating projects that demonstrate best practice.

• **Face to face engagement** can be via door knocking, attending existing community meetings or events, or running project specific events (discussions, debates, public meetings, interactive exhibitions) where you provide information about what is happening, when, where and why. This is your opportunity to listen, address concerns, make changes and give feedback.

• **Local press/media briefings** can help to mitigate negative news stories.

3) **Where and when**

Make sure you plan your engagement in venues that are local, and easily accessible, at convenient times for the people you are trying to engage, for example, in the evening for people who work, and during school time for stay at home parents.

Look at the local events’ calendar and attend or have a stand at events like fetes and carnivals, this saves you a lot of time publicising the event and will also help you reach a different audience.

4) **How feedback will be gathered and incorporated**

Use the results to make changes to the project, identify gaps and respond to people’s concerns. Make sure that you communicate: tell people you have listened, how you are responding and what you are changing in light of their views. Do you need to do more engagement?

With all these methods, make sure you are well prepared before engaging with people and have a clear route for them to find out more information, follow up or take part.

**8.0 Scoping exercise**

By now in the project, there should be some elements in place:

1. The broad concept and the objectives you want to achieve
2. An idea of who the key stakeholders will be in the project
3. A smallish group of people who will help develop the project to the next stage.

The next step is to perform a scoping exercise.

In order to progress the project to the point at which specialists can provide advice, there first of all needs to be a process that narrows down the project options.
The purpose of a scoping exercise is to help shape the initial project, by looking at the specifics of the location. This is often done as a desktop exercise, using a template scoping exercise to help narrow down the options. Whilst some knowledge of heat networks and how they work is beneficial, the content of this toolkit (and other freely available resources) should be enough to enable a successful scoping exercise to be undertaken.

Plan Local provides a good template scoping exercise that takes around four hours to complete, and will help narrow down some of the details of the project. You can download the exercise [here](#). The key elements to undertaking a successful scoping exercise are:

- You are already clear about what the objectives of the heat network project are
- You have the right knowledge about your community in the room

**National Heat Map**

Another useful resource is DECC’s [National Heat Map](#), a publicly accessible high-resolution web-based map for England. It provides modelled estimates of total heat demand for every address in England.

There are a range of tools and functions on the map to assist users and you can export reports or maps for use by other people. This is useful when preparing a business case for a heat network and for assessing the economic case for a network. The reporting tools provide heat demand density data in kWh/m², (the annual heat demand divided by the area) across the country, and are particularly useful when looking to estimate the potential scale of network that could be developed in an area.

The network drawing tool enables users to draw a potential network route, by simply connecting up with Google Street View. This helps identify level of heat demand across the proposed route. Users can then access information on the associated linear heat demand density in kWh/m per year, also useful for understanding the economics of heat density across the route.

The national heat map also includes a water source heat map layer, enabling potential developers to understand the heat potential in their local water bodies, which could be used in a water source heat pump. The water source layer also identifies possible constraints on any water source...
development, for example, if the water source is located in a site of special scientific interest e.g. a salmon spawning area. It is not a guarantee that a particular location will be suitable (or unsuitable) for a WSHP installation. It should however help facilitate decisions on further feasibility studies by developers.

8.1 Why undertake a scoping exercise?
Specialist advice and expertise in heat network projects are unavoidable, and often need to be paid for in the form of feasibility studies. These feasibility studies are the first step to getting data and numbers into a project, but are totally dependent on the client asking the right questions.

Feasibility studies are expensive, but necessary, building blocks to a viable project that can attract investment. Typically, a feasibility study requires one specific project for a contractor to investigate, rather than them exploring the viability of a range of options. Whilst the latter can be done, this would normally be termed a strategy study. Funding for both types of study can be accessed through the Rural Community Energy Fund or RCEF and the Urban Community Energy Fund or UCEF (in England) depending on the location of the group asking for funding. In Wales, the Welsh Government Local Energy service provides support to community and commercial developers in Wales to encourage and facilitate more local ownership of electricity and heat generation projects. Development Officers are available to provide advice, and feasibility and capital funding is available. Information is available on the Local Energy website: http://localenergy.gov.wales/en/

Local authorities working with a community group in England can access RCEF and UCEF as long as the application comes from the community group. Parish councils are eligible in their own right.

The more specific you can be as a client when paying for professional advice, the better value for money you will achieve. The purpose of a scoping study is to identify the clear opportunities you may want to explore. These can then be examined and narrowed to a single project idea that can be taken forward to a feasibility study.

The government’s Heat Network Delivery Unit (HNDU) has been funding local authorities to carry out heat network feasibility studies.

