

Scottish Futures Trust

Guidance on Delivery Structures for Heat Networks

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SCOTTISH
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Version History

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Contact details

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1. Introduction

The Scottish Government's approach to district heating is set out in the draft Heat Generation Policy Statement 2014. This includes implementation of the Scottish Government's District Heating Action Plan, published in May 2013. The policy is aimed at addressing the barriers to district heating in Scotland, and realising the opportunities. The Action Plan involves a collaborative approach with the wider public sector, business and industry, aimed at building confidence in the public sector to drive projects forward, the private sector to invest, and in consumers to connect.

The Action Plan included a commitment to establish the Heat Network Partnership for Scotland (HNP). The HNP was established in 2013, is led by Scottish Government, and co-ordinates support across a range of public sector agencies (including Resource Efficient Scotland, the Energy Saving Trust, Scottish Enterprise and Scottish Futures Trust) in order to accelerate the uptake of district heating in Scotland.

Scottish Futures Trust (SFT) is one of the core HNP partners. As part of its wider role in working to increase the efficiency and effectiveness of infrastructure investment in Scotland, SFT provides commercial support to authorities to help develop pathfinder district heating initiatives. It also provides broader support, knowledge sharing, and guidance to public sector bodies on delivery structures, financing models and procurement strategies for heat networks.

SFT has published a range of guidance on district heating / low carbon infrastructure investment:

- Guidance on delivery structures that could be adopted by public sector bodies to accelerate investment in low carbon infrastructure¹. The guidance applies to non-domestic energy efficiency, street lighting, and district heating, and includes approaches to aggregation;
- Legal guidance² on the powers of Scottish public bodies to generate, procure and trade heat and electricity, and the legal, regulatory and administrative constraints on these powers;
- Financial Guidance on VAT considerations for district energy initiatives³; and
- Legal guidance on energy service companies (ESCOs), including the rationale and process for establishing ESCOs, types of structures that can be used, and governance arrangements⁴.

This report supplements the existing guidance by providing key information on the most common delivery structures that have been adopted in the UK to date for district heating projects. It draws on practical experience from both within Scotland and elsewhere in the UK, where the larger number

¹ http://www.scottishfuturestrust.org.uk/files/publications/SFT_Delivery_Structures_2013.pdf

² <http://www.districtheatingscotland.com/content/procurement>

³ <http://www.districtheatingscotland.com/content/finance>

⁴ <http://www.districtheatingscotland.com/content/procurement>

and scale of district heating projects has led to the emergence of models that have not yet been adopted in Scotland.

The report is intended to be illustrative rather than exhaustive: the main delivery models are identified, along with some variants. Links to further information, materials, case studies and guidance are provided.

1.1. Scope of guidance

This guidance is intended as a point of reference for public sector bodies in Scotland wishing to develop district heating schemes with multiple heat users and/or heat sources. It identifies the main delivery structures currently used and, through relevant case studies, illustrates the following:

1. key characteristics of the various delivery structures;
2. advantages and disadvantages of each structure; and
3. the type of projects for which authorities may wish to consider a similar delivery structure.

The drivers, economics, and approaches to district heating projects vary considerably from scheme to scheme: it is a multi-dimensional environment. It would be difficult, if not impossible, to write down a definitive set of rules or a 'decision tree' that would determine the most appropriate delivery structure for a given situation.

Instead, the guidance seeks to provide readers with a general understanding of the rationale for choosing a particular delivery structure, based on actual experience from real-life projects gained over a number of years.

The scope of district heating projects can vary considerably. The various components of a scheme can be summarised as:

- **Generation** – construction, installation, operation and maintenance of heat generation assets. The generation asset is typically located in an energy centre and could be based on a range of technologies (e.g. surplus heat recovered from an energy from waste centre or other industrial facility, water source heat pump, gas CHP, solar thermal, etc.), and could change over time as lower carbon / renewable heat sources emerge;
- **Transmission** – construction, installation, operation and maintenance of the main connecting pipelines for the scheme, which transfer heat from the generating asset to where it is needed for space and hot water heating; and
- **Management** – including the construction, installation, operation and maintenance of the distribution pipework for the various heat loads connected to the network, customer contract management and metering / billing services.

The vast majority of heat networks in the UK are relatively small-scale, in which these elements are under a high degree of common ownership or control. In many cases, generation, transmission and management is carried out by a single organisation (typically a local authority or housing association) supplying properties on a single site.

As small-scale island networks gradually expand and integrate to form larger scale networks, and recovery of low-grade heat from industry becomes more widespread, the various elements will become increasingly 'unbundled' (i.e. under separate ownership).

Where this happens (e.g. dense urban areas), the delivery structures need to evolve to manage the different ownership of generation, transmission and distribution assets (which have very different risk profiles) to allow the continued successful operation of the network.

The delivery structure may include the following aspects of project implementation:

- **Development** – large scale district heating projects are typically successful where a phased approach is adopted. Where a larger scheme is envisaged, procurement will typically include the delivery of a small number of initial phases with the opportunity to develop and deliver future phases;
- **Delivery** – responsibility for implementing the various elements of the project (generation, transmission, management - as described above); and
- **Funding & financing** - the funding and financing requirement for the project will be dependent on the commercial viability of both the initial phase(s) and the overall project.

The case studies illustrate how the different elements influence the choice of delivery structure.

There are a variety of delivery structures that have been successfully deployed to deliver heat networks in the UK. These reflect the diversity of drivers, objectives and constraints that can initiate and then shape the development of schemes.

The development of an appropriate delivery structure for a district heating scheme will be strongly influenced by the objectives of the lead organisation. The process is iterative rather than sequential, and requires the careful balancing of a number of elements, including:

- the degree of control (usually exercised either by ownership of assets or through a variety of contractual mechanisms) that the lead organisation wishes to exercise over the development and operation of the scheme in order to secure its over-arching objectives;
- the risk appetite of the lead organisation and other key stakeholders;
- the scale and type (e.g. new build / retrofit) of scheme;
- phasing of the scheme;
- the required return on investment and the overall commercial viability of the scheme;
- the capacity and capability of the lead organisation to develop and operate the scheme;
- availability of funding and access to finance;
- impact of legislation and regulation; and
- exit strategy.

Again, the case studies illustrate how these factors have influenced the delivery structure.

The remainder of this guidance is structured as follows:

- **Section 2** - summarises the main approaches to delivering heat networks that have emerged in the UK to date;
 - **Section 3** - provides case studies to illustrate where these approaches have been adopted by actual projects;
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- **Section 4** - provides some observations on common themes emerging from the UK experience of heat networks, as illustrated by the case studies; and
- **Section 5** – provides references to further sources of information and guidance on various aspects of project development.

1.2. Acknowledgements

The report has been prepared by Scottish Futures Trust, with generous input to case studies from a number of sources. SFT gratefully acknowledges the contribution of:

- Dr David Hawkey and Prof Janette Webb, University of Edinburgh RC-UK Heat and the City, for providing case studies on Aberdeen Heat and Power, and Cube Housing Association. Their research was funded by the Research Councils' UK (RC-UK) Energy Programme, Grant Number RES-628-25-0052. Full details are available at www.heatandthecity.org.uk;
- Charlotte Large, Decentralised Programme Manager, at Islington Borough Council, for providing background information for the Bunhill Heat and Power case study;
- Bill Dewar, Lead M&E Professional, Fife Council, for providing background information for the Dunfermline Community Energy Scheme case study;
- Nick Morris, Head of Energy Services, Leicester City Council, for providing background information for the Leicester case study;
- Clare Hebbes, Senior Project Director, Argent LLP, and John Marsh, Director, Metropolitan, for providing background information for the King's Cross case study; and
- Dr Ruth Rule, Energy Direction Ltd, for assistance with preparing cases studies on the King's Cross, Leicester and Bunhill schemes.

2. Overview of delivery structures

Delivery structures for district heating projects range from fully public sector led to fully private sector led, and include a variety of joint public/private or ‘hybrid’ arrangements.

One way of representing this is to map various generic structures onto a continuum, in which the balance of risk and reward varies along with the level of control of the participating organisations. In Table 1 below, the structures towards the top of the table are ones in which the public sector takes the lead, has a high degree of control, but takes most of the risk. The structures further down the table involve increasing private sector involvement, with the private sector partner taking more of the risk (and, consequently, reward), which translates into less control for the public sector.

Table 1: Generic delivery structures representing a variety of public/private sector roles



Option	Description	Risk allocation	Example
1	Entirely public sector led: entirely publicly funded, developed, operated and owned	Public sector retains all risk	Public sector procures contracts for equipment purchase only. Procurement could be direct, or via a publicly owned arm's length entity (e.g. an energy services company)
2	Public sector led: entirely publicly funded, greater use of private sector contractors	Private sector assumes design & construction risk, and possibly operational risk	Public sector procures turnkey asset delivery contract(s), possibly with maintenance and/or operation options
3	Public sector led, private sector invests/takes risk in some elements of the project	Private sector takes risks for discrete elements (e.g. generation assets)	As 2, with increased private sector operational risk, and payment or investment at risk
4	Joint venture – public sector & private sector partners take equity stakes in a special purpose vehicle	Risks shared through joint participation in JV vehicle / regulated by shareholders agreement	Joint Venture – both parties investing and taking risk
5	Public funding to incentivise private sector activity	Public sector support only to economically unviable elements	Public sector makes capital contribution and/or offers heat/power off-take contracts
6	Private sector ownership with public sector providing a guarantee for parts of project	Public sector underpins key project risks	Public sector guarantees demand or takes credit risk
7	Private sector ownership with public sector facilitating by granting land interests	Private sector takes all risk beyond early development stages	Public sector makes site available and grants lease/licence/wayleaves
8	Total private sector owned project	Private sector carries all risks	No or minimal public sector role (e.g. planning policy / stakeholder management)

2.1. Risk

Key risks for district heating / energy projects include:

- **Design risk** – the risk associated with the impact on a project of deficiencies in design (e.g. of heat mains, energy centres, control systems, internals);
- **Construction risk** – the risks associated with the building of physical assets to a specified design;
- **Operational risk** – the risk associated with operating and maintaining assets to meet specified requirements;
- **Demand / market risk** - the risk associated with variances from anticipated demand – e.g. heat loads fail to materialise, or connection of loads to the network is significantly delayed, or loads choose to disconnect from the network;
- **Performance risk** – the risk associated with being able to supply customers to an agreed performance / service standard – e.g. due to demand being greater than forecast, or heat output being less than anticipated for the heat generation source(s);
- **Financial risk** – various financial risks capable of producing financial loss, including credit risk, interest rate movements, exchange rate risk, etc.; and
- **Regulatory risk** – the risk associated with changes to the legal / regulatory framework adversely impacting a project (e.g. planning control, metering, billing, consumer protection, technical standards).

District heating is often perceived by developers and financiers as a relatively high-risk investment compared with other types of infrastructure projects. A commonly cited reason for this view is the difficulty of managing demand risk for a proposed large-scale network in a relatively unregulated market.

The public sector can help to de-risk these projects, making them more investible for developers and financiers, in a variety of ways, including:

- facilitation – co-ordinating and brokering commitments from third parties;
- regulation – e.g. through the planning system;
- committing public sector buildings as long-term anchor loads; and
- underwriting certain project risks.

When considering the most appropriate delivery structure for a project, it is important to consider:

1. the nature of the ‘risk’ and how it relates to the objectives of the stakeholders;
2. the party best placed manage the risk - this will differ according to the type of risk and may vary from project to project and;
3. the alternative approaches for managing the risk - e.g. is it necessary to have outright ownership over key assets in order to manage risk, or can robust contractual mechanisms provide sufficient protection?

There can be a conflict between the level of risk that the public sector wishes to transfer in relation to a project, and the level of control and governance that it wishes to retain.

Outsourcing to the private sector is often considered the least risk delivery option from the public sector's perspective. However, where the public sector promoter wishes to address broader policy issues - such as alleviation of fuel poverty - by taking forward a district heating initiative, transferring all project risk to the private sector is likely to involve significant loss of control of outcomes for the public sector. In particular, in order to manage its risk, the private sector will require significant control over the way in which the resulting scheme is operated. The net effect may be to decrease risk in relation to the successful delivery of the project infrastructure, but to increase risk that the scheme will fail to realise the public sector's broader policy objectives.

This is an important observation, for many schemes promoted by local authorities and housing associations are motivated by a desire to alleviate fuel poverty.

Therefore, in considering alternative delivery structures for such a project, the promoter must consider whether each structure will allow it a sufficient level of control over the anticipated outcomes from the project, e.g. control over tariffs charged to social housing tenants, or control over the potential to expand and integrate small island networks into larger schemes in the future.

This also emphasises the need for public sector bodies to be clear about their overall objectives for developing a heat network.

2.2. Common delivery structures for UK district heating schemes

A relatively small number of delivery structures have been deployed on multiple occasions across the UK, and between them account for a significant number of existing heat networks. These, together with examples of projects which fall broadly into these categories, are outlined in Table 2.

At least one case study is provided for each of the four categories in Table 2. These are indicated in bold type.

It should be noted that the four common delivery structures identified below each contain variants: no two projects are exactly alike.

For example, within the category of publicly led, publicly owned & operated schemes, there are two obvious variants:

- Aberdeen City Council established an arm's length wholly-owned company, Aberdeen Heat and Power Company Limited, to develop and operate heat networks in Aberdeen. Another example of this approach is the Pimlico District Heating Undertaking, which is managed by an arm's length company (City Homes Limited) owned by Westminster City Council.
- By contrast, Fife Council operates the Dunfermline Community Energy Scheme, and Islington Borough Council the Bunhill district heating network, in-house, i.e. without having set up arm's length companies.

A similar observation can be made about the other categories in Table 2.

Nevertheless, this broad categorisation is a useful way of capturing the essence of the delivery structures for a large number of projects.

Table 2: Common delivery structures for UK district heating schemes

Delivery Structure	Description	Relevant examples of DH schemes
Public led, public sector ownership	Public sector organisation leads the development of the project and takes full financial risk. Elements of the construction and operation are outsourced to the private sector through turnkey asset delivery contracts.	Aberdeen Heat and Power Ltd Dunfermline Community Energy Scheme London Borough of Islington Pimlico District Heating Undertaking
Housing association led scheme	Residential Social Landlord led project, with RSL making a financial contribution and taking financial risk for the project. Elements of the construction and operation are outsourced through turnkey asset delivery contracts.	Cube Housing Association (Glasgow)
Public led, private sector ownership	Public sector procures a private sector partner under a long-term service concession agreement. Concessionaire develops, owns and operates scheme(s) in a defined area for the term of the concession agreement. Assets may or may not revert on expiry.	Leicester Birmingham
Private led, private sector ownership	Private sector led – developer procures a long-term private sector ESCO partner to develop, own and operate a scheme on the developer site under a long-term concession. Ownership of the assets sits with the ESCO.	Kings Cross Cranbrook / Skypark

3. Case studies

The case studies follow the broad structure below (not all points are relevant to every case study):

- **Project summary** – overview of the project, including lead entity / promoter, other stakeholders (public & private), delivery structure, references to further information and key contacts.
 - **Project drivers** – identification of strategic drivers for the project; whether internal / external; whether aligned across organisations; how any conflicts were resolved.
 - **Project objectives** – what did the project set out to achieve?
 - **Description of initial project** – what was the scale and scope of the initial project / phase? Did the project encompass generation, transmission and distribution? Was there an existing heat source?
 - **Initial delivery structure**
 - Rationale for initial delivery structure, e.g. response to finance / funding opportunity, market pressure, availability of heat source etc.
 - Establish whether the delivery structure took into account the anticipated future expansion of the scheme.
 - **Governance** – what governance arrangements were put in place for the project?
 - **Finance** – how was the project funded, and how was the delivery structure influenced by availability of funding?
 - **Contracting route** – how was the project contracted? Which risks did the authority retain / share / transfer? What main contracts were let? Was a special purpose vehicle established? If so, what was the ownership structure and what risks were transferred to the SPV?
 - **Procurement route** - how was the project procured? Under what procurement procedure(s) were the main contracts let (open, restricted, negotiated, competitive dialogue)?
 - **Subsequent expansion**
 - How has the delivery structure evolved and what were the drivers for change?
 - How have changes to available finance and risk perception, and wider market awareness, impacted on the delivery structure?
 - **Future proposed changes** – are any future changes to the delivery structure envisaged?
 - **Advantages and disadvantages of the chosen structure**
 - Has the delivery structure allowed the original project objectives to be achieved?
 - Has the delivery structure constrained future development?
 - **Replicability** - key reasons why a future project might utilise a similar delivery structure (or would not); what would be done differently next time?
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3.1. Case Study 1 - Aberdeen Heat and Power Company Ltd

Project Summary	<p>Aberdeen Heat and Power Company Ltd (AH&P) was set up in 2002 by Aberdeen City Council (ACC) as an independent, not-for-profit company limited by guarantee. AH&P employs a general manager and technical officer, and retains the services of a consulting engineer, accountant and accounts/administration assistant. Revenues are mainly from the sale of heating, hot water and electricity, with a small proportion (3%) from maintenance.</p> <p>AH&P's mission is to deliver clean affordable energy with socio-economic benefits to the citizens of Aberdeen.</p> <p>The key drivers for the initiative were to reduce fuel poverty and to improve the National Home Energy Rating (NHER) of the City Council multi-storey housing. A further goal was to reduce carbon emissions from energy use. An independent not-for-profit company, supplying heat, via combined heat and power generation, to clusters of multi-storey blocks was assessed as the most cost effective means to achieve these goals. Households benefit from reduced energy bills and warm homes. The Council has also reduced its energy costs and the business structure has created opportunities for future expansion.</p> <p>By 2014, three district energy centres and heat networks had been developed, supplying over 1700 households and 12 public buildings. Energy bills have been reduced by approximately 45%, with estimated carbon savings of 40%.</p>
Lead entity	Aberdeen City Council
Delivery Structure	Arm's-length not-for-profit company, limited by guarantee
References	<ol style="list-style-type: none"> 1. http://www.aberdeenheatandpower.co.uk 2. Aberdeen City Council – Cogenco case study 3. www.heatandthecity.org.uk
Key contact	Ian Booth, General Manager, Aberdeen Heat and Power Ltd.

3.1.1. Project drivers

The UK Home Energy Conservation Act (HECA) (1995) required local authorities to reduce home energy consumption and CO2 emissions by 30% between 1997 and 2007. Aberdeen City Council appointed a Home Energy Coordinator and administrative assistant to take responsibility for Council strategy to meet these targets. First steps included an energy appraisal of housing stock. This concluded that the multi-storey blocks (of which there are 59, consisting of 4500 flats, across the city) had the poorest energy efficiency ratings (average 3.3 out of 10 on the National Home Energy Rating (NHER) scale), and were difficult and expensive to heat. A further study revealed that up to 70% of the residents were living in fuel poverty and could not afford to heat their homes properly,

with resulting damp and, in some cases, poor health. Many multi-storey blocks had a high tenancy turnover and were hard to let, resulting in further deterioration in building fabric.

The key driver was therefore the provision of affordable warmth to housing tenants. The Council's 1999 Affordable Warmth strategy targeted use of the housing capital budget to reduce home energy use by 30% in the least thermally efficient high-rise flats. In 2002, following a Council conference on climate change mitigation, strategy relating to fuel poverty was updated to integrate the environmental aim of reducing CO2 emissions (Aberdeen City Council *Fuel Poverty Strategy 2002*). In addition the Council aimed to improve economic returns from existing housing stock.

3.1.2. Project objectives

To provide alternative energy efficient heating, which would deliver:

1. a substantial improvement in the National Home Energy Rating (NHER) of the city's multi-storey flats;
2. affordable warmth for tenants;
3. reduction in CO2 emissions;
4. sustainable and affordable energy for Aberdeen City Council;
5. improved economic returns to the Council from its housing stock⁵; and
6. affordability to the Council in terms of capital outlay.

The initial technical and economic options appraisal included evaluation of the potential to provide a common source of heating to clusters of neighbouring buildings via a shared source of heat, from a combined heat and power (CHP) generator, and a distribution network.

In the report, the lowest short-term cost option was replacement of electric storage heating, but this involved higher 'cost in use' to tenants, and higher carbon. The lowest 'cost in use' to tenants was CHP and district heating, with new external cladding of housing blocks.

However, the high cost of external cladding made this unaffordable to the Council. The preferred option was identified as CHP and DH without external cladding of housing blocks: compared to CHP / district heating with external cladding of buildings, it involved a relatively small additional cost in use and a relatively small decrease in carbon savings.

3.1.3. Description of initial project

The first district heating (DH) scheme, in the city's Stockethill area, has been operational since 2003. Four blocks of flats (288 flats in total) were connected to a gas-fired CHP engine with back-up gas

⁵ This included improved building fabric condition as well as rental returns

boilers. The CHP electrical output is 210kWe, with heat output at approximately 300kWth, supplying 3,485 MWh/annum heat.

It was recognised at the time that the heat load was highly cyclical (summer v. winter demand and daily peaks in the morning and evening), which does not produce the most efficient operation of the CHP plant. The selection of Stockethill was not however governed by technical efficiency criteria alone, but incorporated costs in the round, including those associated with organisational decision-making, energy project management, political support and social acceptability of community heating. Stockethill housing blocks were selected on the basis of fabric condition, anticipated ease of system implementation, and the stable population of householders who were expected to understand the benefits of the scheme and become effective ambassadors.

The project was also relatively simple to manage in relation to Council structures and decision-making, because it required capital contributions from housing services only. In subsequent developments, more typical of the diverse heat load connections needed to optimise CHP and DH efficiencies, funding had to come from multiple budgets held by different council divisions, with the attendant complexities associated with timely decision-making and legal contracts. The selection of Stockethill was hence part of a long-term strategy for DH development, and provided a means of shared learning about how to standardise Council procedures to reduce future costs and time demands of project co-ordination, and to ensure best outcomes for householders and the Council.

The Council's formal evaluation of the project found that the system was delivered on budget, and met affordable heating and carbon saving goals.

3.1.4. Initial delivery structure

An initial CHP and DH feasibility report recommended creation of a 'not-for-profit' company to fulfil the financing requirements for replacement heating, and use of a cost- rather than market-based heat tariff (i.e. tariffs would be based on the cost of supplying heat, rather than what the market would potentially bear). This structure was viewed by the Council as enabling affordable warmth targets to be met more rapidly than under internal governance.

In summary the creation of AH&P was considered to be the best means for achieving:

- delivery of social and environmental objectives for affordable warmth and carbon savings;
- control and governance:
 - meeting affordable warmth targets more rapidly than under internal governance;
 - retaining local control over system development and asset ownership;
 - efficient procurement process, based on a long-term (fifty year) framework agreement between the Council and AH&P, designed to benefit from the 'Teckal' exemption for in-house arrangements (see next sub-section for further details);
 - as between the Council and AH&P, construction and operational risks are transferred to AH&P under the framework agreement;
- business management and accountability:
 - managing fuel purchases, operation, maintenance and sale arrangements;
 - developing projects to a set budget and timetable;

- guaranteeing a reliable standard of service and customer protection;
- financial viability:
 - A low rate of return on investment was acceptable, given the primary return sought was well-being and local economic benefit, combined with carbon savings;
 - grant funding could be used within the required short timescales; and
- risk management:
 - the Council would retain much of the risk irrespective of delivery vehicle, as the initial phase connected Council-owned housing. The Council is required as a social landlord to ensure security of the tenants' heating supply and to consider what would happen if AH&P were to cease trading. Under Scots law AH&P assets would revert to the Council, which owns or leases the land where the assets are located. In addition, the Council has underwritten lending to AH&P to finance developments. Therefore, there would be no other major claim on assets by any outside body (e.g. lenders); and
 - heat costs are charged at a flat rate with rent and collected by the Council, which accepted the risk of tenant non-payment, setting this against expected improvements in revenues from housing stock and reduced costs of heating for Council buildings to be connected to the network in future.

3.1.5. Governance

Following full agreement of the Council in 2002, Aberdeen Heat and Power Ltd (AH&P) was formed as an independent not-for-profit company, limited by guarantee, to develop and manage DH projects linked to clusters of multi-storey housing. As a company limited by guarantee, it has a membership structure rather than shareholders and a volunteer board of directors. The Board consists of Council representatives, tenant representatives and up to 6 independent members with relevant expertise.

The independent organisation benefits the council by ring-fencing finances and management responsibility, and facilitating capital investment in housing stock refurbishment, while spreading the capital cost over several years. The Council entered into a fifty-year framework agreement with AH&P for procurement purposes, utilising the *Teckal* exemption. The exemption provides that, in certain circumstances, the award of a contract by a public body to a wholly-owned arm's length entity established by it will not fall within the definition of 'public contract', with the result that EU law will not require the contract to be put out to tender. The exemption contains a 'control test' and a 'function test'. First, the local authority must exercise similar control over the entity to that which it exercises over its own departments, and second the entity must carry out the essential part of its activities with the controlling local authority or authorities.