Outputs from the scoping exercise should be:

- An idea of the geographic reach of the project
- An idea of whether there are key customers you want to include
- An idea of where the energy centre could be sited (based on any early considerations you may have had about fuel)
- A very rough idea of the MW size (capacity) and MWh (demand) of the plant you may need (the Plan Local tool will help you identify these figures)
- Which stakeholders need to be engaged early on
- What your next steps are
9.0 Explore business model options
A completed scoping exercise will help narrow the options for what kind of network might be developed, and who would be key connecting customers for the heat. Before taking the emerging project to a technical feasibility assessment, it is worth exploring what business models could be used to help the project achieve your objectives.

Whilst you may not know what business model is going to suit your project best, exploring the options now may help narrow the field or help give you a feel for whether the project is economically viable.

A basic lifecycle options’ appraisal should be carried out to see how the proposed scheme compares to the alternative (business as usual) approach, and to see if it is cost effective.

The business model refers to how you are going to invest capital, generate revenue and deal with finance implications. For general information on finance and business models see the Finance section of the Hub.

9.1 Shared ownership
An increasing number of renewable energy projects have been developed under shared ownership models in recent years in the UK. Effectively, any project that is owned by more than one body is considered to be shared ownership and there are several distinct forms that this can take. You can read in detail about the various shared ownership models on the Local Energy Scotland website.

For heat network projects, shared ownership models are common, particularly as scale increases. For example, at the small scale, a simple project that generates heat from a gas boiler and delivers it to a school may also sell that heat to an adjacent nursery. This would not be shared ownership, but would be a basic Energy Service Company (see below) structure. At the other extreme, a large network may supply 200 residential homes and some commercial property: it is unlikely that one single organisation will own and operate the energy centre, the pipework and the heat interface units. It will likely be owned by a special purpose vehicle (SPV) setup specifically to run that network (and invested in by multiple organisations, and/or members of the local community).

Which ownership model best suits the project will depend on:

- the objectives of the heat network project developer
- the scale of the network
- who is interested in supporting the network (local businesses, local authorities, community energy groups, local landowners etc)
- the capabilities, and attitude to risk, of the project developers

9.2 Energy Service Companies (ESCos)
Ownership is only one aspect of a heat network project. Unlike renewable electricity projects where a market exists to purchase the power, heat networks only function if customers connect directly and buy the heat they consume. This means that a necessary part of any heat network project is the heat sales element.

For small projects, limited to a handful of connections, a simple contract may be agreed whereby the network’s running costs are divided amongst the connected customers, with each customer paying
in proportion to the heat they consume. As networks get bigger, so do the financial risks and demands.

For many larger heat networks, a company is setup to primarily handle the billing and sales side of the heat market; an Energy Services Company known as an ESCo. This company must be able to:

- manage meter reading
- prepare bills and statements
- manage payments from customers
- manage non-payment of bills and credit arrangements
- deal with complaints, queries and connections
- adhere to all necessary customer protection and financial regulations

In addition, many ESCos take on further aspects of the network, such as purchasing fuel, or overseeing operations and maintenance. Whether this is undertaken by a commercial company, as part of a local authority or community energy organisation will impact what level of profit can be taken from heat sales and what happens to it. Sometimes the provision of broadband can also be considered under the auspices of a multi-utility services company (MUSCO).

You can find out more about how ESCOs work in a guide developed by the Centre for Sustainable Energy.

Woolhope Woodheat is a community cooperative that has setup as an Energy Service Company, installing biomass boilers in hard-to-heat buildings and selling the heat directly to the customer.

Photo Credit: Woodhope Woodheat project

9.3 Third party ownership
A heat network can be a fairly simple premise from a business point of view. Capital is raised to pay for the installation, revenue is generated from sales of heat and further income may be derived from incentive schemes, notably the Renewable Heat Incentive.

Rather than attempt to own and operate the network in its entirety (which some local authorities, social landlords and even community energy groups do), there is of course the option for a third party organisation to develop the project, either on their own, or in partnership with a community-led group. In recent years, many heating system installers have been able to raise the necessary finance to build and run heat networks, albeit on a limited scale.