AH&P is required by the terms of the framework agreement to tender its capital works contracts in accordance with public procurement procedures. The Council also required AH&P to take financial services from it, on a contract basis, during the early years of the project.

For each DH development the Council enters into a standard Installation Agreement with AH&P which specifies the scope of the project and fixes the capital costs. This reduces the risk to the Council of cost over-runs.

All surpluses made by AH&P are used firstly to keep the heat charge to domestic customers at an affordable warmth rate, and secondly to cover the extra costs of future-proofing the heat network. A high proportion of the capital cost of a district heating system is for the pipe network and the housing for the CHP plant. At the technical feasibility stage of each project, AH&P sizes, and hence costs, these elements appropriately for the needs of the planned project, but not for future growth in heat demand and in network expansion. However, AH&P invests its surplus income to gain the benefit of oversizing main sections of the pipe network and energy centre building in order to cater for future load growth. For example, the CHP energy centre at Seaton was built to accommodate 3 generators and associated plant, when initially only 1 generator was to be installed; also the distribution pipe network at Seaton Phase One was oversized to enable later extension into the City Centre.

3.1.6. Finance

The £1.8 million Stockethill energy centre and heat network were funded by a 40% grant contribution from the UK Community Energy Programme (CEP)⁶, combined with a 7% grant from the energy utility Energy Efficiency Commitment (EEC, now ECO), with 53% from the City Council housing capital budget.

A £1million loan from the Cooperative Bank to AH&P, repayable over 10 years, was raised to finance the construction. A favourable interest rate was secured through provision of a loan guarantee from the Council, hence minimising the total capital costs. As noted above, any profit realised by AH&P is used to maintain affordable heat tariffs or reinvested into extending / future-proofing the network.

3.1.7. Procurement route

The Council identified a consulting engineer using a list of approved contractors provided by the Energy Saving Trust as part of the UK Community Energy Programme. Integrated Energy Utilities (IEU) tendered for the contract to provide detailed technical and economic appraisal for a pilot CHP and DH scheme for a cluster of multi-storey blocks.

The same engineer was retained by AH&P to carry out detailed design work for Stockethill, and to manage the tendering for the build contract. This was considered the most effective means of minimising materials and construction costs. AH&P own, operate and maintain the systems (including lifecycle replacement of assets).

⁶ The UK Community Energy Programme (CEP) ran from 2002-2007, and consisted of a £50M budget from UK Treasury Capital Modernisation Funds for a Community Energy Programme (CEP) to support DH developments led by public bodies. Applicants for capital grants had to demonstrate *additionality*, and show that community heating was the most viable solution for cost and carbon saving compared to alternative options, and that a range of finance options (such as existing capital funds or bank loans) had been explored.

3.1.8. Subsequent expansion

The second energy centre and heat network at Hazlehead is located in the original boiler house of Hazlehead Academy, a Council secondary school. The district heating network is connected to 4 multi-storey blocks (200 flats) and a sheltered housing scheme. Heat is also supplied to the Hazlehead Park Sport Pavilion and both heat and electricity are supplied to Hazlehead Academy and Swimming Pool complex. The public buildings have a different heat profile from the flats; consequently the CHP generator runs throughout the year, providing improved efficiency and additional revenue from the higher level of electricity generated and sold. The CHP electrical output is 300 kW_e with heat output at approx. 488 kW_{th}, supplying 5,600 MWh/Annum.

The £1.6 million Hazlehead energy centre and heat network were funded by a 40% grant contribution from the UK Community Energy Programme (CEP), combined with a 7% grant from the energy utility EEC, with 53% from the City Council housing capital budget.

The purpose-built Seaton Energy Centre and heat network were developed in two phases, at a total cost of £3.3M. The first phase installed a 1MWe CHP generator and back-up boilers. The second phase installed an additional 1MW CHP generator, reducing the dependence on top-up heat from the gas boilers, and increasing system efficiency and revenues. Total capacity is 2,100kW_e and 3,000 kW_{th}. Heating and hot water is supplied to 1,050 flats in 14 multi-storey blocks, a sports changing facility adjacent to the Seaton Energy Centre, and to the Council's leisure complex, comprising Beach Ballroom, Beach Leisure Centre and Ice-Rink. AH&P also supplies the Aberdeen Sports Village and the Aquatic Centre, a 50-metre swimming pool. The diverse heat load provided by the mix of housing, public buildings and community facilities improves the overall efficiency of the scheme.

Phase one of the Seaton energy centre and heat network were funded by a 40% grant contribution from the UK Community Energy Programme (CEP), combined with 60% from the Council housing capital budget. Phase two was funded by 40% finance from the energy utility Community Energy Saving Programme (CESP) and 60% housing capital. In both cases, prudential borrowing was used to cover a time gap between construction and receipt of grant and to capitalise future avoided costs.

In 2013 the Seaton network was extended to the city with a further 5 public buildings connected, including the Aberdeen City Council Town House. The pipework extension was funded by a £1M Scottish Government grant.

Current projects in the Cairncry, Tillydrone and Torry areas of the city are connecting a further 11 multi storey blocks to DH, with a target completion date of April 2015.

In late 2013, a Global District Energy Award was presented to AH&P representatives at a ceremony in New York. The award recognised the achievement thus far and the future potential for business growth.

3.1.9. Future changes

Extension of the heat network to the city centre has opened up potential for connections to commercial buildings. Since the terms of the Teckal exemption restrict the ability of AH&P to act as a supplier to non-council buildings, a wholly-owned subsidiary of AH&P, District Energy Aberdeen Ltd (DEAL), has been established to trade with the private sector. DEAL will operate as a profit-making enterprise, with any profit returned to AH&P for use in maintaining affordable tariffs for social housing and to build reserves for capital replacement and further developments.

In the longer term, AH&P aims to replace fossil fuel energy sources, as sustainable heating supplies become viable. Through liaison with academic and other partners, the aim is to investigate use of biomass, bio-gasification, anaerobic digestion and geo-thermal sources. There are also plans to link the multiple CHP stations around the City into one city-wide heat network.

3.1.10. Advantages and disadvantages of the chosen structure

The delivery structure has allowed the original project objectives to be achieved:

- heating costs per household have been reduced by up to 50%, and all households connected to new DH have been taken out of fuel poverty;
- reliable and controllable heating systems have been installed in domestic and public buildings;
- housing standards have been improved and dampness eliminated: average National Home Energy Rating (NHER) in multi-storey housing increased from 3.3/10 in 1999 to 7.19/10 by 2009. This has led to reduced turnover of tenancies, informal evidence of improvements in health, much reduced level of tenant complaints and improved Council revenues;
- the fixed capital costs reduce the risk to the Council;
- use of gas CHP and DH has provided a reduction of approximately 40% in carbon emissions in comparison with electric heating; and
- subsidiary company DEAL is expected to enable further growth of the heat network, while maintaining heat costs at an affordable level for the domestic sector.

The key disadvantage of the structure is that it has placed significant responsibility on Council officers, Councillors and volunteer AH&P Board Members, most of whom had very limited experience or technical expertise in energy systems. The Council also retained significant project risks, providing a loan guarantee for the first project, overdraft facilities for AH&P during the early years, and collecting tenants' payments for heat with rent. The business has consequently had to develop considerable knowledge about distributed energy systems, business operation and energy markets, without the contribution of established utility companies. The criteria of affordability of investment to the Council also required grant funding to meet a proportion of capital costs.

3.1.11. Replicability

The approach adopted by Aberdeen City Council is likely to be suitable to be adopted by other public sector bodies (primarily local authorities and housing associations) in the following circumstances:

1. a proposed project is not financially viable without a component of grant funding and/or low-cost, long-term loans;
2. the public sector body is able and willing to provide a significant level of financial resource in the form of loans or guarantees;
3. availability of resource and willingness within the public sector body to develop energy projects;
4. prioritisation of social benefits, and reduction of CO2 emissions, over other objectives such as income generation;
5. a high degree of local control over cost structures and revenues is desired in order to control energy tariffs and future expansion;

6. the public sector body has a desire for clarity in relation to ring-fencing business finances and project management and ensuring accountability through an independent non-profit company.

The approach is unlikely to be suitable where:

1. suitable internal resource is unavailable;
2. an element of risk transfer is required; or
3. there is a lack of capital or development funding available.

Key considerations for other public bodies considering a similar approach include:

1. ensuring sufficient resource to undertake initial technical appraisal of options for meeting objectives and to de-risk the project as far as possible;
2. ensuring sufficient resource for professional advice on independent company structures, contractual and procurement processes between the public body and the proposed arm's length company, state aid issues and tax treatment (including VAT considerations);
3. identification and selection, through competitive procurement, of suitable consulting engineers for detailed project design and development, and continuous project cost management;
4. allocating sufficient funding and resource for development phase to minimise overall project costs and maximise long-term value from the project;
5. consider the timing of fuel source supply contracts in relation to setting of energy tariffs, and the objective of affordable heat prices, particularly in relation to bulk gas purchase in wholesale markets, and maximising income from the sale of electricity generated.

3.2. Case Study 2 – Bunhill, London Borough of Islington

Project Summary	<p>In 2012 Islington Council commissioned a design and build contract and a 10 year maintenance contract. Vital Energi were appointed to build the energy centre and heat network.</p> <p>The Council manages the operation of the scheme, gaining revenue from electricity and heat sales.</p> <p>The key driver for the approach was to retain control and enable savings to be passed to residents via reduced energy bills as well as creating opportunities for further expansion.</p>
Lead entity	London Borough of Islington
Delivery Structure	Wholly public-sector owned
References	<ul style="list-style-type: none"> • www.islington.gov.uk/heatnetwork
Key contact	Charlotte Large, Decentralised Energy Programme Manager at Islington Borough Council.

3.2.1. Project drivers

In the conceptual stage of the project the key driver was environmental, namely the reduction of CO2 emissions in the Borough. As a result of a political change during this early stage the project driver moved from realising environmental to social benefits, primarily through the alleviation of fuel poverty. The aim was to reduce fuel poverty in the Borough by providing a buffer against increasing fuel prices to local residents. In addition, the Council wished to provide a sustainable and resilient heat solution to their existing communally heated estates. Reducing CO2 emissions was an added benefit.

A further driver was to maintain a flexible approach in respect of providing low-cost, low-carbon heat to dense and hard-to-treat areas of the Borough. By linking development and heating systems greater efficiencies and economies of scale could be achieved.

3.2.2. Project objectives

To provide alternative heating, which would:

1. reduce fuel bills to residents, providing a buffer against increasing fuel prices;
2. provide a flexible approach to low-cost, low-carbon heat provision in dense and hard to treat areas of the borough;
3. achieve efficiencies & economies of scale connecting to new-build developments.
4. reduce the Borough's CO2 emissions (40% target by 2020);
5. reduce the Borough's and partners' energy costs;

3.2.3. Description of initial project

Bunhill energy centre houses a 1.9MWe gas CHP engine and 115 cubic metre thermal store. The network is comprised of one kilometre of trenching, which holds two kilometres of insulated district heating pipework. The £3.8 million energy centre and heat network were funded by grants secured from the Greater London Authority and the Homes and Communities Agency.

The inner-city environment presented many challenges, from tight infrastructure, lack of space, parking, noise and air-quality considerations. The council undertook up-front work where possible to reduce the project risks and minimise uncertainties during the construction phase, including design work, application for planning permission and underground surveys. A design and build contract was tendered, and a separate 10-year maintenance contract entered into to provide assurance to the Council. In 2012 Vital Energi successfully built the energy centre and heat network.

3.2.4. Initial delivery structure

Detailed feasibility studies of the potential of the scheme were undertaken. As a result of the detailed feasibility work and the following factors the Council decided to finance, own and operate the scheme itself.

1. Control and governance - Retaining control and governance in the project was considered essential to realising the project objectives.
2. Financial viability – it was determined at an early stage that the project would not attract third party finance and was reliant on grant funding from the Homes and Communities Agency and Council allocated Growth area funding. A further consideration was the ability to allocate the grant funding within the required timescale and therefore to avoid an extended procurement process.
3. In house expertise – the Council benefitted from a strong internal team including legal and financial support.
4. Risk – it was considered that the Council would retain much of the risk associated with the project irrespective of the delivery vehicle as the initial phase was primarily to connect Council owned housing and leisure centres.

The Council issued a design and build and maintain contract through the OJEU process, which was secured by Vital Energi.

3.2.5. Procurement route

The Council retained a client engineer both pre and post procurement to ensure that the proposed scheme would meet its immediate needs and retain flexibility for future expansion. The Council undertook extensive design work prior to tendering for the separate design and build and operation and maintain contracts.

The design and build contract was undertaken on an ‘all in risk’ basis. While the Council paid a premium for this, it was considered appropriate based on the high level of upfront work undertaken and the need for price certainty.

The operation and maintenance contract was tendered at the same time as the design and build contract, but is separate and extends for a 10 year period, at which time the Council will re-tender. It is also possible that expansion plans may require the O&M contract to be renegotiated earlier.

3.2.6. Subsequent changes to delivery vehicle

The project is currently held within the Council's general fund and work is being undertaken to transfer the project to the corporate landlord account. The purpose of this change is to create a standalone project with greater transparency; it is also anticipated that it will assist in relationships with leaseholders. Although the Council has no immediate plans to divest itself of the assets, the proposed changes would enable the Council to realise their value at a future point in time.

3.2.7. Future expansion

A second phase of the project is currently being developed as part of the European Union Celsius project (<http://www.celsiuscity.eu/>). The Council will receive €1m over four years, to be combined with £2.7m of Council capital and £200k of section 106 contributions⁷ to fund the next stage of the project. Phase two will connect an additional 500 homes including a number of new builds.

3.2.8. Replicability

The approach adopted by the London Borough of Islington is likely to be suitable to be adopted by other public sector bodies in the following circumstances:

1. proposed project is not financially viable without grant funding, and the public body is able and willing to provide significant funding towards project costs;
2. availability of resource, expertise and appetite within the public sector body to develop and operate energy projects;
3. prioritisation of social benefits over other project objectives such as CO2 savings; and
4. a high degree of control and governance is desired to control energy tariffs and future expansion.

It is unlikely to be suitable where:

1. internal resource is limited;
2. an element of risk transfer is required, and
3. there is a lack of capital or development funding available.

⁷ Under section 106 of the Town and Country Planning Act 1990, planning authorities can agree with developers a contribution to the authority associated with an increase in the value of land in respect of which planning permission is sought. In Scotland the equivalent provision is section 75 of the Town and Country Planning (Scotland) Act 1997.

Key considerations for other public bodies considering a similar approach would include:

1. ensuring sufficient resource to undertaken upfront technical appraisal of proposed project to de-risk the project as far as is reasonable;
2. allocating sufficient funding and resource for the optimisation and commissioning phase to maximise value from project;
3. consider using the competitive dialogue procedure, where timescales allow, to enable specific elements of the project to be tested in the market; and
4. consideration of tariff structures, in particular the tension between energy tariff (unit costs of energy) and standing charges (fixed costs), and how different structures may impact on the ability to realise energy discounts, particularly in relation to bulk supply agreements.

3.3. Case Study 3 – Dunfermline Community Energy Scheme

Project Summary	<p>The Dunfermline Community Energy Scheme (DCES) was developed by Fife Council between 2006 and 2011. It supplies heat to approximately 245 housing tenants and a number of public buildings in Dunfermline town centre, including a swimming pool, a residential care home and a sheltered housing complex. It is owned and operated in-house by the Council.</p> <p>The scheme uses low carbon heat derived from landfill gas as its primary heat supply – the only scheme of its kind in the UK. It has also recently incorporated an additional low carbon heat source, namely heat recovered from the Council’s anaerobic digestion plant.</p>
Lead entity	Fife Council
Delivery Structure	Wholly public sector owned
References	
Key contact	<p>Bill Dewar, Lead M&E Professional, Fife Council</p> <p>Shona Cargill, Energy Strategy Programme Manager / Lead Office (Climate & Zero Waste), Resource Efficient Solutions Ltd</p>

3.3.1. Project drivers

A significant driver for the inception of the Dunfermline Community Energy Scheme (DCES) was the desire to make use of surplus low-carbon heat recovered from landfill gas engines at the Council’s landfill site in Lochhead, located approximately a mile to the north of Dunfermline town centre.

In 2005/6, the Council installed a system to capture landfill gas generated by de-composing biodegradable municipal waste, and to make the gas available as a fuel for electricity generation. At the same time, the Council awarded a 15-year concession for the operation of the landfill gas collection system and the right to utilise the harvested gas to generate electricity. The Council receives a royalty payment on the sale of electricity derived from the landfill gas. Waste heat from the engine exhaust gases and jacket water systems is captured by heat recovery units.

The Council wished to utilise the surplus heat in the town centre, both for its own properties and to provide a source of low-cost, low-carbon heat for the tenants of 3 multi-storey blocks of Council flats, which were previously electrically heated.

3.3.2. Project objectives

The main objectives for the initial phase of the network were:

- to make best use of the surplus heat derived from landfill gas captured from the Council’s landfill site;

- to use the recovered heat to provide a resilient source of low-cost low-carbon heat for the Council's own properties and social housing in the town centre.

3.3.3. Description of initial project

The scope of the project consisted of:

- installation of heat recovery equipment to capture surplus heat from landfill gas engines and convert it to hot water;
- construction of a pumping station at the landfill site, and a primary distribution main to transport heat from the generation source at the landfill site to the town centre;
- construction of an energy centre in the town centre, including the installation of 2 x 2.4MW gas-fired boilers to provide top-up and stand-by capacity to the primary heat supply derived from landfill gas, and a 100m³ thermal store;
- construction of a distribution network for the onward supply of hot water to the connected buildings;
- installation of heat interface units in each connected building.

The DCES network contains approximately 5km of buried, pre-insulated pipework, and serves 213 Council tenants, the Carnegie Leisure Centre, tenants of Bield Housing Association's sheltered housing complex at Grant's Bank, the Matthew Fyfe residential home, and an NHS clinic. The scheme also has connection, but does not currently supply heat, to Wellwood primary school and Queen Anne High School.

During recent years on average approximately 75% of the heat consumed annually by the connected buildings is derived from the harvested landfill gas.

3.3.4. Initial delivery structure

The Council wished to retain a high degree of control over the development and operation of the DCES scheme, and elected to retain the ownership and operation of the scheme assets in-house following construction and commissioning of the network. The Council has chosen not to operate the scheme through a special purpose vehicle to date, but has provided operational resource through its Property Services and Housing departments.

3.3.5. Governance

The original scheme has been managed in-house by the Council to date. Operation and maintenance services are currently carried out on the Council's behalf by Vital Energi.

3.3.6. Finance

The DCES scheme was developed following a successful application by the Council for a £1.6m capital grant from the Community Energy Fund. The balance of £2.7m was met by capital funding from the Council.

The Council had originally hoped to take forward an additional heat network. However, the tendering process suggested that this would be unaffordable at the time, and so the Council focussed initially on the Dunfermline scheme.

3.3.7. Procurement route

The original DCES scheme was procured by the Council under a design and build contract, which was awarded to Vital Energi. The contract was tendered in accordance with the principles of the Code of Procedure for Single Selective Tendering 1996. The contract comprised the General Conditions of Government Contracts for Building and Civil Engineering Major Works GC/Works/ 1/ Without Quantities (1998). Vital Energi have provided operation and maintenance services to the Council for the existing network during the period since it was commissioned. From 1 April 2015 responsibility for maintenance will be assumed by Bailey Maintenance.

3.3.8. Subsequent expansion

During 2012/13 the Council constructed an anaerobic digestion (AD) facility adjacent to the landfill site. The AD facility uses food and garden waste as a feedstock, and produces biogas and digestate as outputs. The biogas is converted to electricity via gas engines, and the surplus heat from the gas engines is captured and fed back into the heat network (around a third of the recovered heat is used as process heat for the AD plant). The additional low-carbon heat source will offset the decline in landfill gas yields as the landfill cells mature.

During 2013/14 the Council collaborated with NHS Fife, with support from SFT, to investigate the possibility of extending the DCES network to NHS Fife's Queen Margaret Hospital and a number of other Council-owned properties. However, after conducting feasibility studies and preparing an outline business case, the parties decided not to take this forward, on the basis that the project was financially marginal. During 2014, the Council established a heat supply to a new Tesco supermarket in the town centre, and began supplying heat to an arts centre (the former fire station).

3.3.9. Advantages and disadvantages of the chosen model

The original approach adopted by Fife Council (i.e. for the creation of the original network, operated in-house) is likely to be suitable to be adopted by other public sector bodies in the following circumstances:

1. the proposed project is not financially viable without grant funding;
2. availability of resource and expertise and senior-level commitment from within the public sector body to develop and operate energy projects;
3. prioritisation of social benefits over other project objectives such as CO2 savings; and
4. a high degree of control and governance is desired to control energy tariffs and future expansion.

It is unlikely to be suitable where:

1. internal resource is limited;
 2. significant risk transfer is required, and
 3. there is a lack of capital or development funding available.
-

3.4. Case Study 4 – Leicester

Project Summary	The Leicester partnership, led by Leicester City Council, secured a 25 year energy services agreement with the potential for a 5-year extension to deliver a Citywide District Energy Scheme (6MWe of CHP and 16km of new network). The agreement also included the adoption of existing district heating assets into the City and the option for future expansion.
Lead entity	Leicester City Council
Delivery Structure	Service Concession
References	http://www.leicester.gov.uk/EasySiteWeb/GatewayLink.aspx?aId=102693 http://www.cofely-gdfsuez.co.uk/solutions/district-energy/district-energy-schemes/leicester-district-energy/
Key contact	Nick Morris, Head of Energy Services, Leicester City Council.

3.4.1. Project drivers

There have been a number of communal heating schemes within the city of Leicester City since the 1950s. Over time these have been converted from coal to gas fired boilers or CHP, however they have previously not been physically connected.

Since 2003 there has been an ambition to develop a city centre heat network that would link the major heat demands in the centre and therefore provide cheap, reliable and low carbon heat. In 2007 a detailed study was undertaken which confirmed the potential of utilising existing district heating schemes.

Leicester City Council (LCC) has made the reduction of Leicester’s carbon footprint a priority through its One Leicester Strategy. There is a strong climate change strategy and energy planning policy with district energy at its core. The key aim is for “the provision of controllable and reliable warmth to a group of buildings at an affordable price, minimising CO2 emissions and using Combined Heat and Power via a District Heating System”.

3.4.2. Project objectives

The Council has a key carbon reduction target, to reduce the emissions in the city by 50% compared to 1990 levels by 2020. The project is expected to make a major contribution to this target, however it was also envisaged that it would:

1. provide affordable and reliable warmth;
2. provide a secure and sustainable energy supply;
3. retain expansion potential; and
4. not require investment by LCC or any of the members of the Leicester Partnership (comprised of the Council, the University of Leicester and HMP Leicester).

3.4.3. Description of initial project

LCC commissioned a study to carry out initial heat-mapping, identify the technical feasibility of buildings that could be connected to a city centre heat network and determine the location of potential energy centres. This allowed them to begin conversations with potential public sector partners and understand any significant technical and organisational barriers that may impact upon the scheme. LCC were keen to include as many public bodies as possible in the process to ensure scheme size and carbon/cost benefits could be maximised.

The Leicester District Energy Scheme optimises the six existing district heating schemes in the city, linking four housing estates with a number of Council buildings and those of the University of Leicester. It is hoped that the scheme can be expanded in the future to include HMP Leicester and potentially De Montfort University.

The scheme currently uses a combination of over 5MW of low carbon gas-fired combined heat and power and biomass boilers to achieve CO₂ emissions savings of 12,000 tonnes per annum, with further reductions expected as more users join the scheme.

In the early stages of project development the Council had considered developing and financing the district heating project, however, as the project progressed it became clear that 'outsourcing' the project was preferable.

The business case for the heat network was created giving consideration to the environmental, social and economic benefits. A detailed commercial plan which identified significant potential revenues and gave a promising payback period was determined and provided confidence for the Leicester Partnership to progress to procurement.

Financial officers scrutinised the proposals and recommended a third party should provide capital and stand financial risks. This reduced the potential for revenue from the scheme for the Council and devolved control to the chosen partner. However, it was felt that allowing the market to determine an optimum solution through competitive dialogue was preferable to the Council taking on risk.

3.4.4. Procurement route

Leicester City Council published a contract notice in OJEU in 2009 on behalf of the Leicester Partnership. This was followed by a 12 month competitive dialogue procedure.

The competitive dialogue process was chosen by the Council to encourage a range of innovative solutions in the development of the scheme. A number of alternative proposals for the provision of low carbon heat into the network were proposed, however the traditional gas fired CHP proposal was chosen due to its viability.

The 25 year concession (with the option of a 5 year extension) was secured by Cofely- GDF Suez, with construction commencing in 2011.