This can be different to operating as an ESCO, as the ownership of the scheme may sit with an organisation that has nothing to do with the heat generation and sales. Alternatively, a third party may own, operate and deliver heat to connected customers as a complete turnkey solution.
At this stage of a project’s development, it is likely to be unclear as to what the costs are, and what revenues may be accrued. The economic detail of the project will emerge after the feasibility study. The important thing to note at this stage is that heat network projects are long-term assets with long-term revenue generation prospects, but potentially low margins. As the project developer getting the project scoped and off the ground, it is important to consider your ambitions for the project. As a prompt, and a very rough guide to business models:

| Are you mainly interested in the impact of energy bills? | Potentially use a third party to deliver the network |
| Would you like to explore using the network to raise money for community/local uses? | Shared ownership may give you more control over the revenue streams |
| Would you like to use the network as part of a wider energy plan, incorporating other projects and schemes? | Consider setting up as an ESCO or other SPV to deliver the project in-house or with partners |

10.0 Consideration of local impacts (Planning permission, emissions, traffic, pipe-routing)

From a technical point of view, heat networks are fairly straightforward: heat is produced, transported through pipes (normally underground) and delivered to an interface in customers properties. However, each of these three main elements will have aspects that need to be considered on a site by site basis.

Of course, scale plays a huge part in how much time and analysis will need to be spent exploring the issues for each element. A 200kW biomass boiler house will have a far lower impact on its surroundings than a 2MW CHP plant. The table below is not exhaustive, but should help illustrate what a heat network project may impact upon locally.

<table>
<thead>
<tr>
<th>Energy Centre</th>
<th>Considerations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Planning permission, Hydraulic modelling of the pipeline</td>
<td>An Energy Centre’s location can be dealt with in two ways: 1. A suitable site is offered (either by the local authority or a private landowner) and the network assessed to accommodate the location. 2. The optimum location for the Energy Centre is assessed on the performance of the network, and suitable sites searched for.</td>
</tr>
<tr>
<td>Flues</td>
<td>Planning permission, Plume analysis (possibly)</td>
<td>Almost every energy centre will have a flue to expel exhaust</td>
</tr>
</tbody>
</table>

Department of Energy & Climate Change
Flue heights will affect planning permission and potentially require further analysis of their plumes.

| Access | Planning permission  
Engagement with highways agency and local authority  
Engagement with fuel providers | Energy centres will need to be constructed and maintained, and unless they are gas or heat pump driven, will also need regular fuel deliveries. Depending on the size of the network, there may be impacts on traffic.

| Noise | Consultation with the local authority and environment agency | Depending on the scale of the heat generation plant and the pumps, noise may be an issue. If this is likely to be an issue, either the energy centre can be located away from residential properties, or additional noise attenuating equipment can be installed, at extra cost.

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Considerations</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Routing | Highways agency/local authority (typically ‘hard dig’)  
Private landowners (typically ‘soft dig’)  
Hydraulic modelling | The more ‘hard-dig’ pipe routing that can be avoided, the cheaper the installation costs will be. Particularly in urban or semi-urban area, roads offer good direct access to properties, but complexity when sharing with other services. It is good practice to minimise pipe runs where possible to avoid unnecessary costs. Small heat networks are often dug into fields adjacent to roads, entering customer properties through the back gardens. This can mean lower installation costs, and can enable some of the works to be tackled by the community directly. |
| Type of pipe | Heat networks can use either specialist plastic or steel pipework. | Although there are no differences from an environmental or permitting point of view, the choice of |
Pipe will have a huge impact on the project, including trench sizes, which for larger networks will have an impact on costs. Pipe material selection will be based on a number of project factors such as network length, operating temperatures and cost.

<table>
<thead>
<tr>
<th>Wayleaves</th>
<th>Installing a new utility on someone else’s land may incur an annual cost.</th>
</tr>
</thead>
</table>

### Heat Interface Units

<table>
<thead>
<tr>
<th>Installation</th>
<th>Considerations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building regulations</td>
<td>HIUs are installed within customers’ curtilage, normally inside the property on an external wall. As such, the local impact to the customer will be a certain amount of disruption as the HIU is installed and existing equipment is removed (if appropriate).</td>
<td></td>
</tr>
</tbody>
</table>

| Interface with existing wet radiator or underfloor systems | Building regulations Performance | The HIU will have to interface with either an existing wet radiator system, or a new wet radiator system (if replacing night storage heaters for example). This could represent significant upheaval for potential customers. Typically, if the heat network is being retrofitted to existing private properties, it is the homeowner who must pay for any alterations to the inside of the property, bar the HIU itself. |

### 11.0 Technical and economic feasibility study

The technical and economic feasibility study of a project is critically important to confirming the business model and unlocking finance, as well as identifying any key or ongoing risks and challenges for the specific project. The results of the ‘techno-economic analysis’, as it is commonly known, will often be used to verify the viability of the project and underpin all subsequent work.

There are a number of aspects to a techno-economic feasibility study that should be understood before they are commissioned:
A techno-economic study focuses on a firm project idea, testing the feasibility of that specific plan. It is not usually a scoping exercise that explores many options.

A techno-economic study must be tightly scoped: the consultant or designer undertaking the study will work to your instructions and constraints. For example, if you have an initial network layout in mind, but believe there could be a more efficient route, you must ensure the consultant/designer includes this variable in the study. Beware, as you increase the number of variables your consultant is considering, the more money it will cost to get to a firm answer.

You must be clear on what answers you want; Feasibility studies are only valuable when they provide evidence for progressing the project (or not). They should be used to provide early estimates of at least:

- Capital cost (CAPEX), including cost of construction
- Operating and maintenance costs (OPEX)
- Cost of finance
- Pipework routing
- Energy centre location(s)
- Correct sizing of plant and equipment (including boilers, pipework & back-up systems)
- Impact of fuel variation (unless you have firmly settled on using a particular technology)

The data listed above forms the nuts and bolts of your business model and subsequent detailed design. The construction costs will normally be assumed using industry standards, but if there are local circumstances that may impact these costs, such as narrow lanes limiting lorry size, protected trees limiting digging routes, or you plan to save money by digging your own trenches, these should be highlighted at this stage.

What aspects of the network do you need to stay flexible? This is relevant if you expect or aspire for the network to be expanded in future phases or have yet to decide on a technology for providing heat. In this case, the consultant may run the model for a variety of network pressures/flowrates and heat generation types.

For small networks, feasibility studies are often done by heating system installers who have experience of heat networks. These will often be delivered fairly cost-effectively, but may be based on assumptions that deliver over-sized (and therefore inefficient) systems. More complex networks, say 30 homes+ or a mixture of residential and commercial demands, may require more specialist consultants to perform the feasibility study.

Feasibility studies can be expensive, but should still represent value for money if they are tightly scoped, focused on the one project you have chosen and use a consultant/designer with the appropriate level of expertise for the scale of the project and the chosen technology.

Feasibility studies (as opposed to scoping exercises) are often an activity that can be directly funded through government or local authority support. Organisations such as Community Energy England and Community Energy Wales may be able to signpost you to sources of funding in your area.
11.1 Overview of the technologies

As part of providing the consultant/designer with a clear brief for performing a feasibility study, narrowing down the range of heat generation technologies *beforehand* is a good idea. If there are technologies you are confident will not be viable in the chosen location (for example a 5MW energy from waste plant is unlikely to be popular in the centre of village green), then don’t include them in the specification of the feasibility study.

The technologies which (currently) often form the basis for heat networks at community scale are, in order of popularity:

- natural gas
- biomass (including wood chip and pellet)
- heat pumps

Each of these technologies has its own pros and cons, some of which are outlined below:

<table>
<thead>
<tr>
<th>Natural gas</th>
<th>Biomass</th>
<th>Heat pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative cost of heat provision £/MWh⁷</td>
<td>99</td>
<td>125</td>
</tr>
<tr>
<td>Most suitable for:</td>
<td>Locations with a gas grid connection close by</td>
<td>Rural locations with good transport links</td>
</tr>
<tr>
<td>Risk and incentives</td>
<td>Lowest risk investment but not eligible for RHI support</td>
<td>Eligible for RHI support</td>
</tr>
<tr>
<td>Running costs</td>
<td>Minimal maintenance requirement</td>
<td>Relatively high maintenance requirement</td>
</tr>
</tbody>
</table>

Fuel cost | See section 12 on fuels |

**Photo Credits: Regen SW**

Ground Source Heat Pumps (GSHP) and water source heat pumps (WSHP) are increasingly being considered for running heat networks, but currently work best for large scale networks, or smaller networks contained in a single building.

In addition, there are some more unusual sources of heat that can be used for heat networks, such as waste process heat, mine water (geothermal) heat and anaerobic digesters creating fuel gas. However, these more innovative solutions tend to be explored on larger, commercial projects.

11.2 Heat only or heat and power?
There are two main types of heat generating equipment:

1. Those that create electricity and use the waste heat in a network (combined heat and power, CHP)
2. Those that create just the heat (heat-only plant).

Heat networks are long-term projects, often only economically viable if considered over many years. Depending how you are assessing your heat network project, it may be useful to consider how the generation of electricity as well as heat could influence the business model. A CHP plant may, in certain circumstances, generate more revenue streams for the project and potentially offer better savings to customers. A rule of thumb when considering CHP is that in order for it to be cost effective, a CHP plant should be sized and run for at least 4000-5000 hrs per year (that’s over 75 hrs/week).