3.4.5. Initial delivery structure

The Leicester District Energy scheme is being delivered through a new subsidiary company, the Leicester District Energy Company, wholly owned by Cofely-GDF Suez. £1m of funding for the project was secured from the Community Energy Saving Programme (CESP), with the remaining £14m of required investment being provided by Cofely. The Council also provided a guaranteed initial heat load for the project; this included 2,800 Council tenants and a number of Council buildings. The

Council was able to substitute exact buildings during the development of the project as long as the heat load remained within 10% of the agreed volume.

The Council agreed the heat supply contract with the concessionaire, Cofely-DGF Suez, on behalf of its tenants and for its own stock. The University of Leicester agreed a separate heat supply contract; any additional heat users would be required to do likewise.

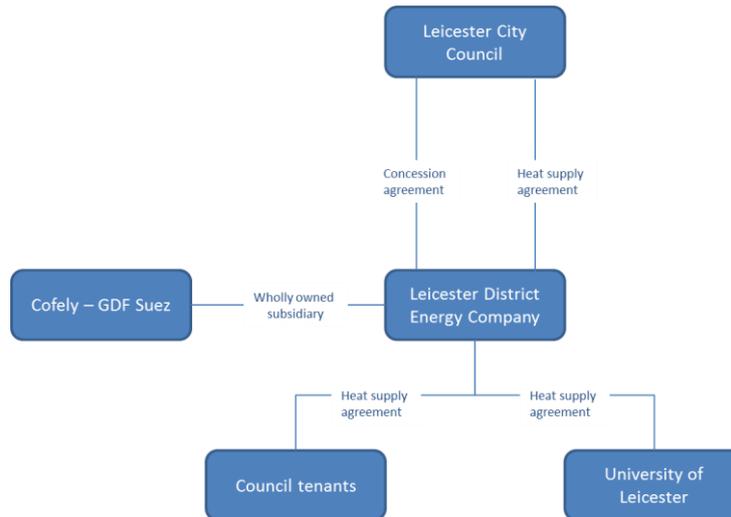


Figure 1 Leicester district heating project initial structure

3.4.6. Subsequent changes to delivery vehicle

There are currently no planned changes to the delivery vehicle, although the details of the partnering arrangement are currently being finalised. The partnering arrangement will establish a process by which any financial benefit from future connections is shared between the concessionaire and the Council. It is envisaged that the sharing arrangements will apply to all additional connections beyond the initial guaranteed heat load.

3.4.7. Future expansion

The project was procured with a clear need for future expansion, and the ability easily to connect new buildings in the future was fundamental to the project. The project was also designed to allow the use of emerging renewable technologies in future years.

The project broke ground on 29 June 2011 and phase 1 commenced in June 2011 and was completed in the summer of 2012 with the installation of 7km of buried distribution network. Phase 2 commenced in August 2011 and a small amount of biomass-fuelled generating capacity was also installed by the summer of 2012. Phase 3, which connected the University, started in July 2011 and became operational in April 2012.

There are further plans (phases 4 and 5) to connect the prison, hospital and other public and private sector buildings with the end vision of a city-wide scheme. At the same time work is ongoing to further reduce the carbon content of the heat supplied through the network.

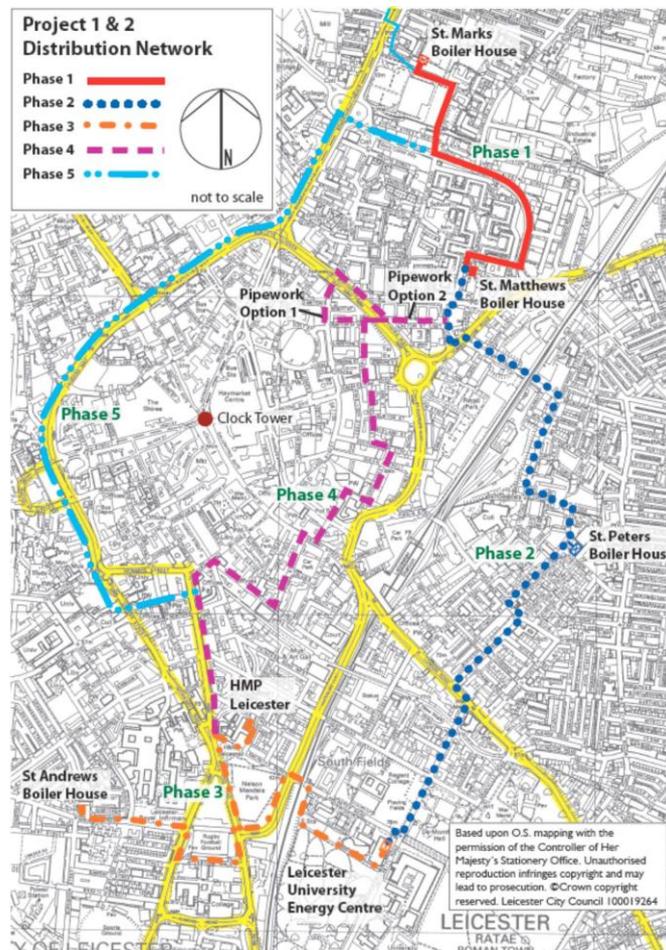


Figure 2 Phased expansion of Leicester City heat network

3.4.8. Advantages and disadvantages

The key advantage of the chosen structure for the Council was the ability to secure external funding for the project and transfer a significant proportion of the financial risk (as well as design, construction and operational risk for the new network developments). In order to achieve this, however, it was necessary for the Council to provide an initial guaranteed heat load. This provided the developer and funder with secure revenue stream to support the upfront capital costs.

The key disadvantage of this approach adopted is the reduced control over the future of the extension of the network. Under the existing contract Cofely-GDF Suez is required to operate the extended scheme (supplying 2,800 dwellings and 35 Leicester City Council operational buildings as well as the University site), and must also achieve a 12,000 tonnes CO₂/ per annum reduction for the city.

Cofely is not directly obliged to extend the network further through their current contract. The management and future expansion of the scheme is reviewed through a Joint Strategic Board. The only condition on expansion is that Cofely share any potential upside with the Council as part of the partnering agreement

The Council does have future expansion plans, beyond those set out in its existing planning policy, but these are not enforceable through the current contract and the Council recognises that it may need to consider the possibility of working with another provider to develop new schemes if a suitable agreement cannot be reached with Cofely.

3.4.9. Replicability

The approach adopted by Leicester City Council is likely to be suitable to be adopted by other public sector bodies in the following circumstances:

1. limited public sector capital available for infrastructure investment;
2. limited resource and/ or appetite within the public sector body to operate and develop energy projects;
3. prioritisation of affordable and reliable warmth, a secure and sustainable energy supply and significant reduction in CO2 emissions over other project objectives; and
4. initial project phase is clearly identified.

It is unlikely to be suitable where the public sector body seeks:

1. a high level of control and governance over the scheme, including but not limited to energy tariffs, standing and fixed charges, and the future expansion of the network;
2. to maximise the potential for revenue to accrue to the public body from the scheme; and
3. specific project outcomes that may need to be balanced against project returns, such as fuel poverty, inward investment or job creation.

3.5. Case Study 5 – King’s Cross

Project Summary	Construction started onsite in 2008 on the energy centre, which will house three gas fired 2MW CHP engines. The majority of occupiers are expected to be connected before 2020, resulting in a 45MW peak heat demand and 5MW local absorption cooling. Carbon savings as a result of the district heating scheme are expected to be in the region of 45%.
Lead entity	King’s Cross Central Limited Partnership
Delivery Structure	Wholly private sector
References	www.kingscross.co.uk/the-energy-centre-at-kings-cross www.met-i.co.uk
Key contact	Clare Hebbes - Senior Project Director, Argent LLP John Marsh – Director, Metropolitan (John.Marsh@bu-uk.co.uk) http://www.met-i.co.uk/#case-study-panel

3.5.1. Project drivers

King’s Cross is the largest site in single ownership to be masterplanned and developed in central London in over 150 years. The site itself had very little in the way of existing services, offering the developer, the King’s Cross Central Limited Partnership (KCCLP), a ‘blank canvas’ to create infrastructure suited to the 21st century.

Together with the London Borough of Camden planning team, a series of targets were set including the reduction of carbon emissions by at least 50% relative to 2005 levels. These require a number of energy saving and efficiency measures, with a significant part being played by the energy centre and district heating network.

3.5.2. Project objectives

1. To create a development that is sustainable in the long term
2. To provide low carbon heat to up to 2,000 new homes, 23 new and refurbished office buildings and 5 million square feet of retail space.
3. To reduce carbon emissions by 60% from 2001 levels.

3.5.3. Description of initial project

Argent LLP, the developer of the Kings Cross site, was committed to ‘doing the right thing’ in relation to improving energy performance and reducing the carbon emissions from the development. Following discussion with Camden Council an energy strategy for the development was produced, that later became an integral part of the planning permission for the site. From initial work

undertaken it was clear that gas fired CHP was the only practicable technology able to meet the required carbon emission reduction for the site.

Due to the economic difficulties at the time the development build-out rate was much lower than originally expected. As a result a temporary solution was installed to supply the first two buildings on the site and the first customer, the London School of the Arts, in 2008.

Subsequently 2 of the proposed 3 CHP engines have been installed and the scheme can supply up to 34MWth.

3.5.4. Initial delivery structure

Working with its utility partner, Metropolitan, KCCLP created a joint venture, Metropolitan King's Cross (MKC), to deliver all of the low-carbon heat requirements on the site. While KCCLP recognised the need for them to retain a high degree of risk and control over the development of the project a key requirement of the joint venture was for Metropolitan to have a financial interest in the success of the project, and a 90%/ 10% split was agreed.

Following the model of other utilities and the likely requirements of future regulation, an early decision was taken to separate the generation and distribution of heat. The heat network is therefore under separate ownership from the generation assets, facilitating the future extension of the network off-site, and the potential for new heat generators to feed into the network and serve new customers. The separation would also allow for the pipework to be novated to another vehicle should a wider district heating network be established in the future.

MKC operates the energy centre under a 25 year concession agreement, balancing the commercial needs of an independent ESCO with the security required to serve a long-term regeneration project. Under this agreement, one of MKC's key responsibilities is compliance with a code of practice. This sets out how the ESCO should deal with all customers and includes requirements for prices to be benchmarked and at least competitive with heating through other traditional means, such as gas boilers. It is hoped that this will be redundant once regulation is in place.

3.5.5. Funding / Financing

The construction of the energy centre and district heating grid to enable carbon savings at the site was funded as part of a £250m funding package secured for the King's Cross Central development by KCCLP.

3.5.6. Procurement route

As a private sector entity KCCLP was not subject to public procurement rules. A competitive tender process was carried out for an ESCO to deliver energy services to the site. Metropolitan was the successful bidder, the key differentiator being Metropolitan's understanding of the uncertainty associated with a development build-out.

3.5.7. Subsequent changes to delivery vehicle

No changes to the delivery vehicle are currently envisaged, as the development is still being built out. Beyond the build-out any changes would need to provide a high level of customer service to ensure the reputation of KCCLP is maintained.

3.5.8. Future expansion

MKC may consider future expansion beyond the development into the neighbouring boroughs of Camden and Islington where it is economic to do so. The key constraint in relation to further expansion is the layout of the site which is constrained by both the railway lines and canal, rendering a number of potential connections uneconomic.

3.5.9. Replicability

The approach adopted by KCCLP would potentially be suitable for adoption by other developers in the following circumstances:

1. heat network being developed as part of a redevelopment / regeneration site (with associated build-out uncertainty) in area with supportive planning policy and relatively high land values;
2. prioritisation of energy performance and CO₂ emission reduction relating to planning permission;
3. high-density development in urban environment where gas-fired CHP is the only practicable technology solution;
4. a high degree of control and governance is desired by the developer to provide transparency to users in relation to energy tariffs and protect the reputation of the developer;
5. no competing heat supply infrastructure on site (i.e. a gas distribution network); and
6. potential for bundling multiple utilities (fibre, electricity, heat, etc.).

It is unlikely to be suitable where:

1. the public sector seeks a high degree of control and influence over further expansion beyond the development – though the developer can be required through the planning system to design, build and operate the network to technical standards that facilitate future expansion;
2. the proposed development is small scale with insufficient heat load to justify a standalone scheme; and
3. the development has an associated low land value and the cost of providing a heat network may prevent the construction of the scheme.

Key considerations for local authorities involved in similar developments would include:

1. balancing the energy strategy for the site with the social benefits of the development going ahead;
2. establishing the potential for connecting existing and future heat loads neighbouring the development; and
3. ensuring residential and commercial users of a proposed scheme received appropriate customer service.

3.6. Case Study 6 – Cube Housing Association

Project Summary The Wyndford estate comprises over 1,900 flats and maisonettes constructed in the mid 1960s. In 2012 the estate received an energy efficiency retrofit, with external cladding on the tower blocks and district heating initially delivered to over 1,500 tenancies, subsequently extended to owner occupiers. The energy retrofit was driven by the need to reduce energy costs to residents of the estate, both in response to their expressed concerns and to achieve regulatory energy efficiency requirements.

SSE operate the scheme under a thirty-year concession contract with Cube Housing Association. SSE subcontracted the design and construction work to Vital Energi. SSE operates the scheme as a commercial venture, and assumes associated operational business risk. The tariff charged to users on the estate is pegged to the average of the ‘Big 6’ energy suppliers’ direct debit gas costs. The concession agreement stipulates that the system will be returned to Cube in good working order at the end of the concession period. Capital replacement works are carried out by SSE and paid for by Cube as and when required.

The retrofit has been part funded by a Community Energy Saving Programme (CESP) award from British Gas. This covers the full cost of the external cladding and around a fifth of the capital costs of the heat network. A capital contribution was also made by SSE, and the remainder of the capital costs have been met directly by Cube.

Lead entity	Cube Housing Association
Delivery Structure	Long term (30 year) concession contract (design-build-operate)
References	<ol style="list-style-type: none"> 4. Cube Housing Association project profile 5. Vital Energi Case Study 6. www.heatandthecity.org.uk
Key contacts	<p>Willie Croft, Head of Regeneration at Cube Housing Association (to 2013, now River Clyde Homes)</p> <p>Maureen Hannigan, Head of Asset Management, and Scott Devlin , Asset Liaison Coordinator, Cube Housing Association</p> <p>David Forbes, Business Development Manager, Heat Networks, SSE</p>

3.6.1. Project drivers

The key driver for the Wyndford project was reduction in the costs of heating for households. This driver was manifest in two ways: first the Scottish Housing Quality Standard (SHQS) set minimum energy efficiency levels to be achieved in social housing by 2015, which feasibility studies found

could not be achieved through fabric upgrades alone; second, Cube's surveys of residents highlighted the high cost of keeping relatively small homes warm as the second most pressing issue on the estate (after security). Prior to installation of district heating almost all the flats and maisonettes on the estate were uninsulated; with no gas supply to the estate, electric heating predominated. The original storage heaters (two per flat) had not been upgraded since the estate was developed in the 1960s. Many households also used direct electrical-resistance heating which, coupled with time-of-use electricity tariffs, led to high heating costs. Wearing outdoor clothing indoors, going to bed early and staying away from their flats (e.g. at relatives' homes) were common strategies residents used to stay warm.

Cube commissioned the Mackintosh Environmental Architecture Research Unit, Glasgow School of Art, to undertake an options appraisal for improving the energy performance of the estate. The study recommended communal heating for the multi-storey blocks and suggested biomass combined heat and power (CHP), using the electricity to support communal demand (lifts and lights). Initially carbon savings were an ancillary consideration rather than a main driver, but assumed greater importance as project funding became linked to emissions abatement (via CESP).

3.6.2. Project objectives

To provide an alternative, energy efficient heating system, which would

1. bring flats up to SHQS energy efficiency standards;
2. deliver affordable warmth for residents;
3. be available to owner occupiers to connect to, but that would not be reliant for financial viability on any users other than Cube Housing Association tenants;
4. have scope for expansion, should additional heat load become available in future;
5. be future proofed to allow fuel switching;
6. reduce CO₂ emissions; and
7. not require the housing association to manage the production or retail of energy, nor expose it to operational risks of the project.

3.6.3. Description of initial project

Different technical configurations for the project were explored through feasibility studies and the procurement process. While the first feasibility study had explored biomass CHP, Cube chose not to pursue this approach because of the level of fuel transport this would require, the need for fuel storage, and uncertainties in the security of biomass supplies.

Feasibility studies explored additional connections including a nearby regeneration area, a swimming pool which was refurbished around the same time, university buildings and a large supermarket (also under development at the same time). However, difficulties coordinating agreement meant the current project delivers heat only to residents on the estate. This first phase of development focused on Cube's tenants in order to meet the deadline for CESP funding (December 2012). In early 2013 the Scottish Government offered grants to over 350 owner-occupiers on the estate to cover the costs of connection and new internal heating systems.

The network is supplied by a 1.2MW gas CHP engine with three 4.5MW backup/peaking gas boilers, and a thermal store (120,000 litres). Electricity from the CHP is not supplied specifically to the estate but is exported via the public network. The energy centre is sited beside a disused football pitch on the estate, and the heat network distributes heat to the multi-storey blocks and maisonettes on the

estate. These comprise four 26-storey blocks, five 14-storey blocks, one 9-storey block, seven 8-storey blocks and a series of maisonettes and flats. The heat network includes 2.7km of underground pipework. There are over 1,900 homes on the estate, of which Cube owns over 1,500.

3.6.4. Initial delivery structure

Cube established two clear aspects of the delivery structure early on: first, Cube would contribute some of the capital costs of the project, but seek to leverage other sources of finance; second, Cube would not play a role in the selling of energy, nor be exposed to business risks associated with system operation (such as bad debt risks). Within those parameters, however, various delivery structures were considered, particularly through the procurement process. The approach favoured by Cube, and eventually adopted, was a concession model: a third party would develop and operate the system for a fixed period, after which the assets created (energy centre and heat network) would be handed back to Cube.

Early thinking on delivery structure explored the possibility that a concession holder (i.e. the company developing and operating the system) would also provide some of the project finance (around three quarters of the required capital expenditure), securing long-term debt against the value of heat and electricity sales. However, the financial crisis and associated changes to credit markets undermined this model, as long-term finance was unlikely to be available to a concession holder. Under this initial model, Cube would have funded insulation of the homes from its own resources, and was exploring internal wall insulation as a lower cost alternative to external cladding.

In spite of the difficulties caused by the financial crisis, Cube persisted in developing the project, seeking to explore alternative delivery and finance models. The availability of CESP funding, which became apparent relatively late in the development process, enabled a different approach. British Gas fully funded external cladding of the multi-storey blocks, allowing Cube to cover a greater proportion of the remaining CAPEX requirement from its own resources, which were also supplemented by an additional CESP grant from British Gas. The requirement for the concession holder to raise long-term finance was accordingly reduced.

SSE were awarded the concession to develop and operate the heat network, and subcontracted design and construction work to Vital Energi. Vital Energi in turn subcontracted parts of the construction and installation, seeking where possible to make use of local companies. The rapid pace of installation required to meet the CESP deadline put pressure on this process; there were problems with the quality of work carried out by one subcontractor inside flats, resulting in their replacement.

The concession contract is for a 30 year term, after which SSE is required to return the system to Cube in good working order. Under formulae set out in the project agreement, Cube pay SSE an on-going charge to cover maintenance of the energy centre and network (excluding maintenance within tenants' homes), and make a budget allowance for capital replacement works carried out by SSE. Owner occupiers, in contrast, have an additional fixed charge on their energy tariff to contribute to capital replacement costs. SSE collects this charge from owner occupiers (as part of their bill) and passes it to Cube to assist with its capital replacement budget. The project agreement makes provision for SSE to connect other users to the system.

The project agreement also governs the heat tariff. This comprises a fixed and a variable element and was agreed through negotiation between Cube and SSE. The variable element is calibrated to be equivalent to the average of the 'Big 6' energy suppliers' direct debit gas tariffs (accounting for differences between domestic gas boiler efficiency and district heating).

3.6.5. Governance

As concession holder, SSE is responsible for the business operation of the system, within parameters set out in the project agreement. The agreement was established through the procurement process (see below) and covers various aspects including:

- how the tariff for heat is set;
- division of responsibility for maintenance (for example, Cube is responsible for maintenance of the heating systems within the flats);
- the capital replacement charge paid by Cube;
- provisions concerning liabilities for energy demand reduction, including if Cube were in future to re-provision some of the estate's housing (for example, by demolishing and rebuilding some of the buildings); and
- benefits and risks of any expansion of the scheme during the period of the concession contract accrue to SSE.

3.6.6. Finance

All finance for external cladding of the housing blocks was from British Gas, under CESP (cost figures not available). The project capital expenditure was around £15m, which was financed by the combination of a further British Gas CESP award (around 20%), Cube's own resources and a capital contribution from SSE. Cube had explored other financial support mechanisms, but found incentives were generally tied to the use of renewable energy sources, which they considered unsuitable at this stage in the project's development.

3.6.7. Procurement route

Cube appointed a legal firm to advise on the procurement process, and under their guidance initiated a competitive dialogue procedure. Overall the procurement process took around 12 months. Although this put pressure on the time left within CESP deadlines to complete the project, Cube officers described the dialogue process as time well spent. The advantage of the competitive dialogue route was that Cube could assess different proposals, rather than having to specify the exact system requirements, as required by conventional procurement routes. Around twenty companies attended the initial open day, seven or eight submitted expressions of interest, and three were shortlisted, each proposing different technical, financial and organisational approaches. Through the procurement process Cube was able to assess the pros and cons of different options, and to negotiate terms of the agreement (such as where responsibility for different aspects of maintenance and replacement would lie, and what the associated costs would be).

The complexity and detail of the procurement process led Cube to retain the services of a high quality engineering consultancy and an experienced legal firm. The cost of this service was borne by Cube, and was considered a risk of the procurement process. Cube officers emphasised that the high quality of the advice they received was crucial to their ability to successfully negotiate with bidders.

3.6.8. Subsequent Expansion

At the beginning of 2013 Scottish Government offered grant funding to all owner occupiers on the estate to cover their costs of connecting to the district heating system and installing new internal wet heating systems. 266 owner occupiers took up the offer of free connection to the network.

Owners pay a slightly different tariff because they are charged for a share of system maintenance and replacement costs; Cube pays this cost for the tenants. The project is designed to have scope for expansion, though to date heat connections beyond the estate have not been made.

3.6.9. Advantages and disadvantages of the chosen structure

The structure of the project evolved as the availability of finance changed (from long-term commercial loans to CESP grants). Through this evolution, however, Cube has achieved a concession structure with the following main advantages:

- significant improvements in the affordability of heating for most residents on the estate, with the majority of tenants (80%) reporting their homes are now warmer;
- the energy efficiency improvements (cladding plus the heat network) are projected to save 7,000 tonnes of CO₂ per year;
- single turnkey contract with SSE, who organised (via Vital Energi) design and installation of a complex project involving multiple subcontractors;
- operation of the system and exposure to business risks (including energy price fluctuation and bad debt risk) have been passed on to a utility company, shielding the housing association from potential financial risk;
- the Wyndford estate has benefitted from one of the largest CESP awards in the UK;
- by persisting with the project in spite of changing financial conditions, Cube were able to take advantage of CESP funding when it became available with a project that was already well advanced;
- use of the competitive dialogue procedure enabled Cube to appraise contrasting proposals, and to negotiate details of the arrangements with the bidders;
- the project has been extended to owner occupiers, but was not dependent on their connection for viability. Similarly, SSE is able to extend the network to other customers should it choose to do so; and
- SSE is required to return the system to Cube in working order at the end of the 30 year concession period.

A number of difficulties or disadvantages faced by the project can also be identified:

- use of CESP funding put tight time constraints on the project (in spite of plans being well developed when CESP funding was announced) which contributed to difficulties with subcontractors. In addition, the rapid pace of installation reduced the scope to ensure that the placement of flow and return pipes did not undermine visual amenity on the estate (Cube has since installed additional containments to improve the aesthetic qualities of the system);
 - the length of time required for project development and procurement meant Cube was unable to give residents accurate information about how the project would operate until close to the time of installation;
 - some residents on the estate have found the transition to the new heating system challenging. Some lacked an understanding of how to operate their heating controls, contributing to difficulties managing heat use and costs. In addition, moving from one energy supply (electricity) to two (heating and electricity) means residents now pay two standing charges, which some have objected to.
 - Cube foregoes potential additional business benefits (e.g. favourable changes in energy prices) and control over the provision of heating over the 30 year term (in exchange for being shielded
-

from any business downside risk). For example, heat tariffs are governed by formulae agreed by Cube and SSE in the project agreement. The housing association therefore has less flexibility to alter tariffs in future.

3.6.10. Replicability

The approach adopted by Cube Housing Association would potentially be suitable for adoption by other housing associations in the following circumstances:

1. registered social landlord seeks to develop a district heating initiative but not take on the role of energy provider (either production, or purchase and sales of energy), and seeks to transfer operational risks to a third party;
2. various technical, organisational and financial configurations may meet the housing association's requirements, and the housing association seeks to explore offerings from the market through procurement; and
3. capital funding is available.