Often, whether to consider CHP or not as part of any one particular project can be quickly assessed, early on in the process. Typically, CHP plants:

• are much more expensive than heat only plants of the same scale
• are sized to provide a proportion of a local electricity demand. Normally, this is a single property or site that has a constantly high electricity demand
• will need a grid connection big enough to take their full electrical capacity

CHPs are normally sized to provide around two thirds of a constant electrical demand:

![CHP Diagram](image)

Depending on the type of CHP used (you can view the different types and how they are sized [here](#)), many CHPs will produce roughly double the amount of kWh of heat to kWh of electricity. This is known as the heat to power ratio. As it is the electricity profile onsite that defines how big an efficient CHP system should be, this will set the total heat available for a heat network, but care should be taken when sizing CHP for a heat network, so the maximum efficiency is achieved without wastage of heat.

By examining the electrical demands of a site, it is possible to determine whether a CHP powered heat network may be viable, and therefore whether it should be included in the scoping exercises. The potential demand for a cooling requirement (such as air conditioning and refrigeration) can also be a factor.
12.0 Fuel sources
The overall business model, the energy centre location and its size and complexity are hugely influenced by what is generating the heat in the energy centre.

Choosing a technology for your heat project can often be influenced by considering the long-term implications of the fuel to be used. Each fuel type will have its pros and cons specific to your site and project. Use the clear objectives that you will have already set for the project to help prioritise which fuel and technology may be the best fit. Things to consider:

- carbon emissions
- importance of incentive schemes (Renewable Heat Incentive)
- fuel price trend
- risk

The most common fuels required for heat network plants are:

- natural gas
- biomass (either wood chip or wood pellet)
- ground heat, water courses or waste from local industrial or commercial processes.

Other sources can be used too, such as biomethane or municipal waste.

Some options may easily be struck from the list. For example, if you are in an off-gas area, a gas fuelled heat network may cost far too much to connect to the gas grid. Alternatively, you may be looking to the renewable heat incentive scheme to help with project finances, which would mean exploring biomass, biomethane and heat pumps as technology options.

Performing a SWOT analysis (strengths, weaknesses, opportunities and threats) is a good way to analyse which technology and fuel type options may fit for your project. Click here for more information on how to perform a SWOT analysis.

12.1 Carbon emissions
The carbon dioxide emissions attributed to your heat network will be different depending on which technology and fuel is used. Almost certainly, the carbon emissions generated by the project will be less than the equivalent produced by each property generating its own heat, but could still vary wildly, depending on whether it is using biomass, gas or heat pumps.

The Biomass Energy Centre has a good resource to compare the relative carbon emissions of common fuel types – click here to view.

12.2 Incentive schemes
Currently the only incentive scheme that is relevant to heat networks is the non-domestic Renewable Heat Incentive, and this will only be an option for schemes that use renewable forms of heat, i.e. biomass, heat pumps, energy from waste and anaerobic digestion. There are several very good resources available on the RHI, starting with the RHI module on the Community Energy Hub. However, often receiving an incentive can be at odds with receiving a grant, so care must be taken when exploring what funding streams are available.
12.3 Fuel price trend

Heat networks will run day in, day out for upwards of 40 years once installed. Considering what may happen to fuel costs in that time is a challenge, but looking at the historical changes in price may help influence what fuels you might consider. There are some free resources that help you check trends in fuel price:

- **Boiler Juice** – this website offers free historical views of heating oil for England and Wales
- **Forest Fuels** – Current woodfuel prices available online from this woodfuel provider
- **DECC** – produce regular statistics on energy trends
- **Energyteam** – produce an interactive chart of UK wholesale electricity prices (heat pumps use electricity as a primary fuel)

13.0 Deciding on a business model, and developing the business plan

Both smaller local authority-led and community energy business models are typically based around generating financial value for a community from investing in a local asset. In the case of a heat network project, the asset can be made up of several parts such as the generating plant, the pipework, the energy centre land and the ability for the system to generate revenue.

The decision for you, the developer, is how much risk you are prepared to take on, based on:

- the skills and knowledge you have at your disposal (as part of the local authority or community group)
- the resources you have to deliver and operate the project
- how important it is that the revenues generated by the scheme are retained locally
- how much investment you can secure

For example, you might already have a commercial partner in mind who is prepared to use their expertise and time to do a lot of the project development and bear much of the risk, but who will expect a greater share of the profits as a result. Alternatively, you might want the project to be wholly community developed and owned so that 100% of the profit is retained locally, but this will be more risky. You need to have a good understanding of the variables that will determine success, and be able to predict the range of outcomes to make a decision on the right model for you. To do this you will need to develop a business plan that includes a financial model that enables you to test different scenarios. You should use this to determine what scale of project (or projects) is needed to cover operational overheads.
Questions to ask during the business planning process:

- What are we trying to achieve? Fixed or expandable goals?
- When will value be created?
- Who takes the risk at the development stages?
- How will we raise finance?
- Who earns the value?
- What scale of project(s) is needed to cover operational overheads?
- What skills do we have already? How do we access other expertise?
- What kind of organisation do we want to be and what added value do we offer?
- How much will it cost to deliver and is it financially sustainable?

The nature of the business plan is inevitably bound up with the shape of the project you have mind, e.g. a small network feeding three homes and pub will require a very different business plan approach than a town-wide scheme. There is no right or wrong answer, because each location will have different drivers for wanting the network, and different objectives.

**Examples/case studies to look at:**

<table>
<thead>
<tr>
<th>Example/Case Study</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayville Community Centre Passivhaus Refit, 2011</td>
<td></td>
</tr>
<tr>
<td>Community Energy Case Studies from the Community Energy Scotland Website</td>
<td>2014</td>
</tr>
<tr>
<td>Bede School Biomass Heating Project, 2014</td>
<td></td>
</tr>
<tr>
<td>John Cleveland College Woodheat Cooperative, 2015</td>
<td></td>
</tr>
<tr>
<td>Bunhill Heat and Power, Islington 2012</td>
<td></td>
</tr>
<tr>
<td>Church and School Biomass Partnership, Truro, 2015</td>
<td></td>
</tr>
</tbody>
</table>
14.0 Financing
Heat networks have high upfront costs (as do many renewable heating technologies) and understanding the financing element of any project is vital. Projects can be paid for through money from a range of sources, all with their pros and cons and differing levels of cost. Despite the high upfront costs, the running costs for heat networks can be lower than alternative forms of heating.

14.1 Types of finance
There are two types of finance:

1. **Debt finance**
   This is when an organisation receives money from a lender and the organisation will then, over time, pay back the amount plus an agreed amount of interest. Debt finance can be secured through a loan, peer-to-peer lending or crowdfunding. The disadvantage of debt finance is that future cash flow will be hindered by repayments so levels need to tightly controlled. Debt funding is usually secured on project assets and can also occasionally be secured on bank accounts that have been set up to manage project finances.

2. **Equity finance**
   This is when an organisation receives money from a lender by selling to them stock in the company, with the lender receiving a share of profits and a say over how the organisation is run. Equity finance can be secured through a public share offer via crowdfunding or private arrangements. The disadvantage is that you are giving up a proportion of the control of the project to a number of third parties.

14.2 Stages of finance
There are three main stages of project finance:

1. **Project Development**
   Getting the project off the ground, working out whether it’s feasible and monies could come from grant funding or debt/equity finance.

2. **Project Construction**
   Making things happen, installing a heat network and money is most likely to come from debt or equity finance, but there may be appropriate grant funding schemes

3. **Project Operation**
   Creating heat, supplying customers, paying back any debts, making dividend payments

A common action is for debt finance arranged in stages 1 or 2 to be renegotiated and refinanced for stage 2 or 3. The level of risk drops as you move from stages 1 to 3, reflecting that the idea is becoming real and close to generating income.

14.3 Financial modelling
It is important for groups to be able to understand and carry out assessments of the indicative financial performance of a heat network project. Financial models are often complicated and can be difficult to set up for inexperienced groups. A community finance model has been created on the
Community Energy Hub that enables communities to understand the potential profitability of a project before deciding whether it is worth undertaking further technical and financial due diligence.

An important element of the financial modelling might be tax relief and incentives. Up to date information on what is available can be found from the Department of Energy & Climate Change, Community Energy England, Community Energy Scotland or Community Energy Wales.

14.4 Project development funding

There are sources of funding to help pay for those early stages of a project:

- **Rural Community Energy Fund/Urban Community Energy Fund**: funded by government to support rural and urban communities in England in the development of renewable energy projects
- **Community benefit funds**: local funds set up by some renewable energy developers in areas near wind and solar farms, such as Lancaster University, and a register of wind farm funds can be found here
- **Power to Change**: independent charitable trust, set up in January 2015 with a £150 million endowment from the Big Lottery Fund, to support, develop and grow community business across England
- **Local trust funds**: there are a range of community trust funds in the UK to support projects in line with fund goals, such as the Stevenage Community Trust, and a good place to start is your local authority
- **For a local authority led project**, the government’s Heat Network Delivery Unit (HNDU) can be approached for specialist support and funding for early-stage design work

A good source of information on funding sources is Locality, a national network of ambitious and enterprising community-led organisations, working together to help neighbourhoods thrive.