It is unlikely to be suitable where:

1. a housing association seeks long-term control over the energy provision business model (for example, changes to tariff formulae if energy market conditions change significantly);
2. there is a lack of capital funding available; or
3. project viability depends on supplying energy users beyond the social landlord's tenants.

Key considerations for other social landlords considering a similar approach include:

1. ensuring sufficient resource to undertake initial technical appraisal of options for meeting objectives and to de-risk the project as far as possible;
2. allowing sufficient time, and allocating sufficient resource (such as engineering consultancy services) for the procurement process; and
3. maintaining a long-term view of the project potential, and responding flexibly to changes in the availability of finance.

4. Observations

As noted in the Introduction, the case studies are intended to be illustrative rather than exhaustive: no two district heating schemes are the same. The delivery structure for a given scheme has to balance a multiplicity of factors, including:

- stakeholder drivers & objectives;
- desire for control;
- risk appetite;
- resource availability;
- type of project – new build or retrofit;
- size of project & phasing;
- access to finance;
- commercial viability;
- legislation and regulation; and
- exit strategy.

Balancing these is an iterative process, which needs to take into account the perspectives of multiple stakeholders, whose drivers and objectives may be quite different.

When looking across the case studies, some common themes emerge, and are explored in this section. Similar comments could be made about a number of other district heating schemes in the UK, so the case studies can be thought of as illustrating more general observations about the UK experience of delivering heat networks.

4.1. Relationship between objectives & control

There are different mechanisms for a public body to exercise control over the key outcomes that it wishes to realise from an infrastructure project.

One mechanism is for the public body to retain ownership over the physical assets of the project: it can exercise control through that ownership. This is the ‘in-house’ model, as represented by the Dunfermline and Islington case studies (and also, at one step removed, by Aberdeen City Council, via its ultimate control of Aberdeen Heat & Power Company Ltd).

Alternatively, ownership can rest with a third party, with whom the public body has a contract in place regulating use of the asset. In other words, control does not necessarily require ownership of the physical assets used to produce the desired outcomes; contractual arrangements will in many cases suffice, and may be necessary in cases where ownership is not practicable, e.g. because of funding or other resource constraints.

For example, under a service concession (as represented by the Leicester and Cube Housing Association models) the extent to which an authority can retain control over key aspects of a project will depend on the terms of the concession / project agreement. Depending on the procurement procedure adopted, the authority will be able to negotiate the terms of the concession with bidders, who will be negotiating under competitive tension. In the Cube case study, for example, the Housing

Association considered that use of the competitive dialogue procedure had allowed it to explore through dialogue how key operational risks (e.g. lifecycle replacement, and bad debt risk) should be allocated between the parties, and therefore achieve a mutually satisfactory risk allocation.

Inevitably, the authority will not be able to exercise the same degree of control over a scheme which is subject to a service concession as it would over in-house service provision: a concessionaire needs to retain sufficient control over the scheme in order to manage the risks it is being asked to accept, and also to be able to exploit any opportunity for 'upside' that is the *quid pro quo* for accepting risk.

Control over tariffs

This concept can be illustrated by contrasting how tariffs are set under 'in-house' and concession models. In the case of the former, the authority has the ability to set heat tariffs directly, whereas in the latter, the heat tariffs are likely to be set by the private sector, usually in accordance with an agreed mechanism as set out in the concession / project agreement. As in the Cube case study, the mechanism will typically peg tariffs to a benchmark, e.g. by reference to the market price for alternative heat supply using conventional gas boilers. However, such a mechanism will not necessarily allow heat tariffs to track movements in the concessionaire's operating costs accurately. For example, falling wholesale gas prices are not always fully reflected in domestic gas tariffs (at least, not in the short term).

Heat tariffs under concession agreements will of course also include an element of private sector profit, whereas domestic tariffs for public sector schemes can be set on a not-for-profit basis. For example, in the Aberdeen Heat & Power case study, surpluses from revenues are either re-invested in the network (expansion and upgrading of the scheme) or used to reduce tariffs to social housing customers.

Control over future expansion of networks

Larger authorities may have a long-term vision to provide an integrated heat network, perhaps involving a number of phases through which relatively small, stand-alone networks are first created and subsequently connected into a city-wide scheme.

The authority may not have the capacity or financial resources to implement the initiative in full in the short to medium term. If it wishes to accelerate investment in the city-wide scheme, rather than develop the network organically as and when finances allow, it may need to look for one or more private sector partners to develop, operate and finance schemes. In this case, the authority will need to ensure that its contracts with the private sector provide it with sufficient controls, as the partner(s) will retain control of the physical assets of the schemes (though these may ultimately revert to the authority at the end of a concession period).

In this scenario, a key objective for the authority is likely to be ensuring that individual schemes are future proofed. In this context, future proofing could involve oversizing heat mains, leaving space for additional generating capacity in energy centres, installing connection points for known future loads, and building to technical standards that will support future expansion and integration of the network.

The authority will wish to ensure sufficient control over these outcomes, and may be concerned that failure to do so could result in the most financially attractive schemes being 'cherry picked' by the private sector, and/or an inability to expand schemes or connect with neighbouring schemes at a later date. In other words, adopting a delivery structure which affords insufficient control to the authority is likely to inhibit its ability to realise its strategic long-term objectives for the initiative.

Summary

There can be a variety of reasons why an authority may seek to adopt a delivery model which allows it to retain control over key aspects of the design, construction and operation of a heat network. However, the authority's understandable desire for control has to be balanced with a number of other important factors, including its appetite for risk, its investment criteria (required payback period / internal rate of return), its own capacity and capability, and funding constraints.

In summary, authorities should always:

1. consider how much control over the development and operation of the scheme is required in order to secure the over-arching project objectives;
2. balance this with other factors such as risk appetite, investment criteria, in-house capacity & capability and funding constraints; and
3. consider whether alternative approaches (contracts, rather than ownership of physical assets) could provide the desired level of control.

4.2. Relationship between control and risk

Risk generally goes hand in hand with control: the more control an authority desires over a heat network, the more risk it must accept. Conversely, a risk averse approach is likely to result in some loss of control over the authority's ability to achieve its strategic objectives for the network. For example, if the right to set heat tariffs sits with the contractor rather than the authority, this may impact on the authority's ability to alleviate fuel poverty for housing supplied by the network.

Risk appetite in relation to the design, construction, operation and maintenance of heat networks varies significantly across local authorities, housing associations and other public bodies. Some authorities - particularly (and perhaps not unsurprisingly) those with substantial experience of operating heat networks, e.g. Aberdeen, Fife, and Islington - have significant in-house capacity and capability, and are comfortable taking a degree of risk in relation to technology choices, network design, etc..

In reality, given the specialist nature of the technology, authorities who take forward projects in-house usually rely to some extent on consultants and contractors for aspects of design and project delivery. They do, however, need to manage interface risks carefully - e.g. as between design, construction, operation and maintenance activities.

Other authorities (as illustrated by the Leicester and Cube Housing Association case studies) have sought to maximise risk transfer through a single turnkey contract for the design, construction, operation and maintenance of a district heating scheme. Here, the private sector partner will usually seek to limit its risk exposure by use of a special purpose vehicle for the scheme assets, and pass down key risks to sub-contractors.

In the King's Cross scheme, which is developer-led and a wholly private sector initiative, the public sector takes no risk in relation to the design, construction, financing or operation of the scheme, and can only influence outcomes through regulation (e.g. use of planning powers) and facilitation. The Cranbrook scheme near Exeter provides another example of this developer-led approach.

Looking at both the case studies and wider UK experience of heat networks, it is worth noting that there are numerous examples of successful schemes that are owned and operated by the public

sector. This clearly demonstrates that the public sector can competently manage the risks involved in delivering and operating heat networks.

However, as noted above, risk appetite is just one of many factors that will influence the choice of delivery structure. In circumstances where the authority is not particularly risk averse, there may be other reasons why it decides to adopt a delivery structure in which significant risks are transferred to the private sector. For example, the authority may not have sufficient in-house capacity to develop and manage the project, or to finance it, or may feel that a particular scheme would be better delivered by the market.

For authorities with little or no experience of delivering heat networks, and who may be naturally risk averse, it is worth remembering that many authorities have successfully developed and managed schemes themselves, through a combination of in-house expertise and selective use of contractors (rather than through turnkey delivery contracts, in which the contractor takes responsibility for delivering fully operational assets). It is therefore important that authorities take time when developing projects to identify and assess key risks, to consider which party is best placed to manage them, and to consider how the required assets and services could be contracted for.

Sometimes this can result in a change of approach: in Glasgow, for example, the city council changed its preferred delivery structure for the district heating scheme for the Commonwealth Games Athletes Village from a long-term concession model to an authority owned and operated model. One of the reasons for the change was that the authority took time to assess the risks involved, and developed strategies for managing these in-house. In doing so, it was able to retain much greater control over heat tariffs, thus ensuring these can be set at the lowest possible level in order to provide affordable warmth in an area with high historic levels of fuel poverty.

Sharing experience of how risk is being successfully managed in public sector schemes will be important to the public sector's key role in the future development of heat networks, both in Scotland and more widely in the UK.

4.3. Funding and finance

The delivery structure for a heat network must be developed in parallel with the funding and financing strategy. District heating schemes generally require significant up-front capital expenditure on the generation, transmission and distribution assets. Often the most expensive component is the purchase and installation of the specialist buried heat mains and associated civil engineering works. If properly installed, operated and maintained, the heat mains should have a relatively long useful economic life – it is not uncommon for transmission pipes to be operated for 40 years or even longer. Other components, such as the heat generation plant, will typically have a much shorter economic life. Boilers and CHP plant, for example, will usually be subject to major overhaul and lifecycle replacement after 12-15 years (depending on technology and utilisation).

Hence district heating schemes should be seen as long-term investments, and business cases should be appraised over an extended time period, matched to the useful economic life of the main assets (the heat mains), and allowing for periodic lifecycle replacement of boiler plant and other equipment. For schemes involving significant capital expenditure on buried pre-insulated transmission pipes, it is not uncommon for cash-flows to be assessed over an extended period of 25 to 40 years.

Business cases need to be developed in line with public sector guidance and best practice, and different public bodies have different investment criteria. However, it is worth emphasising, particularly for authorities that have no previous experience in this sector, that district heating schemes should be considered as relatively long-term investments.

Access to funding, and requirements in relation to budgetary and accounting treatment, will be important issues for public bodies in developing delivery structures. For example, different public bodies have different powers in relation to borrowing, ability to provide guarantees, or establishing and investing in joint ventures or special purpose vehicles. The relevant powers for Scottish local authorities, housing associations, universities and colleges, NHS Boards and Scottish Water are analysed in SFT's legal guidance on district heating⁸.

As illustrated by the case studies (e.g. Aberdeen, Fife, Islington), many of the existing heat networks that are owned and operated by local authorities benefited from substantial grant funding, particularly in relation to the initial phases of the scheme. The relevant UK grant funding programmes (e.g. the Community Energy Programme) through which these networks were part-funded are no longer in operation. Other projects have been privately financed (as illustrated by the Leicester and King's Cross case studies), or a mixture of public and private finance (e.g. Cube Housing Association).

A review of current funding and financing mechanisms and government incentive schemes (e.g. ECO, Renewable Heat Incentive) is beyond the scope of this guidance. However, it is worth noting that some development funding is available via the Scottish Government's Low Carbon Infrastructure Transition Programme, and the Heat Network Partnership. There are also occasional opportunities to secure contributions towards capital costs from funding competitions. Some of these are sector specific (e.g. health, higher education), and such funds are generally limited to projects meeting specific criteria (e.g. technical innovation, or carbon reduction criteria) and so are not applicable to all schemes.

There are also a number of low-cost finance mechanisms available to public bodies in Scotland, including the Scottish Government's District Heating Loans Fund (administered by the Energy Saving Trust), SPRUCE (administered by Amber Investments), and the Renewable Energy Investment Fund (administered by Scottish Enterprise). Finance is also available for low carbon projects from the UK Green Investment Bank and commercial lenders.

For the purpose of this guidance, the key point to note is that a public body wishing to develop a district heating scheme may not have access to sufficient capital to fund the scheme in full itself. It may wish to utilise revenue budgets rather than capital budgets, or could have other specific financial objectives (e.g. leveraging external finance) and constraints (e.g. local authority borrowing limits). All of these need to be taken into account when developing the associated delivery structure for the scheme.

⁸ <http://www.districtheatingscotland.com/content/procurement>

In relation to use of revenue budgets, there are a number of commercial and financial structures that could be considered, including service concession arrangements and other models. Depending on the scope of the project, and the precise nature of the contractual and commercial arrangements, these have the potential to score against resource budgets rather than capital budgets. SFT has produced guidance on the commercial and accounting impacts of the main structures in the context of energy efficiency projects⁹. This is clearly a broader category than district heating, though in some cases a district heating project may form part of a public body's wider energy efficiency programme.