15.0 Detailed design

After a technical feasibility has proved that the project concept is viable, a further stage of design is required. This detailed design stage, as it is known, is where specialists will draw up the specifics of the project, normally into a range of reports, specifications, engineering drawings and spreadsheets (depending on the size of the project). Before this work takes place, however, you must have drawn up a detailed specification, which outlines exactly what the designer should be including (and not including) as part of their work.

The purpose of the detailed design stage is to produce the definitive list of the detailed specifications of the equipment that needs to be procured, exactly where and how it needs to be installed and operated to sufficient detail that an installation and/or construction firm can build the project. There will also usually be a functional design strategy that describes how the components of a system will work together. Typically, the detailed design stage will have firmly set out:

- the size and location of the energy centre
- the pipe route and pipe sizes
- an estimate of the heat losses and firm calculations for the overall heat demand
- the design temperatures of the network (flow and return temperatures)
- how the heat network pipes will interface with properties
• specification for the Heat Interface Units
• the pumping regime needed to meet the heat demand
• the heat and power generation plant required to meet the heat and power demand, and any assumptions made to support this
• routes for construction (and if necessary fuel) delivery vehicles
• the electrical and water requirements for the system, including possible ‘private wire’, Private power agreement (PPA) or use of existing electrical networks requirements for CHP based systems
• schedules for each item of equipment needed
• An evaluation of environmental issues such as noise and emissions” and “Safety issues of the design, construction and operation, inc. flue heights etc.

Ultimately, what is included in the detailed design will come down to what you as the client have asked for in the detailed design specification.

15.1 Specification
It is crucial that a clear specification is drawn up for the designer to work against: the designers will not have the local knowledge about the project that you do, and will only be able to produce designs that fit the information they are given.

Writing a clear specification does not mean that you have to already know the answers, but you must be clear when asking for detailed design quotes about what outputs you require. If you are expecting the detailed design to be used to build out the project, you will need to make sure the designer commits to deliver this level of detail.

16.0 Construction and operation

It is well worth looking at the CIBSE code of practice for heat networks to understand the various elements that must be considered, throughout the design and build process. This document is not free, but will provide a solid framework through which to ensure each stakeholder knows their respective responsibilities.

The Broadband for the Rural North project has installed super-fast broadband to over 1000 premises in rural Lancashire, by using volunteers to dig trenches (to specification) in privately owned farming land. As the project is community based (and non-profit) and the farmers stand to gain from the broadband, they typically waive the way leaf charge normally owed to them, and often help dig the trench. Photo Credit: John Hamlett-B4RN.org.uk

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8 For more information on private wire arrangements see https://www.regensw.co.uk/production_site/wp-content/uploads/2015/06/Regen-White-Paper-final-web.pdf
Depending on the scale of your project, specialist contractors will inevitably be required to deliver:

- installation of the plant
- construction of the pipeline and energy centre
- installation of the HIUs
- installation of metering equipment
- commissioning

Some aspects of the construction could potentially be delivered by the project team themselves, depending on the scale of the project. Some community groups have lowered costs of installing services by route-finding and digging their own trenches (see case study below).

Construction costs are a fundamental part of the business plan and so should be considered at an early stage. Exactly who will be overseeing the construction and subsequent operation of the scheme will of course depend on your individual business plan, but the crucial element for you as project developers is to ensure a good working relationship between client, lead contractor, designer and operator. Commissioning for a heat network project can be a long process in itself that ensures the system is setup properly. Failure to commission a system properly can lead to problems later on, or poor performance. In addition, there are long ‘snagging’ periods for heat networks (well over a year typically as the system cycles through a summer and winter period) – the time through which you would expect problems with the system to emerge and be dealt with. A detailed ‘cause and effect’ schedule should be provided by the designer as part of the commissioning works. Ensuring the scheme is properly supported though this time is critical, and being clear on each stakeholder’s responsibilities is fundamental.

One way of keeping track of the construction/operation stakeholders (designer, contractor, fuel providers, client etc.) is to use the Chartered Institute of Building Services Engineers (CIBSE) Code of Practice for Heat networks. This document aims to clearly set out a system that all partners in the project can sign up to and provide guidance on who should be responsible for what, as well as outlining best practice for certain aspects of scheme design. The code is voluntary, but using it may help improve understanding between project partners and also help investors lower their risk rating, as well as steering the project towards current best practices.

**17.0 Decommissioning**

The costs of decommissioning equipment at the end of its life should always be factored in to the overall project costs. In reality, for projects that have lifetimes of 25 years plus (as typical of heat networks) equipment that should be decommissioned is often subsumed into other elements of new projects, sold or simply allowed to remain in-situ. However, for a properly costed project plan, all costs associated with decommissioning the project at the end of its life should be factored in.
18.0 Project Costs

Heat network projects are so site specific that getting a feel for the costs at an early stage can be challenging. There are some useful free resources that will help gauge ballpark figures for projects.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Indicative project costs (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small scale (1-30 homes)</td>
</tr>
<tr>
<td>Scoping Exercise</td>
<td>Free, with support from local authorities/community energy groups/installers</td>
</tr>
<tr>
<td>Feasibility Study</td>
<td>Around £10-15k(^{10})</td>
</tr>
<tr>
<td>Detailed Design</td>
<td>Depending on the type of contract being issued, this is normally part of the overall design and build.</td>
</tr>
<tr>
<td>Construction – HIUs</td>
<td>Around £1-2k each, plus installation costs</td>
</tr>
<tr>
<td>Construction - Pipeline</td>
<td>This will depend on the type of pipe used and the type of ground being trenched, but can be around £500 per metre. This can be significantly reduced if you can provide the manpower to dig some of the trenches</td>
</tr>
<tr>
<td>Construction - Plant</td>
<td>How much the plant will cost will depend on its technology and its scale. You can find some fairly recent guides to plant costs <a href="#">here</a> (particularly page 10) and <a href="#">here</a>. Often, these guide costs are given per MWh per annum. This MWh figure can be estimated during the scoping exercise, or more firmly as part of the feasibility study.</td>
</tr>
<tr>
<td>Other costs</td>
<td>Maintenance costs, fuel costs, billing and metering administration costs and business rates will also all apply. The DECC document <a href="#">here</a> has some indicative details on these elements.</td>
</tr>
</tbody>
</table>

\(^9\) These figures have, where possible, been sourced from heat network supply chain companies

\(^{10}\) Typical range of grant asked for under the RCEF, for heat network feasibility studies
18.1 Project size and impact on economics

Correctly sizing a heat generating plant is crucial to achieving good levels of efficiency. If the plant has been sized too small, some or all customers will not receive sufficient heat during the coldest times of the year. If the plant has been oversized, it will not be operating at its optimum level, leading to poor efficiency and higher running and fuel costs. A regime of thermal storage is often used to build-in some flexibility.

The initial sizing of the plant is often based purely on the demand it needs to serve, and ensuring they will all have heat, even on the coldest days of the year. However, depending on how big the overall network is will impact how this size is calculated. Future expansion of the network (especially if planned to take place within 5-10 years) must also be considered.

Consultants and designers will be able to provide detailed sizing of your particular system, but it is worth noting that there will always be more than one solution that will work. There is likely to be some discussion amongst your design team or advisors on a few aspects that will have a fundamental impact on the final size and running costs of your network. The main aspects are:

- **Network temperature.** The temperature at which the heat generating plant produces water can vary enormously, depending on how the system is designed. Currently in the UK, there is a general trend to trying to achieve lower network temperatures but with a high differential between flow and return temperatures. This can mean the generating plant and pipe diameter is smaller and cheaper to run, but requires the overall system to have been carefully designed to ensure there is enough heat for all customers on the coldest days of the year – for the next 20-30 years!

- **Diversity.** From a logical point of view, the heat generating plant must provide sufficient heat for every customer simultaneously. This can be thought of as the network needing to provide enough heat for every customer on the network to have their heating on and be running a bath simultaneously. In reality, not every customer will be demanding heat at the same time, which means the overall demand the plant must serve is lower than the sum of its connections. This concept is known as diversity and is applied to many building services at the design stage, not just heat networks. Applying a diversity factor can help avoid designing and installing plant that is oversized for a design condition that is unlikely to ever happen.

It may be an idea to consider a ‘modular’ approach where additional plant can be added as the network expands

The Chartered Institute of Building Services Engineers (CIBSE) Code of practice for Heat networks, outlines some of the best practice for network design. This code is voluntary, but clearly states the responsibilities of each organisation in the project. You can download [The Chartered Institute of Building Services Engineers (CIBSE) Code of practice for Heat Networks](#) code of practice for a charge.