For larger schemes, the scale of investment required, and relative scarcity of public sector capital, will point towards a delivery structure involving a degree of private finance. This will typically involve a higher cost of capital than public sector finance, but also brings with it the benefits of private sector due diligence, and its expertise and experience in developing and delivering schemes. The private sector's willingness to invest will depend on its assessment of the commercial viability of the project, on the risks it will be required to assume, and on the adoption of a suitable delivery structure through which it will be able to manage these risks and secure a return on its investment.

Private sector funders will seek to protect the revenue streams associated with the project. This could be through a variety of mechanisms, including the grant of an exclusive right to develop and operate networks in a given area (i.e. a concession), or a guarantee from the public sector as to particular anchor loads taking a heat supply from the proposed network for a fixed minimum period.

There have also been examples of heat networks being financed as part of a multi-utility approach to a large development site. The King's Cross case study is a good example of this, in which the private sector has financed the construction of the heat network for the site along with other services (including fibre optic broadband). The private sector retains ownership of the infrastructure, whilst customers pay a service charge for use of the network.

4.4. Public sector capacity and capability

The case studies illustrate that desire on the part of the public sector bodies to retain a significant degree of control over the development and operation of heat networks needs to be matched not only by their appetite for risk, but also by their ability to deploy suitable in-house capacity and capability in order to exercise the desired control effectively, and manage the associated risks.

Although there is clearly considerable experience within the public sector of successfully managing district heating projects, this experience is not widely distributed, and tends to be focussed within a relatively small number of local authorities and housing associations. Some universities, colleges and

⁹SFT Energy Efficiency Measures – Commercial and Accounting Overview – Part A, available at <http://www.scottishfuturestrust.org.uk/publications/sft-energy-efficiency-measures-commercial-and-accounting-overview-part-a/>, and SFT Energy Efficiency Measures – Technical Guidance and Accounting Impacts – Part B: <http://www.scottishfuturestrust.org.uk/publications/sft-energy-efficiency-measures-technical-guidance-and-accounting-impacts-pa/>.

NHS Boards also have considerable experience of operating smaller, single-site networks, providing heat to their own buildings and campuses.

The Scottish Government's heat map is now being actively used by local authorities to assist with energy master-planning and the identification of potential district heating opportunities. The development of potential opportunities through to viable business cases, through detailed assessments of technical feasibility and financial viability, consideration of alternative delivery structures and financing approaches etc., can be a lengthy and costly process: experience shows that a certain minimum amount of development work is required, which does not readily scale down for smaller schemes.

It is important to recognise this, and to ensure that appropriate resources are allocated within authorities to develop projects within a reasonable time-frame (bearing in mind that funding opportunities are often time-limited), with suitable decision making and governance arrangements in place, and clarity from the outset around the public body's objectives and investment criteria.

It is also important to take a long-term and strategic view of potential opportunities. For some of the larger local authorities and housing associations, there may be an opportunity to consider how a number of smaller, individual schemes can be 'bundled' together into a larger programme. This can have several advantages: it may be possible to secure economies of scale; to share certain project risks across the programme; and the larger scale of investment associated with a programme approach can open up new delivery structures and funding models - private sector investors are often unwilling to consider smaller schemes, as due diligence costs can be disproportionately high.

Private sector contractors may be willing to offer assistance to authorities in developing schemes. This can help to accelerate the project development process and bring useful skills and experience to bear. However, such assistance can sometimes be subject to a requirement to provide exclusivity over the resulting schemes. The public sector body may be unable for procurement reasons to offer such exclusivity. Typically, the public body will need to procure its own professional advisers, or appoint advisers from a suitable pre-procured framework.

4.5. Public sector leadership and collaboration

The public sector clearly has a significant role to play in the development of heat networks. To date, this role has been performed mainly by a relatively small number of local authorities, with some housing associations, universities and other public (or quasi-public) bodies also playing a role.

District heating is a relatively unregulated sector compared to other forms of utility-type networks. Scottish Government planning policy encourages the use of district heating where appropriate, but there is at present no regulatory requirement for a property (public or private) to connect to, or take a heat supply from, or to stay connected to, a heat network. From the perspective of potential financiers and investors, this translates into demand risk and uncertainty over income streams.

As the owner, occupier or landlord of a large number and type of properties, many of which have a substantial demand for heat, the public sector in Scotland has a significant role to play in the development of heat networks by connecting its own buildings to district heating networks where appropriate. Significant 'anchor' loads include local authority buildings (offices, schools, local authority housing stock, etc.), hospitals, universities and colleges, social housing owned by Registered Social Landlords, courts, prisons, and central government buildings.

In the Leicester case study, private investors were attracted on the basis of certain public sector anchor loads being guaranteed to take a heat supply from these network over the term of the concession, and the Council provided an initial guaranteed heat load. This provided the developer and funder with a secure revenue stream to support investment in the upfront capital costs. A number of Council-owned buildings and the University of Leicester are already connected to the network, and it is anticipated that HMP Leicester and De Montfort University will also be connected in due course.

In situations where public sector assets are being considered for connection to an existing or proposed heat network in third party ownership, the relevant authority will need to consider carefully how it procures a heat supply from that network. This will depend on whether the heat network is privately owned and operated (as for the Leicester case study), or publicly owned and operated – different procurement strategies apply. For further details on these strategies, reference should be made to SFT’s guidance on the powers of Scottish public bodies to generate, procure and trade heat and electricity¹⁰.

4.6. Role of Energy Service Companies

It is apparent from the case studies that different types of corporate vehicles are used in district heating schemes. Often these are labelled as ‘energy service companies’ or ‘ESCOs’.

It is important to note that the term ‘ESCO’ is used to represent widely different concepts in different contexts, and hence has little meaning in itself. For example, it can be used to refer to in-house local authority controlled entities such as Aberdeen Heat & Power Company Ltd (or indeed, to their trading subsidiaries, such as District Energy Aberdeen Ltd., which was established to serve commercial customers). It can also refer to a private sector partner appointed by a local authority to take forward district heating schemes in a defined area under a concession (e.g. as in Leicester and Birmingham). The scope could be limited to one or more district heating initiatives, or to energy efficiency measures, or a combination of these. It could also offer a broader multi-utility service (so-called ‘MUSCOs’, akin to the King’s Cross model) rather than being focussed solely on heating and/or electricity. The term can also be used to represent corporate joint ventures established between public and private sector participants, or where joint ventures are established as collaborations between different public sector bodies to provide energy services to their parent organisations.

SFT has developed separate guidance on the various roles of ESCOs, the corporate structures under which they can be established, and associated governance arrangements¹¹. For the purpose of this guidance, the following points illustrate some of the key considerations:

- As illustrated by the Aberdeen case study, establishing a separate local authority owned/controlled ESCo (Aberdeen Heat & Power Company Ltd) can provide a number of advantages: assets and personnel can be transferred into, and ring-fenced within, the ESCo;

¹⁰ <http://www.districtheatingscotland.com/content/procurement>

¹¹ <http://www.districtheatingscotland.com/content/procurement>

the ESCo can be given its own budget, with its own business plan and can be run with a degree of operational independence from the parent authority;

- As between the authority and the ESCo, certain risks can be allocated to the ESCo, from which (if the ESCo is established as an entity with limited liability), the parent authority can be insulated. However, in reality some risk will still sit with the parent authority. In particular, contractors and funders are likely to seek guarantees from the parent authority, e.g. in respect of the ESCo's borrowing (which could secure a lower cost of borrowing than the ESCo could achieve on its own). This results in some residual risk ultimately sitting with the parent authority, notwithstanding the appearance of risk transfer to a wholly-owned ESCo.
- Establishing an ESCo can facilitate a charitable entity to trade with the private sector. For example, some housing associations have established subsidiaries to allow heat supplies to be made to the private sector, with any profits remitted back to the parent body to be re-invested in its activities, and without affecting the parent body's charitable status.
- As illustrated by the Dunfermline and Islington case studies, some authorities have successfully established heat networks and operated them to date without establishing in-house ESCos.
- If an authority wishes to set up a public sector ESCO, it is essential that it establishes appropriate governance arrangements. These should govern the systems, processes, cultures and values by which the ESCO is directed and controlled, and through which it accounts to and engages with its stakeholders/customers¹².

4.7. Future trends

Achieving the district heating targets set out in the Scottish Government's draft Heat Generation Policy Statement will require a step change in the rate at which projects are being developed and delivered.

To effect this change will require a combination of the following:

- **local authorities will need to play a significant role**, including: taking a strategic approach to the development of schemes in their administrative areas; using heat mapping and energy master-planning to identify potential opportunities; encouraging the development of networks through the planning system; and building in-house capacity and capability to develop opportunities to investible propositions;
- **increasing connection of public sector assets** – e.g. central government and local authority offices, schools, universities, hospital, courts & prisons - to provide, where appropriate, long-

¹² See "Delivering Good Governance in Local Government", published by SOLACE/CIPFA in 2007.

term anchor loads around which new networks can be developed or existing networks can be extended;

- **increased collaboration between different public sector bodies** – this is likely to result in more public sector joint venture arrangements, i.e. the establishment of publicly owned ESCOs. These will be collectively owned and controlled by multiple public or quasi-public bodies in the same area (e.g. a local authority, university / college, NHS Board, Registered Social Landlord), all of whom take a heat supply from the entity for their own buildings and/or supply surplus heat into the network;
- **private sector investment** – this will be key to delivering the scale of investment required, and will require active collaboration between the public and private sector in relation to the development, financing and implementation of schemes;
- **adaptability** – the initial business model for a scheme may need to adapt to reflect changing circumstances and new opportunities. These could arise from the authority's exit strategy, e.g. where the authority develops, funds and takes most of the risk in relation to an initial phase, and then looks to refinance and/or transfer ownership of the operational network to a third party (which could be a public or private sector ESCO).

There have also been examples of ownership structures adapting where an initial scheme has failed to deliver the desired outcomes. For example, the Wick district heating scheme started as an initiative by Highland Council. Although the initial development failed to operate satisfactorily, the scheme has since successfully transferred to private ownership, received additional private sector investment (including replacement of the generation assets), and is now successfully operating and expanding; and

- **increased specialisation of roles / unbundling** – as small-scale 'island' heat networks in cities develop, expand and eventually inter-connect, local markets for heat generation could emerge, along with energy service companies whose role would be to purchase heat from generators and distribute and retail it to end users. This would see a gradual shift away from networks where a single organisation is responsible for all aspects of its operation, to a utility type model, where operators of networks purchase supplies from a number of different generators, enter into 'retail' contracts with end users, and are responsible for maintaining the network infrastructure and balancing the network. Such models have developed elsewhere (e.g. Scandinavia) over several decades of gradual development of district heating, and are now emerging in London.

5. Further information

There are a number of sources of information and guidance on district heating / energy. Some of the main ones are listed below:

SFT guidance

- Guidance on the powers of Scottish public bodies to generate, procure and trade heat and electricity, and the legal, regulatory and administrative constraints on these powers: <http://www.districtheatingscotland.com/content/procurement>.
- Guidance on energy service companies (ESCOs), including the rationale and process for establishing ESCOs, types of structures that can be used, and governance arrangements: <http://www.districtheatingscotland.com/content/procurement>
- Public sector delivery structures for low carbon investment: (<http://www.scottishfuturestrust.org.uk/publications/sft-delivery-structures-2013/>
- Energy Efficiency Measures – Commercial and Accounting Overview – Part A: <http://www.scottishfuturestrust.org.uk/publications/sft-energy-efficiency-measures-commercial-and-accounting-overview-part-a/> , and
- Energy Efficiency Measures – Technical Guidance and Accounting Impacts – Part B: <http://www.scottishfuturestrust.org.uk/publications/sft-energy-efficiency-measures-technical-guidance-and-accounting-impacts-pa/>
- VAT considerations for district energy initiatives: <http://www.districtheatingscotland.com/content/finance>

Heat Network Partnership:

- Home page: <http://www.districtheatingscotland.com>
- Policy & legislation: <http://www.districtheatingscotland.com/content/leadership>
- Case Studies: <http://www.districtheatingscotland.com/content/district-heating-case-studies>

Heat and the City: <http://www.heatandthecity.org.uk>

Association of Decentralised Energy

- Home page: <http://www.theade.co.uk>
- Decentralised Energy Planning Guidance: http://www.theade.co.uk/decentralised-energy-planning-guides_1592.html